VIRGINIA—OZONE

Designated Area	Designation		Classification	
	Date [1]	Type	Date [1]	Type
Norfolk-Virginia Beach-Newport News (Hampton Roads) Area Chesapeake Hampton James City County Newport News Norfolk Poquoson Portsmouth Suffolk Virginia Beach Williamsburg York County	[insert date 45 days after publication date].	Unclassifiable/ Attainment	.....	.....

[1] This date is November 15, 1990, unless otherwise noted.

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40 CFR Part 80

[FRL–57–02–2]

RIN 2060–AD27

Regulation of Fuels and Fuel Additives; Standards for Reformulated Gasoline

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of denial of petition for reconsideration.

SUMMARY: Pursuant to section 553(e) of the Administrative Procedure Act, the American Petroleum Institute requested that EPA reconsider and repeal the Phase II reformulated gasoline emission reduction standard for oxides of nitrogen. For the reasons provided below, EPA is denying this petition. EPA's review of new data concerning the air quality benefits and cost-effectiveness of the reformulated gasoline emission reduction standard for oxides of nitrogen demonstrates the continued appropriateness of the standard.

EFFECTIVE DATE: March 12, 1997.

ADDRESSES: Information relevant to this action is contained in Docket No. A–96–27 at the EPA Air and Radiation Docket, room M–1500 (mail code 6102), 401 M St., SW., Washington, DC 20460. The docket may be inspected at this location from 8:30 a.m. until 5:30 p.m. weekdays. The docket may also be reached by telephone at (202) 260–7548. As provided in 40 CFR part 2, a reasonable fee may be charged by EPA for photocopying.

FOR FURTHER INFORMATION CONTACT: Debbie Wood, Office of Mobile Sources, Fuels and Energy Division, (202) 233–9000.

SUPPLEMENTARY INFORMATION

I. Introduction and Background

On February 16, 1994, EPA published a final rule establishing various content and emission reduction standards for reformulated gasoline (RFG), including provisions for the certification of RFG and enforcement of RFG standards, and establishing certain requirements regarding unreformulated or conventional gasoline (59 FR 7716). The purpose of the RFG program is to improve air quality by requiring that gasoline sold in certain areas of the U.S. be reformulated to reduce emissions from motor vehicles of toxics and tropospheric ozone-forming compounds, as specified by section 211(k) of the Clean Air Act (CAA or the Act). Section 211(k) mandates that RFG be sold in nine specific metropolitan areas with the most severe summertime ozone levels; RFG must also be sold in any ozone nonattainment area reclassified as a severe area, and in other ozone nonattainment areas that choose to participate or ''opt in'' to the program. The Act further requires that conventional gasoline sold in the rest of the country not become any more polluting than it was in 1990 by requiring that each refiner's and importer's gasoline be as clean, on average, as it was in 1990. This has resulted in regulatory requirements referred to as the ''anti-dumping'' program.

The Act mandates certain requirements for the RFG program. Section 211(k)(1) directs EPA to issue regulations that:

> Require the greatest reduction in emissions of ozone forming volatile organic compounds (during the high ozone season) and emissions of toxic air pollutants (during the entire year) achievable through the reformulation of conventional gasoline, taking into consideration the cost of achieving such emission reductions, any nonair-quality and other air-quality related health and environmental impacts and energy requirements.

Section 211(k) specifies the minimum requirement for reduction of volatile organic compounds (VOCs) and toxics for 1995 through 1999, or Phase I of the RFG program; the section specifies that EPA must require the more stringent of a formula fuel or an emission reduction performance standard, measured on a mass basis, equal to 15 percent of baseline emissions. Baseline emissions are the emissions of 1990 model year technology vehicles operated on a specified baseline gasoline. Section 211(k)(2) compositional specifications for RFG include a 2.0 weight percent oxygen standard and a 1.0 volume percent benzene standard. Section 211(k)(2) also specifies that emissions of oxides of nitrogen (NO_X) may not increase in RFG over baseline emissions.

For the year 2000 and beyond, or Phase II of the RFG program, the Act specifies that the VOC and toxic performance standards must be no less than either a formula fuel or a 25 percent reduction from baseline emissions, whichever is more stringent. EPA can adjust these standards upward or downward taking into account such factors as technological feasibility and cost, but in no case can the standards be less than 20 percent.

Shortly after passage of the CAA Amendments in 1990, EPA entered into a regulatory negotiation with interested parties to develop specific proposals for implementing both the RFG and anti-dumping programs. In August 1991, the negotiating committee reached

consensus on a program outline that would form the basis for a notice of proposed rulemaking, addressing emission content standards for Phase I (1995–1999), emission models, certification, use of averaging and credits, and other important program elements.

The regulatory negotiation conducted by EPA did not address the Phase II VOC and toxic standards for RFG, nor did it address a reduction in NO_X emissions beyond the statutory cap imposed under section 211(k)(2)(A). The final rule promulgated by EPA closely followed the consensus outline agreed to by various parties in the negotiated rulemaking process. The final rule also adopted a NO_X emission reduction performance standard for Phase II RFG, relying on authority under section 211(c)(1)(A).

In December 1995, the American Petroleum Institute (API) submitted a petition to EPA requesting reconsideration and repeal of the Phase II RFG NO_X standard. API also requested suspension of the effective date of the standard, pending deliberations on the cost-effectiveness of NO_X control. EPA's initial review of the API petition indicated that it presented no compelling new evidence or argument that would warrant revisiting the decision made in promulgating the Phase II RFG NO_X reduction standard. EPA also conducted a review of relevant and available new information on costs and benefits developed since promulgation of the final rule to ensure that EPA's conclusions on the appropriateness of the Phase II RFG NO_X reduction standard remain well-founded. EPA published a Federal Register notice requesting comment on the issues raised in the API petition.[1] In December 1996, EPA reopened the comment period, to allow public comment on a draft Department of Energy report on RFG costs, and held a meeting with interested parties to discuss the draft report.

The arguments presented in the API petition are summarized below, followed by a summary of the public comments received, and EPA's response to the petition and comments. A complete copy of the API petition, public comments, and new information generated by EPA may be found in the docket for this action.

[1] 61 FR 35960 (July 9, 1996).

II. Summary of API Petition

A. Consistency With CAA and Negotiated Rulemaking

In its petition, API argues that the Phase II RFG NO_X emission reduction standard is inconsistent with the 1990 Clean Air Act Amendments and the 1991 regulatory negotiation.[2] API cites provisions of the statute that specifically require reductions in various pollutants, and contrasts those explicit NO_X reduction mandates with the ''no NO_X increase'' approach toward RFG in section 211(k).[3] API also argues that the 1991 agreement reached in the regulatory negotiation does not address a Phase II NO_X reduction, and that the focus of debate during the regulatory negotiation was whether *de minimis* increases in NO_X would satisfy the no NO_X increase standard.[4]

B. Air Quality Benefits

In its petition, API argues that ozone benefits for the Phase II NO_X standard are overstated.[5] API states that the primary basis for the NO_X standard is ozone attainment, because of the role NO_X emissions play with VOC emissions in the formation of ozone.[6] API cites EPA's 1994 Trends Report[7] to support its statement that substantial progress toward ozone attainment has been made.[8] API argues that progress toward attainment of the National Ambient Air Quality Standard (NAAQS) for ozone can be expected to continue because of new federal programs and state obligations established under the Clean Air Act Amendments of 1990.[9]

API further argues that EPA's section 182(f) waiver decisions show that NO_X reductions are not always warranted for ozone attainment.[10] API states that, in establishing section 182(f) waivers, Congress recognized that NO_X reductions do not always contribute to ozone attainment, because of atmospheric meteorology and the complex relationship of NO_X and VOC emissions.[11] API characterizes section 182(f) as stating that major stationary source requirements for NO_X do not apply where NO_X reductions do not contribute to ozone NAAQS attainment or do not yield net air quality benefits in the affected nonattainment area.[12] API argues that the Phase II RFG NO_X standard emphasizes those portions of a 1991 National Research Council study[13] and other studies that show NO_X control to be an effective ozone control strategy, while discounting those parts of the same studies showing that NO_X control may be counterproductive in a particular area.[14] API cites studies to contradict EPA's discounting of the adverse effects of NO_X reductions on ozone.[15] API points to parts of EPA's 1993 report to Congress (pursuant to section 185B of the CAA) to support its contention that NO_X control may not always be appropriate to reduce ozone.[16]

API argues that in granting section 182(f) waivers, EPA has concluded in most cases that additional NO_X reductions are not needed for ozone attainment; however, in a few cases, EPA has found that NO_X reductions would be detrimental to ozone attainment.[17] Moreover, three waivers would suspend major stationary source NO_X control in cities required to use RFG: Chicago, Milwaukee, and Houston.[18] API states that the waivers have no set period of duration and stay in place so long as the conditions in section 182(f) are met.[19] API concludes that the Phase II NO_X standard is incongruous with the granting of section 182(f) waivers in RFG areas.[20] API also argues that the Phase II RFG NO_X standard is incongruous with the two-phased approach EPA adopted for submittal of ozone SIP attainment demonstrations.[21] API concludes that given the substantial progress toward ozone NAAQS attainment, and the CAA requirement of continued steady progress, EPA's Phase II RFG NO_X standard applicable in all RFG areas is incongruous with the granting of state

[2] API Petition for Reconsideration and Rulemaking on NO_X Reduction Portion of the Reformulated Gasoline Rule (hereinafter ''Pet.'') at p. 1.

[3] Pet. at p. 2.

[4] Pet. at p. 3.

[5] Pet. at p. 5.

[6] Ibid.

[7] U.S. EPA, *National Air Quality and Emissions Trends Report 1993*, EPA 454/R–94–026, October 1994, p. 6.

[8] Pet. at p. 6.

[9] Ibid.

[10] Pet. at p. 7.

[11] Pet. at p. 8.

[12] Ibid.

[13] National Research Council, *Rethinking the Ozone Problem in Urban and Regional Air Pollution*, National Academy Press, Washington, DC., 1991.

[14] Pet. at p. 9.

[15] Pet. at p. 10.

[16] Pet. at p. 11.

[17] Pet. at p. 12.

[18] Pet. at p. 13. API also points out that Dallas, which chose to implement the RFG program, has been granted a section 182(f) waiver. The Dallas waiver is based on a showing that Dallas would attain the ozone NAAQS without implementation of the additional NO_X controls required under section 182. 59 FR 44386 (August 29, 1994).

[19] Ibid.

[20] Pet. at p. 14.

[21] Ibid.

petitions for waiver from section 182 NO_X reduction requirements.[22]

API also argues that non-ozone benefits claimed for the Phase II RFG NO_X standard are wholly speculative; no evidence is offered by EPA to show that the assumed effects are measurable, let alone significant.[23] Non-ozone benefits claimed include less acid rain, reduced toxic nitrated compounds, reduced nitrate deposition, improved visibility, lower levels of nitrogen dioxide, lower levels of PM–10, and protection against increases in fuel olefin content which could increase the reactivity of vehicle emissions.[24]

C. Cost-Effectiveness

API argues that the impact of the NO_X reduction standard on gasoline refining costs and on refinery flexibility is understated.[25] API cites statements by EPA acknowledging that a NO_X performance standard restricts the flexibility of refiners in producing qualifying RFG.[26] API discounts EPA's assertion that the performance standard is not a fuel recipe and refiners may produce gasoline in any way that achieves the desired result.[27] According to API, any NO_X reduction ''interferes with refining flexibility and leaves refiners with unduly costly and narrow choices for producing RFG.''[28]

API argues that the cost-effectiveness of NO_X reduction is overstated because sulfur removal costs are understated and ozone benefits are overstated.[29] API references detailed information submitted during the RFG rulemaking that criticizes inadequacies in the Bonner & Moore refinery model used by EPA.[30] API also cites a 1994 DOE study[31] that API characterizes as suggesting that EPA's desulfurization costs are too low.[32] API cites cost estimates recently prepared by EPA for the Ozone Transport Assessment Group (OTAG) to illustrate its point that EPA and API are far apart on cost estimates.[33] API states that if EPA used more accurate desulfurization costs, the cost of Phase II NO_X reductions would increase above the $10,000 per ton benchmark EPA rejected as too high during the RFG rulemaking.[34]

API also argues that EPA's analysis of cost-effectiveness does not take into account that NO_X reductions do not contribute to ozone attainment in certain areas.[35] API states that the Chicago, Milwaukee, Houston and Dallas areas each have section 182(f) waivers and comprise 33 percent of the non-California RFG market.[36] API argues that the benefit of NO_X reductions in these areas is at least zero, if not less than zero, thereby driving EPA's cost-effectiveness up to about $7,500 per ton, based on this factor alone.[37]

API further argues that EPA understated the relative cost-effectiveness of major stationary source NO_X control strategies, by dwelling on motor vehicle and engine controls.[38] API argues that stationary source controls can discriminate between areas where NO_X reductions contribute to ozone attainment and areas where they do not, unlike motor vehicle, engine, and fuel controls.[39] API cites several studies conducted by or for EPA between July 1991 and July 1994 that contain more comprehensive information about stationary source controls, including cost-effectiveness.[40] API provides a table citing data from those studies, and includes its estimate of incremental cost-effectiveness for several technologies.[41] API concludes that its incremental cost-effectiveness values compare favorably even to EPA's incremental cost-effectiveness estimate of $5,000 per ton of NO_X removed for a 6.8 percent NO_X emission reduction.[42]

API argues that control of major stationary sources for NO_X offers a far larger potential for overall reduction in air pollution.[43] API cites EPA's 1994 Trends Report that combustion stationary sources account for about 50 percent of national NO_X emissions with a NO_X reduction potential of 75 to 95 percent.[44] API further argues that major stationary source controls can be targeted to avoid the economic waste of NO_X controls where they are not needed and the adverse effect on ozone because of atmospheric chemistry.[45]

API concludes that EPA should repeal the Phase II RFG NO_X emission reduction standard or, at least, suspend the effective date until a comprehensive consideration of NO_X control cost-effectiveness is performed.[46] API claims EPA should sequence NO_X controls where NO_X reductions are appropriate, targeting major stationary source NO_X controls first as they are claimed to be more cost-effective and can be targeted where needed geographically. Other controls should not be considered until major stationary source controls are employed and evaluated, according to API.[47] Finally, API concludes that Phase II RFG NO_X emission reductions are not compelled by the statute, are not necessary, and are not the most cost-effective controls for NO_X reduction and, thus, satisfy none of the criteria for regulatory action set out in Executive Order 12866.[48]

III. Summary of Public Comment

EPA received public comment on the API petition from 26 commenters, including the oil, automotive, and utility industries, and from states and state organizations. This section summarizes those comments.

A. Consistency With CAA and Regulatory Negotiation Agreement in Principle

Whether the Phase II RFG NO_X reduction standard is consistent with the CAA and the regulatory negotiation is addressed in comments by several oil companies, and by oil, automotive, utility, and state associations. Most comments from the oil industry restate the points made by API in its petition to EPA, described in the previous section. One oil company also argued that EPA did not give proper consideration to the statutory factors required under section 211(c)(1)(A) of the Act, given that EPA is still trying to define the complex relationships involving NO_X, atmospheric chemistry, and ozone formation.

The automotive, utility, and state association comments argue that although the Phase II RFG NO_X reduction standard is not mandated by section 211(k) of the CAA, it is not inconsistent with the CAA, and that the Phase II program was not addressed by the regulatory negotiation's Agreement in Principle, so the NO_X reduction standard does not contradict or supersede any specific term of the agreement.

[22] Id.
[23] Pet. at p. 15.
[24] Ibid.
[25] Pet. at p. 16.
[26] Ibid.
[27] Id.
[28] Pet. at pp. 17–18.
[29] Pet. at pp. 18–19.
[30] Pet. at p. 19.
[31] U.S. DOE, Estimating the Costs and Effects of Reformulated Gasolines, DOE/PO–0030, December 1994 (hereinafter ''1994 DOE study'').
[32] Pet. at p. 20.
[33] Pet. at pp. 20–21.
[34] Pet. at p. 21.
[35] Pet. at p. 22.
[36] Pet. at p. 22.
[37] Pet. at p. 22.
[38] Pet. at p. 23.
[39] Pet. at p. 23.
[40] Pet. at pp. 23–24.
[41] Pet. at p. 25.
[42] Pet. at p. 26.
[43] Pet. at p. 27.
[44] Pet. at p. 27.
[45] Pet. at p. 29.
[46] Pet. at p. 31.
[47] Pet. at p. 30.
[48] Pet. at pp. 30–31.

B. Air Quality Benefits

Most comments address the issue of whether EPA overstated the air quality benefits of the Phase II RFG NO_X emission reduction standard. Several oil industry comments cite air quality modeling data generated by OTAG to support the API argument that NO_X reductions may cause urban ozone increases, also referred to as NO_X disbenefits. One oil company argues that the OTAG modeling results present compelling new evidence against the Phase II RFG NO_X emission reduction standard, citing one day each of two modeling runs as evidence that aggressive NO_X controls significantly increase ozone concentrations in the urban areas where ozone levels are highest. Those runs include a 60 percent reduction in elevated NO_X emissions, and a 60 percent reduction in elevated NO_X emissions plus a 30 percent reduction in low-level NO_X emissions.

Another oil company argues that the OTAG modeling results are significant new evidence to support the API petition, and show that the NO_X disbenefit phenomenon is consistently present and most pronounced in the Chicago metropolitan area. That company further argues that OTAG modeling results show that urban VOC reductions do not eliminate the disbenefit from NO_X reductions, although the company notes that VOC reductions do mitigate the disbenefit. That company argues that the scale of significant ozone transport tends to be substantially localized rather than OTAG domain-wide, undercutting the transport rationale for widespread imposition of NO_X controls. The commenter bases its arguments on modeling results for three days for each of three ozone episodes; one with 60 percent elevated point source NO_X reductions, the second with 60 percent elevated point source NO_X reductions plus 30 percent low-level NO_X reductions, and the third with 30 percent VOC reductions plus 60 percent elevated NO_X reductions and 30 percent low-level NO_X reductions. Also included was one day of a run of 30 percent low-level NO_X reductions only.

In its comments on the petition, API argues that OTAG air quality modeling sensitivity runs as of August 1996 show that downwind air quality benefits of NO_X control are far less than expected, undercutting the core transport rationale for widespread imposition of RFG NO_X controls. API argues that OTAG modeling confirms its central thesis that NO_X emissions reductions increase ozone levels immediately downwind of several urban nonattainment areas, notably Chicago and New York. Finally, API argues that the OTAG modeling shows that the ozone increases were not fully ameliorated by larger NO_X reductions or VOC reductions; even if VOC controls were effective, this would put affected states in the position of imposing extra VOC controls to offset the adverse air quality impact of RFG NO_X controls.

Several states, and state and utility associations also addressed the air quality benefits issue. States and state associations stress the importance of the Phase II RFG NO_X standard in state ozone attainment and maintenance planning. State associations argue that OTAG has projected that, in 2007, mobile sources will still contribute 43 percent of all NO_X after implementation of CAA controls; given the challenges facing so many areas in identifying and implementing programs that will lead to attainment of the ozone standard, the air quality benefits associated with the NO_X reduction potential of Phase II RFG cannot be overstated. One state points out that with the anticipated lowering of the federal ozone standard, the Phase II RFG NO_X emission reduction standard will become even more critical for states. A state association argues that although there has been progress toward attainment, loss of a tool as significant as Phase II RFG in reducing VOC and NO_X would only exacerbate state emission reduction shortfalls.

While state and state association comments acknowledge that in certain urban areas, NO_X reductions can increase ozone, state associations argue that API's advocacy of repeal of the NO_X standard is both premature and shortsighted; premature because OTAG is still seeking to define the extent and impact of NO_X disbenefits and how disbenefits should be accommodated, and shortsighted because for many areas of the country it has been conclusively ascertained that NO_X reductions will be imperative if the ozone standard is to be attained and maintained.

Several states and state associations argue that modeling demonstrates that NO_X reductions are beneficial, and for many areas imperative, notwithstanding potential disbenefits in some limited geographic areas. One state and a state association argue that all major regional modeling efforts performed or underway through such organizations as OTAG and the Ozone Transport Commission have demonstrated that NO_X reductions are beneficial in reducing ozone levels and will be needed to achieve attainment of the ozone standard in many areas, and particularly in the eastern U.S. They argue that the importance of NO_X reductions in reducing ozone levels is becoming even more pronounced as modeling efforts utilize the newer and more accurate methodology for estimating biogenic VOC emissions.

A state association argues that the regional photochemical modeling results prepared for OTAG are confirmatory of previous modeling that both elevated and low-level control of NO_X are beneficial at reducing the regional extent of ozone, and that the combination of NO_X and VOC control, especially in urban areas, can be very effective in reducing regional ozone levels. Another state association also argues that modeling studies have shown that urban VOC reductions, such as those provided by RFG, are effective at addressing any limited NO_X disbenefits, while leaving in place the very extensive regional benefits of NO_X emission reductions. One state argues that there is no definitive data that Phase II RFG could be a significant disbenefit to ground level ozone attainment and, in the absence of evidence to the contrary, the state will operate under the assumption that all reductions of ground level ozone precursors are both important and beneficial.

A state association argues that granting contingent waivers on a local nonattainment area basis does not negate EPA recognition and support for regional efforts to use NO_X reductions to address ozone transport and attainment issues. It argues that NO_X waivers do not take into account that when controls are removed or absent in one area, particularly a control of regional significance, this would generally cause or exacerbate problems for any area downwind of that area. It argues that while the understanding and development of mechanisms for regional ozone reductions over large areas is still evolving, mechanisms that have the greatest potential continue to rely on a balance of both VOC and NO_X control.

A utility industry group argues that the API petition fails to buttress its argument that EPA overstated the air quality benefits of the Phase II RFG NO_X standard with new evidence; instead, API relies upon arguments already rejected by EPA. API's section 182(f) waiver argument fails because the grant of a waiver says nothing about the value of the Phase II RFG NO_X standard; the utility group argues that the section 182(f) waiver provisions do not apply to the RFG program and that, although temporary waivers have been granted in some places based on highly specific localized facts, the Agency has made it clear waivers would be reevaluated in

light of additional data. The utility group also argues that progress by the states toward attainment as indicated in the 1994 Trends Report does not establish that the Phase II RFG NO_X standard is unnecessary or unwise; although progress has been made toward attainment, more still needs to be done.

C. Cost-Effectiveness

Most commenters addressed whether EPA understated the cost-effectiveness of the Phase II RFG NO_X standard. Several oil companies cite data from OTAG both on the comparative cost of stationary source reduction measures and the cost of implementing Phase II RFG throughout the OTAG region. Several companies submitted or cite a ranking developed by the New Hampshire Department of Environmental Services for OTAG of cost per ton ranges for NO_X reduction measures. The ranking places Phase II RFG as the second most expensive NO_X control measure at $25,000 to $45,000 per ton. The cost ranges are comprised of the lowest and highest marginal cost estimates provided by EPA, the states, industry, and other OTAG participants, and represents the extent of disagreement over the ''true'' costs of each measure, according to one oil company comment. One company argues that these data may be interpreted to show that a NO_X reduction strategy that includes the Phase II RFG NO_X reduction standard is purchasing a much smaller reduction at a much higher price than is available from alternative measures. That commenter also claims that DOE's analysis indicates a significantly higher cost per ton of NO_X removed than estimated by EPA in its Regulatory Impact Analysis (RIA) for the final RFG rule.

In its comments, API also cites the OTAG region-wide cost-effectiveness estimate for the Phase II RFG NO_X standard. API argues that even if that figure is adjusted for comparison with only those areas that will use Phase II RFG, the adjusted figure would still ''dwarf'' EPA's $5,000 per ton estimate; however, API did not include such an adjusted figure in its comments. API also cites the New Hampshire list as evidence that the NO_X standard is not cost-effective.

Two state associations argue that it would be more accurate to characterize the cost of Phase II RFG from combined VOC and NO_X reductions; the combined OTAG range for the OTAG region is $3,500 to $6,200. One state argues that the cost of the NO_X standard is within a reasonable range of cost-effectiveness. That state also argues that the cost of the NO_X standard is highly favorable compared to the cost of typical transportation control measures.

An automobile industry association argues that the API focus on sulfur reduction overlooks the fact that sulfur reductions also decrease hydrocarbon (HC) and carbon monoxide (CO) emissions. That association argues that recent industry data show that when advanced technology vehicles are operated on high sulfur fuels, their emissions will be no better than Tier 0 level vehicles; comparing those new data with expected costs of compliance compiled by Turner, Mason & Company in April 1992 yields a cost-effectiveness estimate of about $200 per ton of pollutant removed when the benefits of sulfur removal on HC, CO, and NO_X are considered.

A clean fuel industry association evaluated capital investment options for reducing the sulfur level in gasoline to meet the Phase II RFG NO_X emission reduction standard. That association argues that average costs from the investment options evaluated were generally equal to or less than EPA's original cost estimates for reducing sulfur levels in RFG; therefore, that association argues, the cost of the Phase II RFG NO_X emission reduction standard has not fundamentally changed and it is still a cost-effective standard.

The utility industry argues that API presented no compelling new evidence that desulfurization costs are understated. One utility industry group argues that API's claim that EPA underestimated desulfurization costs does not address the fact that desulfurization is not required; nor did API address the ability of industry to meet the standard without desulfurization. That group also argues that the fact that it might be cheaper to reduce emissions from stationary sources than to reduce NO_X in fuels does not mean the same ozone reduction benefits would be produced. Another utility industry association argues that, even if API's claim that regulating stationary sources is more cost-effective is true, that does not justify forcing stationary sources to subsidize the petroleum industry by paying for that industry's share of clean air compliance costs.

IV. EPA Response

A. Consistency With CAA and Negotiated Rulemaking

As EPA pointed out in the RFG final rule, the regulatory negotiation conducted by EPA did not address Phase II RFG VOC and toxic standards; neither did it address a reduction in NO_X emissions beyond the statutory cap imposed under section 211(k)(2)(A).[49] Because the regulatory negotiation did not address Phase II RFG standards, including the NO_X reduction standard, Phase II RFG standards are consistent with the Agreement in Principle that resulted from the regulatory negotiation. A reduction in NO_X emissions does not interfere with or reduce the benefits gained by the parties from the elements of the Agreement in Principle that were finally adopted in the RFG rule. While it adds costs and gains benefits, these are in addition to, and not at the expense of, the elements addressed in the regulatory negotiation. The costs and air quality benefits of the Phase II RFG NO_X emission reduction standard are discussed in more detail in later sections of this notice.

The Phase II RFG NO_X standard is also fully consistent with the Act. EPA proposed and finalized the NO_X emission reduction performance standard for Phase II RFG relying on EPA's authority under section 211(c)(1)(A) of the Act, based on EPA's view that NO_X reductions from summertime RFG are important to achieve attainment of the ozone NAAQS in many nonattainment areas.[50] Section 211(c)(1)(A) of the Act allows the Administrator to regulate fuels or fuel additives if ''any emission product of such fuel or fuel additive causes, or contributes to, air pollution which may reasonably be anticipated to endanger the public health or welfare.'' Section 211(c)(2)(A) further provides that EPA may control those fuels and fuel additives ''after consideration of all relevant medical and scientific evidence available * * * including consideration of other technologically or economically feasible means of achieving emissions standards under [section 202 of the Act].''

EPA used this authority to require reformulated fuels to also achieve NO_X reductions in order to reduce ozone formation, based on scientific evidence regarding the benefits of NO_X control and on the cost-effectiveness of NO_X reductions. A detailed discussion of the determination of the need for and scientific justification for NO_X control is presented in the RIA for the final rule.[51] The fact that scientific understanding of atmospheric chemistry and ozone formation continues to evolve does not

[49] 59 FR 7744 (February 16, 1994).

[50] Ibid.

[51] U.S. EPA, Final Regulatory Impact Analysis for Reformulated Gasoline, December 13, 1993, pp. 313–326.

negate that determination. In addition, as discussed below, EPA's review of the air quality benefits and cost-effectiveness of the NO_X reduction standard does not show that the rulemaking determinations supporting this standard were inappropriate.

B. Air Quality Benefits

1. The Need for Regional NO_X Reduction

At present, there are 74 areas in the United States, with a population exceeding one hundred million, that do not meet the ozone NAAQS of 120 parts per billion (ppb) for a one-hour daily maximum. The following section describes ozone formation, the regional scale of the ozone problem, and the reductions needed to meet the ozone standard.

Ozone Formation. Ozone is a naturally occurring trace constituent of the atmosphere. Background ozone concentrations vary by geographic location, altitude, and season. Part of this background ozone concentration is due to natural sources and part is due to long-range transport of anthropogenic or man-made precursor emissions. The natural component of background ozone originates from three sources: (1) Stratospheric ozone (which occurs at about ten to 50 kilometers altitude) that is transported down to the troposphere (i.e., from the ground level through about ten kilometers), (2) ozone formed from the photochemically-initiated oxidation of biogenic (i.e., produced by living organisms) and geogenic (i.e., produced by the earth) methane and carbon monoxide with nitric oxide, and (3) ozone formed from the photochemically-initiated oxidation of biogenic VOCs with NO_X. NO_X plays an important role in the oxidation of methane, carbon monoxide, and biogenic VOC, though the magnitude of this natural component cannot be precisely determined.[52] The background ozone concentration near sea level in the U.S. for a one-hour daily maximum during the summer is usually in the range of 30–50 ppb.[53]

While ozone formation in the atmosphere involves complex non-linear processes, a simplified description is offered here. For more information on ozone chemistry, see, for example, the 1991 National Research Council study. In short, nitric oxide (NO) is formed during combustion or any high temperature process involving air (air being largely N_2 and O_2). NO is formed, for example, when fuel is burned to generate power for stationary or mobile sources. The NO is converted to NO_2 by reacting with certain compounds formed from oxidized VOCs, called radicals. It is also converted to NO_2 by reacting with ozone (O_3). Sunlight then causes the NO_2 to decompose, leading to the formation of ozone and NO. The NO that results is then able to start this cycle anew. A reaction path that converts NO to NO_2 without consuming a molecule of ozone allows ozone to accumulate; this can occur by the presence of oxidized VOCs.[54] That is:

1. NO is formed from combustion involving air:

N_2+O_2==>NO molecules.

2. NO_2 (nitrogen dioxide) is formed when NO reacts with radicals from oxidized VOCs.

3. NO_2 is also formed when NO reacts with ozone; this removes ozone:

$NO+O_3$==>NO_2+O_2.

4. Sunlight causes NO_2 to decompose, or photolyze, into NO and O. Ozone is formed when an oxygen molecule (O_2) reacts with the oxygen element (O), formed from the decomposition of NO_2:

NO_2==>NO+O; and

$O+O_2$==>Ozone.

A general explanation for the formation of ozone in or near urban areas follows.[55] NO_X is produced when combustion temperatures are above 2500°K, and air is used as an oxidizer in the combustion process. Incomplete combustion of the fuel also results in the emission of raw fuel components and oxygenated organic components or VOCs from the fuels. In sunlight, these components form free radicals (e.g., OH, HO_2, RO, RO_2) that oxidize NO to NO_2 (reaction 2 above). The free radical is recreated in the process. Each free radical is cycled up to five times. The NO_2 then reacts with sunlight to recreate NO and to produce ozone (reaction 4 above). After the first oxidation of NO to NO_2, every subsequent operation of the cycle produces ozone with an efficiency greater than 90 percent. In current chemical reaction mechanisms, a typical nitrogen is cycled three to five times. Some of the ozone produced reacts with organics and with sunlight to produce more free radicals to maintain the cyclic oxidation process.

Ozone itself is a major source of the free radicals that oxidize NO into NO_2. This represents a powerful positive feedback process on the formation of more ozone, given available NO_X. The oxidation of the VOCs also leads to the production of more free radicals. As the cycle operates, NO_2 reacts with free radicals and is converted into nitrates. This form of nitrogen cannot cycle. This also removes free radicals. A system that converts all NO_X to nitrogen products cannot create any more ozone.

NO_2 reacts rapidly with free radicals. In situations that have a limited supply of radicals, NO_2 effectively competes with VOCs for the limited free radicals, and is converted into nitrates. This results in virtually no production of ozone. Where there are large amounts of NO relative to the sources of radicals (such as VOCs), then the reaction between NO and existing ozone removes ozone (a radical source), and the large amount of NO_2 formed competes effectively with VOCs for the other available radicals, thus leading to an overall suppression of ozone.

In general, areas with high VOC to NO_X concentration ratios (greater than eight to ten) can effectively reduce local ozone concentrations with local NO_X emission reductions.[56] In areas where VOCs are abundant relative to NO_X, ozone formation is controlled primarily by the amount of NO_X available to react with the oxidized VOCs (reaction 2 above).[57] These ''NO_X limited'' areas generally include rural, suburban, and downwind areas.[58] In contrast, in areas with low VOC to NO_X ratios, ozone formation is controlled primarily by the amount of VOC available. Ozone scavenging by the NO–O_3 reaction (reaction 3 above) is more effective than the reaction of oxidized VOC with NO producing NO_2 (reaction 2 above).[59] Such areas are ''VOC limited'' and generally include the central core areas of large urban areas with significant vehicle emissions.

The rate of ozone formation varies with the VOC to NO_X ratio. By reducing local emissions of VOC, the formation rate generally slows down, leading to lower ozone levels locally, but with eventual production of approximately the same total amount of ozone. Reduction of NOx emissions can lead to

[52] U.S. EPA, Office of Air Quality Planning and Standards, ''Review of National Ambient Air Quality Standards for Ozone, Assessment of Scientific and Technical Information,'' OAQPS Staff Paper, EPA–452/R–96–007, June 1996.

[53] Ibid.

[54] Seinfeld, John H., ''Urban Air Pollution: State of the Science,'' February 10, 1989 vol., *Science.*

[55] Jeffries, H.E., communication to Clinton Burklin, ERG, October 27, 1996.

[56] National Research Council, *Rethinking the Ozone Problem in Urban and Regional Air Pollution,* National Academy Press, Washington, D.C., 1991.

[57] Seinfeld, John H., ''Urban Air Pollution: State of the Science,'' February 10, 1989 vol., *Science.*

[58] Finlayson-Pitts, B.J. and J.N. Pitts, Jr., ''Atmospheric Chemistry of Tropospheric Ozone Formation: Scientific and Regulatory Implications,'' *Air and Waste Management Association,* Vol. 43, August 1993.

[59] Seinfeld, John H., ''Urban Air Pollution: State of the Science,'' February 10, 1989 vol., *Science.*

a more rapid formation of ozone, though with less total amount of ozone formed.[60]

Different mixtures of VOC and NO_X, therefore, can result in different ozone levels such that the total system is non-linear. That is, large amounts of VOC and small amounts of NO_X make ozone rapidly but are quickly limited by removal of the NO_X. VOC reductions under these circumstances show little effect on ozone. Large amounts of NO and small amounts of VOC (which usually implies smaller radical source strengths) result in the formation of inorganic nitrates, but little ozone. In these cases, reduction of NO_X results in an increase in ozone.

The preceding is a static description. In the atmosphere, physical processes compete with chemical processes and change the outcomes in complex ways. The existence of feedback and non-linearity in the transformation system confound the description. Competing processes determine the ambient concentration and there are an infinite set of process magnitudes that can give rise to the same ambient concentrations and changes in concentrations. Lack of any direct measurement of process magnitudes results in the need to use inferential methods to confirm any explanation of a particular ozone concentration.

The formation of ozone is further complicated by biogenic emissions, meteorology, and transport of ozone and ozone precursors. The contribution of ozone precursor emissions from biogenic sources to local ambient ozone concentrations can be significant, especially emissions of biogenic VOCs. Important meteorological factors include temperature, and wind direction and speed. Long-range transport results in interactions between distant sources in urban or rural areas and local ambient ozone. Peroxyacetyl nitrate (PAN), formed from the reaction of radicals with NO_2, can transport NO_X over relatively large distances through the atmosphere. Its rate of decomposition significantly increases with temperature, so that it can be formed in colder regions, transported, and then decomposed to deliver NO_2 to downwind areas.[61]

Regional Scale of the Ozone Problem. Peak ozone concentrations typically occur during hot, dry, stagnant summertime conditions. Year-to-year meteorological fluctuations and long-term trends in the frequency and magnitude of peak ozone concentrations can have a significant influence on an area's compliance status.

Typically, ozone episodes last from three to four days on average, occur as many as seven to ten times per year, and are of large spatial scale. In the eastern United States, high concentrations of ozone in urban, suburban, and rural areas tend to occur concurrently on scales of over 1,000 kilometers.[62] Maximum values of non-urban ozone commonly exceed 90 ppb during these episodes, compared with average daily maximum values of 60 ppb in summer. Thus, an urban area need contribute an increment of only 30 ppb over the regional background during a high ozone episode to cause a violation of the ozone NAAQS of 120 ppb.[63]

The precursors to ozone and ozone itself are transported long distances under some commonly occurring meteorological conditions. The transport of ozone and precursor pollutants over hundreds of kilometers is a significant factor in the accumulation of ozone in any given area. Few urban areas in the U.S. can be treated as isolated cities unaffected by regional sources of ozone.[64]

NO_X Reductions Needed to Meet the Ozone Standard. Over the past two decades, great progress has been made at the local, state and national levels in controlling emissions from many sources of air pollution. Substantial emission reductions are currently being achieved through implementation of the 1990 CAAA measures for mobile and stationary sources. These measures include the retrofit of reasonably available control technology on existing major stationary sources of NO_X and implementation of enhanced vehicle inspection and maintenance programs under Title I; new emission standards for new motor vehicles and nonroad engines, and the RFG program under Title II; and controls on certain coal-fired electric power plants under Title IV. The effects of these programs on total NO_X emissions over time indicate a decline in emissions from 1990 levels of about 12 percent until the year 2007. However, continued industrial growth and expansion of motor vehicle usage threaten to reverse these past achievements; NO_X emissions will gradually increase for the foreseeable future, unless new initiatives are implemented to reduce NO_X emissions.

For many years, control of VOCs was the main strategy employed in efforts to reduce ground-level ozone. More recently, it has become clearer that additional NO_X controls will be needed in many areas, especially areas where ozone concentrations are high over a large region (as in the Midwest and Northeast, where RFG is mandated in several nonattainment areas). The extent of local controls that will be needed to attain and maintain the ozone NAAQS in and near seriously polluted cities is sensitive both to the amount of ozone and precursors transported into the local area and to the specific photochemistry of the area.

In some cases, preliminary local modeling performed by the states indicates that it may not be feasible to find sufficient local control measures for individual nonattainment areas unless transport into the areas is significantly reduced; this may include transport from attainment areas and from other nonattainment areas. These modeling studies suggest that reducing NO_X emissions on a regional basis is the most effective approach for reducing ozone over large geographic areas, even though local NO_X controls may not be effective by themselves in the urban centers of selected nonattainment areas. Thus, large reductions in NO_X emissions may be needed over much of the nation if all areas are to attain the ozone standard.

The following discussion examines the need for NO_X reductions in those regions of the country where RFG is required.

California. The State of California adopted its ozone SIP on November 15, 1994. The SIP covers most of the populated portion of the state and relies on both NO_X and VOC reductions for most California nonattainment areas to demonstrate compliance with the ozone NAAQS. Specifically, the revised SIP projects that the following NO_X reductions are needed (from a 1990 baseline): South Coast, 59 percent; Sacramento, 40 percent; Ventura, 51 percent; San Diego, 26 percent; and San Joaquin Valley, 49 percent.

The South Coast's control strategy for attainment of the ozone standard specifies a 59 percent reduction in NO_X emissions. The design of this strategy took into account the need to reduce NO_X as a precursor of particulate matter, as described in the SIP submittal. This represents a reduction of over 800 tons of NO_X per day. The reductions are to be achieved from a combination of national, state, and local control measures.

The Sacramento metropolitan area's control strategy for attainment of the ozone standard specifies a 40 percent reduction in NO_X emissions. Modeling results indicate that NO_X reductions are

[60] Ibid.

[61] National Research Council, *Rethinking the Ozone Problem in Urban and Regional Air Pollution,* National Academy Press, Washington, D.C., 1991.

[62] Ibid.

[63] Id.

[64] Id.

more effective than VOC reductions on a tonnage basis in reducing ambient ozone concentrations. The reductions are to be achieved from a combination of national, state, and local control measures, especially mobile source measures such as standards for heavy duty vehicles and nonroad engines.

Lake Michigan Region. Modeling and monitoring studies performed to date for the states surrounding Lake Michigan (Illinois, Indiana, Michigan, and Wisconsin) indicate that reducing ozone and ozone precursors transported into the region's nonattainment areas would have a significant effect on the number and stringency of local control measures necessary to meet the ozone NAAQS. In many cases, boundary conditions appear to contribute significantly to peak ozone concentrations; ozone and ozone precursors flowing into a metropolitan area can greatly influence the peak ozone concentration experienced in the metropolitan area. For example, the 1991 Lake Michigan Ozone Study found that transported ozone concentrations entering the region were 40 to 60 percent of the peak ozone concentrations in some of the region's metropolitan areas. That is, the air mass entering the study area was measured by aircraft at 70 to 110 ppb (compared to the ozone NAAQS of 120 ppb) on episode days.[65]

Separate modeling analyses in the Lake Michigan region indicate that reduction in ozone and ozone precursor emissions would be effective at reducing peak ozone concentrations. In the Lake Michigan case, a modeled 30 percent reduction in boundary conditions was found to reduce peak ozone concentrations as much as a 60 percent decrease in local VOC emissions.[66]

These studies suggest that without reductions in transport and boundary conditions, the necessary degree of local control will be difficult to achieve, even with very stringent local controls. The EPA Matrix Study[67] looked at region-wide NO_X control, and the results indicate it would be effective in reducing ozone across the Midwest. The objective of the EPA Matrix Study was to obtain a preliminary estimate of the sensitivity of ozone in the eastern U.S., from Texas to Maine, to changes in VOC and NO_X emissions applied region-wide. The modeled control strategy of region-wide 75 percent NO_X reduction with 50 percent VOC reduction produced substantial ozone reductions throughout the eastern U.S., with ozone standard exceedances limited to several grid cells in the southeast corner of Lake Michigan, over Toronto, and immediately downwind of New York City.

Taken together, the information available to date suggests that additional reductions in regional NO_X emissions will be necessary to attain the ozone NAAQS in the Chicago/Gary/Milwaukee area and downwind (including western Michigan). NO_X control in nonattainment areas, such as RFG provides, contributes to regional NO_X emission reductions. The information available to date has not shown that upwind controls are all that is needed. Emerging data indicates that NO_X controls in Lake Michigan nonattainment areas can contribute to the ozone reduction benefits derived from regional NO_X reductions. *See* discussion *infra.*

New York Study. New York State's recent urban airshed modeling (UAM) studies show that substantial reductions in the ozone transported from other regions would be necessary for several areas within the UAM domain to achieve ozone attainment.[68] The UAM domain includes areas in New York and Connecticut within and surrounding the New York Consolidated Metropolitan Statistical Area (CMSA). This UAM study demonstrates the potential effectiveness of a regional NO_X reduction strategy in combination with a local VOC reduction strategy. The New York study showed that the combination of a regional strategy reflecting a 25 percent reduction in VOCs and a 75 percent reduction in NO_X outside the New York urban airshed, with a local strategy reflecting a 75 percent reduction in VOCs and a 25 percent reduction in NO_X inside the New York urban airshed, would be necessary for all areas throughout the New York UAM domain to reduce predicted ozone levels to 120 ppb or less during adverse meteorological conditions.

Northeast Ozone Transport Region. The Northeast Ozone Transport Region (OTR) includes the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, and the CMSA that includes the District of Columbia and northern Virginia. In its analysis supporting the approval of a Low Emission Vehicle program in the mid-Atlantic and Northeast states comprising the OTR, EPA reviewed existing work and performed analyses to evaluate in detail the degree to which NO_X controls are needed.[69] These studies showed that NO_X emissions throughout the OTR must be reduced by 50 to 75 percent from 1990 levels to obtain predicted ozone levels of 120 ppb or less throughout the OTR.

Other recent studies have confirmed these conclusions.[70] Additional modeling simulations suggest that region-wide NO_X controls coupled with urban-specific VOC controls would be needed for ozone attainment in the northeastern United States.[71] Taken together, these studies point to the need to reduce NO_X emissions in the range of 50 to 75 percent throughout the OTR, and VOC emissions by the same amount in and near the Northeast urban corridor, to reach and maintain predicted hourly maximum ozone levels of 120 ppb or less.

Eastern Texas. There has been limited modeling work to date that focuses on the air quality characteristics of the eastern Texas region. The State of Texas has been granted section 182(f) waivers for the Houston/Galveston and Beaumont/Port Arthur nonattainment areas based on preliminary UAM modeling which predicted that local NO_X reductions would not contribute to ozone attainment because predicted area ozone concentrations are lowest when only VOC reductions are modeled.[72] Additional modeling is underway by the State, including UAM modeling using data from the Coastal Oxidant Assessment for Southeast Texas

[65] Roberts, P.T., T.S. Dye, M.E. Korc, H.H. Main, ''Air Quality Data Analysis for the 1991 Lake Michigan Ozone Study,'' final report, STI–92022–1410–FR, Sonoma Technology, 1994.

[66] Lake Michigan Air Directors Consortium, ''Lake Michigan Ozone Study—Evaluation of the UAM–V Photochemical Grid Model in the Lake Michigan Region,'' 1994.

[67] Chu, Shao-Hung and W.M. Cox, ''Effects of Emissions Reductions on Ozone Predictions by the Regional Oxidant Model during the July 1988 Episode,'' *Journal of Applied Meteorology*, Vol. 34, No. 3, March 1995.

[68] John, K., S.T. Rao, G. Sistla, W. Hao, and N. Zhou, ''Modeling Analyses of the Ozone Problem in the Northeast,'' EPA–230–R–94–018, 1994. John, K., S.T. Rao, G. Sistla, N. Zhou, W. Hao, K. Schere, S. Roselle, N. Possiel, R. Scheffe, ''Examination of the Efficacy of VOC and NO_X Emissions Reductions on Ozone Improvement in the New York Metropolitan Area,'' printed in *Air Pollution Modeling and Its Application*, Plenum Press, NY, 1994.

[69] 60 FR 48673 (January 24, 1995).

[70] Kuruville, John et al., ''Modeling Analyses of Ozone Problem in the Northeast,'' prepared for EPA, EPA Document No. EPA–230–R–94–108, 1994. Cox, William M. and Chu, Shao-Hung, ''Meteorologically Adjusted Ozone Trends in Urban Areas: A Probabilistic Approach,'' Atmospheric Environment, Vol. 27B, No. 4, pp 425–434, 1993.

[71] Rao, S.T., G. Sistla, W. Hao, K. John and J. Biswas, ''On the Assessment of Ozone Control Policies for the Northeastern United States,'' presented at the 21st NATO/CCMS International Technical Meeting on Air Pollution Modeling and Its Application, Nov. 6–10, 1995.

[72] 60 FR 19515 (April 19, 1995).

(COAST) study, but there is not yet enough data to draw conclusions about the potential effect of transport of ozone and its precursors on these areas. This uncertainty has led the State to request that the waivers from local NO_X controls in these areas be granted on a temporary basis while more sophisticated modeling is conducted. Texas has requested a one-year extension of its temporary waivers for Houston/Galveston and Beaumont/Port Arthur, citing the need for additional time to complete its UAM modeling.[73]

Ozone Transport Assessment Group. EPA is supporting a consultative process involving 37 eastern states that includes examination of the extent to which NO_X emissions from as far as hundreds of kilometers away are contributing to smog problems in downwind cities in the eastern U.S. Known as the Ozone Transport Assessment Group (OTAG) and chaired by the State of Illinois, this group is looking into ways of achieving additional cost-effective reductions in ground-level ozone throughout a region consisting of the eastern half of the U.S. Preliminary findings from the first and second of three rounds of control strategy modeling indicate that regional reductions in NO_X emissions would be effective in lowering ozone on a regional scale. The relative effectiveness varies by subregion and episode modeled.[74] Preliminary OTAG modeling results are described in more detail later in this section.

Summary. The preceding discussion demonstrates that substantial region-wide NO_X reductions will be needed in regions of the country where RFG is required for those regions to reach attainment of the ozone standard. Reduction in NO_X emissions is needed locally in some areas in order to attain the ozone NAAQS while, in some of these or other areas, NO_X emission reductions may be needed to help attain the ozone NAAQS in downwind areas or to help maintain ozone levels below the standard in attainment areas. As a local control (except along the Northeast corridor where its use is so widespread as to constitute a regional control), the RFG program will reduce NO_X emissions in nonattainment areas and contribute to needed regional NO_X reductions.

Control strategies must consider efforts to reduce regional scale NO_X emissions as well as local emissions. In general, NO_X emissions reductions in upwind, rural areas coupled with VOC reductions in urban nonattainment areas appears to be an effective strategy in some cases. In some cases however, the urban nonattainment area is also upwind of another urban nonattainment area or contains so much biogenic VOC emissions that reducing only anthropogenic VOC emissions has too little ozone benefit. For example, the Atlanta nonattainment area has very high biogenic VOC, while in the Northeast, many urban nonattainment areas are upwind of other urban nonattainment areas. In cases like these, local NO_X reductions may be needed in urban nonattainment areas in addition to, or instead of, VOC reductions for purposes of ozone attainment. Thus, effective ozone control will require an integrated strategy that combines cost-effective reductions in emissions at the local, state, regional, and national levels.

2. Section 182(f) Waivers and State Implementation Plans for Ozone Attainment

Because Title I focuses on measures needed to bring nonattainment areas into attainment, the CAA requires EPA to view section 182(f) NO_X waivers in a narrow manner. In part, section 182(f) provides that waivers must be granted if states outside an ozone transport region (OTR) show that reducing NO_X within a nonattainment area would not contribute to attainment of the ozone NAAQS in that nonattainment area.[75] Only the role of local NO_X emissions on local attainment of the ozone standard is considered in nonattainment areas outside an OTR. Any exemption may be withdrawn if the basis for granting it no longer applies. For modeling-based exemptions, this will occur if updated modeling analyses reach a different conclusion than the modeling on which the exemption was based.[76] Thus all local NO_X waivers should be considered temporary and do not shield an area from NO_X requirements demonstrated to be needed for ozone attainment in that area or in downwind areas.

EPA has independent statutory authority under CAA section 110(a)(2)(D) to require a state to reduce emissions from sources where there is evidence that transport of such emissions contributes significantly to nonattainment or interferes with maintenance of attainment in other states. That is, the CAA requires a SIP to conform provisions addressing emissions from one state that significantly pollute another downwind state. EPA has stated, in all Federal Register notices approving section 182(f) NO_X petitions, that it will use its section 110(a)(2)(D) authority where evidence of significant contribution is found to require needed NO_X (and/or VOC) reductions. EPA recently published a notice of intent that it plans to call for SIP revisions in the eastern half of the U.S. to reduce regional ozone transport across state boundaries, in accordance with section 110(a)(2)(D) and (k)(5).[77]

EPA's granting of exemptions from local NO_X controls should be seen in the broader context of SIP attainment plans. For ozone nonattainment areas designated as serious, severe, or extreme, state attainment demonstrations involve the use of dispersion modeling for each nonattainment area. Although these attainment demonstrations were due November 15, 1994, the magnitude of this modeling task, especially for areas that are significantly affected by transport of ozone and ozone precursors generated outside of the nonattainment area, has delayed many states in submitting complete modeling results. Recognizing these challenges, EPA issued guidance on ozone demonstrations[78] that includes an intensive modeling effort to address the problem of long distance transport of ozone, NO_X, and VOCs, and submittal of attainment plans in 1997. Considering its modeling results, a state must select and adopt a control strategy that provides for attainment as expeditiously as practicable.

When the attainment plans are adopted by the states, these new control strategies will, in effect, replace any NO_X waivers previously granted. To the extent the attainment plans include NO_X controls on certain major stationary sources in the nonattainment areas, EPA will remove the NO_X waiver for those sources. To the extent the plans achieve attainment without additional NO_X reductions from certain sources, the waived NO_X reductions would be considered excess reductions and, thus, the exemption would continue. EPA's rulemaking action to reconsider the initial NO_X waiver may occur simultaneously with rulemaking action on the attainment plans. Thus,

[73] 61 FR 65505 (December 13, 1996).

[74] Ozone Transport Assessment Group, joint meetings of RUSM and ISI workgroups, ''First Round Strategy Modeling,'' October 25, 1996, and ''Round 2 Strategy Modeling,'' December 17, 1996.

[75] 42 U.S.C. § 7511a(f)(1)(A).

[76] Seitz, John S., Director, OAQPS, EPA, ''Section 182(f) Nitrogen Oxides (NO_X) Exemptions—Revised Process and Criteria,'' EPA memoranda to Regional Air Directors, dated May 27, 1994, and revised February 8, 1995.

[77] 62 FR 1420 (January 10, 1997).

[78] Nichols, Mary D., Assistant Administrator for Air and Radiation, ''Ozone Attainment Demonstrations,'' memorandum to EPA Regional Administrators, March 2, 1995.

many or all areas, including NO_X waiver areas, are potentially subject to NO_X controls as needed to attain the ozone standard throughout the nation and/or meet other NAAQSs.

API selectively cites to those portions of EPA's 1993 section 185B report to Congress that support its contention that NO_X control may not always be appropriate to reduce ozone, but ignores the report's overall conclusions regarding the need for many areas across the nation to reduce NO_X emissions if ozone attainment is to be achieved. API in particular overlooks the report's finding that, in some cases, even if ozone initially increases in response to small NO_X reductions, ozone levels in many areas will decline if NO_X levels are more significantly reduced. *See* section 2.2.2. Thus, in some cases, state and local agencies may need to reduce NO_X emissions even though doing so may cause a potential increase in ozone concentrations in central urban areas, as part of a larger plan to enable many nonattainment areas to meet the ozone NAAQS. For example, NO_X reductions in the New York metropolitan area are needed for downwind areas within the state and in other states to attain the ozone standard; yet additional VOC controls may be needed in the metropolitan area to offset the local impact of NO_X reductions. Similarly, NO_X reductions in areas upwind of the Northeast Ozone Transport Region may be needed to help downwind areas attain and maintain the ozone standard, even though those NO_X reductions may not in some cases help the upwind areas reduce local peak ozone concentrations. In such cases, a previously granted NO_X waiver will not allow an area to avoid implementing NO_X control requirements deemed necessary for itself or another area's attainment.

The progress toward ozone attainment that has been achieved by states to date and the continued progress by states toward ozone attainment, required by the CAA, are not convincing rationales to EPA for dropping the Phase II RFG NO_X standard, as suggested in the API petition. The previous discussion demonstrates that substantial region-wide reductions in NO_X will be needed in areas of the country where RFG is required for those areas to reach attainment of the ozone standard. Progress toward attainment achieved by states to date and the continued progress toward attainment required under the CAA will not be sufficient without additional combined NO_X and VOC emission reductions for some RFG areas, including the Northeast corridor and the Lake Michigan region, as discussed above, to achieve attainment. Moreover, a NO_X waiver does not excuse an area from reasonable further progress (RFP) requirements. Thus, progress toward attainment is not a convincing rationale for dropping the Phase II RFG NO_X standard, because progress toward attainment is not the same as attainment and, thus, doesn't demonstrate that the Phase II RFG NO_X standard is unnecessary or inappropriate. Because the need for extensive NO_X control is clear, it is not necessary or appropriate for EPA to delay establishing federal NO_X control programs until individual state ozone attainment demonstrations have been developed and presented. EPA agrees with comments that loss of the Phase II RFG NO_X standard would only exacerbate state emission reduction shortfalls.

Moreover, for the reasons discussed above, EPA does not agree that the Phase II RFG NO_X standard is incongruous or at odds with the granting of section 182(f) waivers in RFG areas, as suggested in the API petition. EPA does agree with API's comments that point out that the section 182(f) waiver process alone does not take into account the downwind impact of NO_X controls, but notes that API, in doing so, has ignored EPA's stated intent to require NO_X reductions from states with areas that received NO_X exemptions, pursuant to its section 110(a)(2)(D) authority if such areas are shown to contribute significantly to downwind states' ozone problems.

3. Comparison of Benefits and Disbenefits From NO_X Reductions

The following discussion focuses on another aspect of API's section 182(f) argument: the potential for disbenefits, or increases in urban ozone, that occur as a result of reductions in NO_X. The best data currently available to examine this air quality and ozone attainment issue are the photochemical grid modeling results being generated by OTAG. The OTAG model (UAM–V) includes the best emission inventory information available, provided by the states and reviewed by stakeholders and experts, an improved biogenic inventory (BEIS2), and updated chemistry (CB–IV). Data are available from four ozone episodes.[79] All stakeholders, including states and the oil, automotive, and utility industries, have been involved in OTAG modeling inputs and modeling runs. Further information describing OTAG is available electronically on the OTAG Home Page at http://www.epa.gov/oar/OTAG/otag.html. All OTAG data discussed here are available electronically on the TTN2000 Web Site at http://ttnwww.rtpnc.epa.gov.

OTAG modeling conducted to date consistently demonstrates that NO_X reductions applied equally by source type throughout the 37 state OTAG region result in widespread ozone reductions across most of that region, and in geographically and temporally limited increases in urban ozone.[80] The OTAG sensitivity modeling cited in oil industry comments included large NO_X reductions (i.e., a 60 percent reduction in elevated utility system point source NO_X emissions plus a 30 percent reduction in low-level, or non-utility point and area source and mobile source, including nonroad and on-highway, NO_X emissions), or large NO_X reductions combined with VOC reductions (i.e., a 60 percent reduction in elevated NO_X emissions with a 30 percent reduction in low-level NO_X emissions plus a 30 percent reduction in VOC emissions) over the 37 state OTAG region. That modeling indicates that such emission reductions would result in widespread ozone decreases in high ozone areas. That modeling also indicates ozone increases, or disbenefits, particularly within the Northeast corridor and southwestern Lake Michigan area but only in some grid cells on some days of some episodes.

For example, for July 8, 1988, the OTAG modeling run of a 60 percent reduction in elevated NO_X emissions plus a 30 percent reduction in low-level NO_X emissions, throughout the 37 state region (OTAG run 5e), shows decreases in ozone throughout most of the 37 state region ranging from four to at least 36 ppb.[81] That modeling run also shows increases in ozone of four to 12 ppb in Boston, Savannah, Wheeling, and Houston, and increases of four to 28 ppb in the Norfolk/Virginia Beach area and along the coasts of Connecticut, New York, and New Jersey.

For July 18, 1991, the same modeling run shows decreases in ozone ranging from four to at least 36 ppb throughout most of the 37-state region. Ozone increases of four to 12 ppb appear in Nashville, Paducah, Detroit, Bay City, and Philadelphia, and increases of four to at least 36 ppb in the Lake Michigan area and in Memphis, Louisville, Indianapolis, and Cincinnati. For July

[79] July 1–11, 1988; July 13–21, 1991; July 20–30, 1993; and July 7–18, 1995.

[80] Ozone Transport Assessment Group, joint meeting of the RUSM and ISI workgroups, ''Sensitivity Modeling'' and 5g scatter plots, August 22, 1996, ''First Round Strategy Modeling,'' October 25, 1996, and ''Round 2 Strategy Modeling,'' December 17, 1996.

[81] The upper end of the scale of changes in ozone concentrations modeled by OTAG was 36 ppb.

15, 1995, modeling shows ozone decreases ranging from four to at least 36 ppb throughout most of the OTAG region, and ozone increases of four to 12 ppb in Milwaukee, Chicago, Youngstown, and Philadelphia, and increases of four to 28 ppb on Long Island and in Memphis.

OTAG modeling indicates that urban ozone increases from region-wide NO_X control are smaller in magnitude and area when NO_X reductions are combined with VOC reductions. In a modeling run with a 60 percent elevated source NO_X reduction, a 30 percent low-level NO_X reduction and a 30 percent VOC reduction (OTAG run 5c), for July 8, 1988, ozone increases of four to 12 ppb were confined to Memphis and Norfolk/Virginia Beach, with increases of four to 28 ppb along the coast of Connecticut, New York, and New Jersey. For July 18, 1991, ozone increases of four to 12 ppb appear in Paducah and Philadelphia, with increases of four to 20 ppb in Chicago, Milwaukee, Cincinnati, and Louisville. For July 15, 1995, increases of four to 12 ppb appear in Memphis, Youngstown, Philadelphia, and Long Island.

The above OTAG results for ozone changes were cited without regard to the actual ozone levels. A closer look at OTAG modeling indicates that urban NO_X reductions, as part of region-wide reductions, produce widespread decreases in ozone concentrations on high ozone days. Urban NO_X reductions also produce limited increases in ozone concentrations, but the magnitude, time, and location of these increases generally do not cause or contribute to high ozone concentrations; most urban ozone increases occur in areas already below the ozone standard and, thus, in most cases, urban ozone increases resulting from NO_X reductions do not cause exceedance of the ozone standard. There are a few days in a few urban areas where NO_X reductions produce ozone increases in portions of an urban area that are detrimental. OTAG defined detrimental as an increase exceeding four ppb in a grid cell on a day with ozone exceeding 100 ppb. However, those portions of an urban area with disbenefits on one day of an ozone episode get benefits on later days of the same episode, and later days generally are higher ozone days.[82]

In other words, OTAG has found that, in general, NO_X reduction disbenefits are inversely related to ozone concentration. On the low ozone days leading up to an ozone episode (and sometimes the last day or so) the increases are greatest, and on the high ozone days, the increases are least (or nonexistent); the ozone increases generally occur on days when ozone is low and the ozone decreases generally occur on days when ozone is high. This indicates that, in most cases, urban ozone increases may not produce detrimental effects when viewed alone, and the overall effects over the episode are positive. However, OTAG modeling (run 5e) indicates that at least one area for one day of one episode experienced an increase in ozone on a high ozone day. Concentration difference plots show ozone increases over Lake Michigan and the adjacent shoreline at least as high as 36 ppb on July 18, 1991, when the highest modeled ozone concentration was about 110 ppb. However, concentration difference plots also show ozone decreases in downwind states. Decreases in ozone of five ppb extend into Michigan, and decreases of one ppb extend as far as New York, New Hampshire, Vermont, and Maine. The magnitude of the ozone decrease is as high as ten ppb.[83]

For July 19, 1991, with peak ozone levels of 130 ppb and, therefore higher than for July 18, OTAG modeling (run 4b)[84] showed ozone increases for only two of the 20 highest grid cells in the Lake Michigan region. On July 20, ozone increases are only apparent for ozone levels less than 100 ppb. OTAG modeling thus demonstrates that the ozone reduction benefits of urban NO_X control far outweigh the disbenefits of urban ozone increases in both magnitude of ozone reduction and geographic scope.

Ozone benefits and disbenefits occur from both elevated and low-level NO_X reductions; the relative effectiveness of elevated and low-level NO_X reductions varies by region and ozone episode, according to OTAG modeling.[85] Elevated and low-level NO_X reductions appear to act independently, with little synergistic effect. The pattern of ozone benefits and disbenefits is similar whether the one-hour or the proposed eight-hour ozone standard is modeled.

The NO_X reduction scenarios modeled by OTAG are for large NO_X reductions, greater than the Phase II RFG NO_X emission reduction standard of 6.8 percent of gasoline-fueled vehicle emissions on average. Although EPA believes the direction of the effect is reliable, disbenefits from the Phase II RFG NO_X emission reduction standard would be smaller than the urban disbenefits modeled by OTAG for larger NO_X reductions. EPA recognizes that the OTAG model's coarse grid size (even in fine part of the domain) may cause the modeling to show fewer disbenefit areas than actually exist and would be revealed by finer grid modeling, such as urban-scale modeling. As API points out, urban-scale modeling demonstrations of NO_X disbenefits supported the section 182(f) waivers approved by EPA for three mandated RFG areas (Chicago, Milwaukee, and Houston). The OTAG model's grid size and wide field treatments are not precise enough to be used to balance population exposures to ozone benefits and disbenefits from NO_X control. However, these facts do not change EPA's conclusion that OTAG modeling demonstrates that the ozone reduction benefits of NO_X control far outweigh the disbenefits of urban ozone increases in both magnitude of ozone reduction and geographic scope.

It should be noted that no scenario modeled by OTAG to date completely mitigates the ozone problem throughout the 37 state domain, so some areas, including the Northeast and the Lake Michigan region, will have to go beyond OTAG scenarios to reach attainment. Since OTAG modeling shows that more NO_X emission reductions produce more ozone reductions, the ultimate ozone mitigation level of emissions may not produce urban disbenefits.

OTAG modeling of the transport of ozone and ozone precursors among subregions is less complete than its modeling of various region-wide emission reduction scenarios. Preliminary OTAG sensitivity tests did include a set of four regional impact runs to examine the effect of controls applied differently within the OTAG domain. For this purpose, OTAG was divided into four subregions: Northeast, Midwest, Southeast, and Southwest.[86] The regional impact runs provide

[82] Lopez, Bob, ''Localized Ozone Increases Due to NO_X Control—Transmittal of Technical Evaluation Summary and Draft Policy Options Paper,'' memorandum and attachments from OTAG Task Group on Criteria for Modeling and Strategy Refinement Regarding NO_X Disbenefits to OTAG Implementation and Strategies Workgroup and Criteria Evaluation Miniworkgroup, second draft, December 12, 1996, and Koerber, Mike, OTAG Policy Group Meeting, December 18, 1996.

[83] Ibid.

[84] OTAG run 4b represents the deepest level of controls that has been modeled by OTAG for nonutility point source NO_X emissions, and for NO_X and VOC emissions from area and mobile sources. If the deepest level of NO_X controls being modeled by OTAG for utility NO_X and for utility and nonutility point source VOC is then added (OTAG run 2), ozone increases are not as large on July 19, 1991 and some become ozone reductions.

[85] Koerber, Mike, OTAG Policy Group Meeting, December 18, 1996.

[86] Subsequent to the subregional modeling described here, OTAG has further divided its modeling domain into 13 smaller subregions for purposes of assessing transport between these subregions. This modeling was not complete enough to have been considered in the decision announced today.

preliminary information on the spatial and temporal scales of ozone transport. NO_X reductions of 60 percent from elevated sources and 30 percent from low level sources plus a VOC reduction of 30 percent (OTAG run 5c) were applied to one region at a time for each of the four OTAG ozone episodes. In general, surface plots show that emission reductions in a given region have the most ozone reduction benefit in that same region, although downwind benefits outside the region were also apparent. Northeast reductions benefited the Southeast in one episode. Midwest reductions benefited the Northeast in four episodes and the Southeast in one episode. Southeast reductions benefited the Midwest during two episodes and the Southwest during two episodes. Southwest reductions benefited the Midwest during two episodes.[87]

Although OTAG modeling of ozone transport is incomplete, it indicates that NO_X reductions have downwind ozone reduction benefits, although those benefits attenuate with distance. NO_X reductions in Chicago and Milwaukee may help nearby states such as Michigan and perhaps, to some extent, the Northeast as well. NO_X reductions in the southern end of the Northeast corridor will help the northern end.

The API petition requests that EPA eliminate or delay the Phase II RFG NO_X emission reduction standard.[88] EPA disagrees, as the evidence does not support eliminating or delaying the Phase II RFG NO_X standard. The NO_X reductions obtained from RFG in the metropolitan nonattainment areas are an important component of a regional NO_X reduction strategy, and modeling and analysis to date strongly supports the need for such regional NO_X reductions. Such reductions, especially when combined with urban VOC reductions, lead to ozone reductions on high ozone days across large areas of the country, including all of the major ozone nonattainment areas covered by the RFG program. While the potential for disbenefits is clear, with few exceptions, disbenefits appear on low ozone days and do not cause exceedance of the ozone standard, while benefits appear on high ozone days when they are most needed. As described above, OTAG found only one day of one episode in one area where an urban ozone increase could be classified as detrimental, with detrimental being defined as an increase in ozone of four ppb in a grid cell on a day with ozone exceeding 100 ppb.[89] NO_X control resulted in ozone decreases for the following days of that episode . EPA does not believe the evidence when viewed overall supports forgoing the ozone reduction benefits of NO_X reduction from RFG.

In conclusion, API's arguments that the Phase II RFG NO_X standard may cause limited urban disbenefits, and that additional VOC reductions may be necessary to ameliorate such disbenefits, are not compelling new evidence or arguments that support elimination or delay of the Phase II RFG NO_X emission reduction standard.[90] EPA has concluded that reducing NO_X emissions in required RFG areas as part of a region-wide strategy will contribute to attainment of the ozone standard, even if those NO_X emission reductions do not improve air quality in some portions of some RFG areas on some low ozone days. Additional VOC reductions are an option states may choose to avoid or reduce urban ozone increases from NO_X control.

API recently submitted the results of air quality modeling undertaken by Systems Applications International on API's behalf. API's modeling used the same photochemical grid model, inventory, and episode data as OTAG. API examined the effect in 2007 of a 6.8 percent reduction in mobile source NO_X emissions in RFG areas during the 1991 episode. API's modeling shows benefits and disbenefits in RFG areas, and no change in most non-RFG areas throughout the OTAG domain.[91] On the basis of this modeling, API argues that the Phase II RFG NO_X standard will be ineffective in reducing ozone, underscoring the cost-ineffectiveness of the Phase II RFG NO_X standard, according to API.

However, API's modeling does not indicate whether disbenefits occurred in grid cells with high or low ozone, so EPA cannot determine if the projected disbenefit would actually be detrimental. As discussed previously, OTAG modeling demonstrates that most urban ozone increases from NO_X control occur on low ozone days and do not cause exceedance of the ozone standard, while ozone reductions occur on high ozone days when reductions are most needed. Moreover, API's modeling sets the threshold level of ozone reduction at two ppb, which effectively eliminates benefits below two ppb. The Phase II RFG NO_X standard is estimated to achieve a one to two percent reduction in the national NO_X inventory, and that reduction would translate into a relatively small reduction in the ozone level at levels above 100 ppb. By setting the threshold at two percent, API's modeling may not capture the benefits of the standard. Thus, EPA is not persuaded by API's modeling that the Phase II RFG NO_X standard will be ineffective in reducing ozone; nor does EPA agree that API's modeling underscores the Phase II RFG NO_X standard's cost-ineffectiveness.

4. Non-ozone Benefits

In the RFG final rule, EPA cited non-ozone benefits of NO_X control, such as reductions in emissions leading to acid rain formation, reductions in toxic nitrated polycyclic aromatic compounds, lower secondary airborne particulate (i.e., ammonium nitrate) formation, reduced nitrate deposition from rain, improved visibility, and lower levels of nitrogen dioxide. A complete discussion of these benefits can be found in the RIA accompanying the RFG final rule.[92] EPA did not attempt to quantify the non-ozone benefits of NO_X control in the rulemaking, and did not include non-ozone benefits in its cost-effectiveness determination.

API claims that because EPA did not quantify non-ozone benefits, such benefits are speculative; API presented no evidence to support this claim. EPA does not agree. The fact that EPA did not quantify non-ozone benefits of NO_X control does not render those benefits speculative. In a directional sense, at least, the non-ozone benefits of NO_X reductions, including the Phase II RFG NO_X standard, are clear.

[87] Ozone Transport Assessment Group, joint meeting of the RUSM and ISI workgroups, ''Sensitivity Modeling,'' August 22, 1996.

[88] One commenter suggested that an ''opt out'' provision from the NO_X reduction standard be provided for areas that can document a disbenefit from NO_X reductions. For the reasons discussed above, the evidence does not support such a waiver for RFG standards at this time.

[89] Lopez, Bob, ''Localized Ozone Increases Due to NO_X Control—Transmittal of Technical Evaluation Summary and Draft Policy Options Paper,'' memorandum and attachments from OTAG Task Group on Criteria for Modeling and Strategy Refinement Regarding NO_X Disbenefits to OTAG Implementation and Strategies Workgroup and Criteria Evaluation Miniworkgroup, second draft, December 12, 1996, and Koerber, Mike, OTAG Policy Group Meeting, December 18, 1996.

[90] See discussion in the RFG final rule at 59 FR 7751.

[91] EPA was puzzled by effects that appear in Georgia and Alabama, which are not RFG areas, and contacted API for an explanation. API's contractor, SAI, explained in a February 14, 1997 telephone call that some anomalies of the modeled results can be explained by the differences in the results when directly comparing modeling runs made on two different computers. However, the differences in results from directly comparing modeling runs made on two different computers may also confound the modeled effects of RFG in terms of ozone concentration differences, casting doubt on the credibility of the results, since the modeled effects of RFG are in the same range as the anomalies claimed by SAI.

[92] See the RIA at pp. 321–322. See also 59 FR 7751.

Since publication of the RFG final rule, EPA has identified additional non-ozone benefits from NO_X reductions. The following describes how NO_X emissions contribute to adverse impacts on the environment:

Acid Rain. NO_X and sulfur dioxide are the two key air pollutants that cause acid rain and result in adverse effects on aquatic and terrestrial ecosystems, materials, visibility, and public health. Nitric acidic deposition plays a dominant role in the acid pulses associated with the fish kills observed during the springtime melt of the snowpack in sensitive watersheds and recently has also been identified as a major contributor to chronic acidification of certain sensitive surface waters.

Drinking Water Nitrate. High levels of nitrate in drinking water are a health hazard, especially for infants. Atmospheric nitrogen deposition in sensitive forested watersheds can increase stream water nitrate concentrations; the added nitrate can remain in the water and be transported long distances downstream because plants in most freshwater systems do not take up the added nitrate.

Eutrophication. NO_X emissions contribute directly to the widespread accelerated eutrophication of U.S. coastal waters and estuaries. Atmospheric deposition direct to surface waters and deposition to watershed and subsequent transport into the tidal waters has been documented to contribute from 12 to 44 percent of the total nitrogen loadings to U.S. coastal water bodies. Nitrogen is the nutrient limiting growth of algae in most coastal waters and estuaries. Thus addition of nitrogen results in accelerated algal and aquatic plant growth in the water body causing adverse ecological effects and economic impacts that range from nuisance algal blooms to oxygen depletion and fish kills.

Global Warming. Nitrous oxide (N2O) is a greenhouse gas. Anthropogenic nitrous oxide emissions in the U.S. contribute about two percent of the greenhouse effect, relative to total U.S. anthropogenic emissions of greenhouse gases. In addition, emissions of NO_X lead to the formation of tropospheric ozone, which is another greenhouse gas.

Nitrogen Dioxide (NO2). Exposure to NO2 is associated with a variety of acute and chronic health effects. The health effects of most concern at ambient or near-ambient concentrations of NO2 include mild changes in airway responsiveness and pulmonary function in individuals with preexisting respiratory illnesses, and increases in respiratory illnesses in children.

Nitrogen Saturation of Forest Ecosystems. Forests accumulate nitrogen inputs. While nitrogen inputs in forest ecosystems have traditionally been considered beneficial, recent findings in North America and Europe suggest that, because of chronic nitrogen deposition from air pollution, some forests are showing signs of nitrogen saturation, including undesirable nitrate leaching to surface and ground water and decreased plant growth.

Particulate Matter. NO_X compounds react with other compounds to form fine nitrate particles and acid aerosols. Nitrates are especially damaging because of their small size, which results in penetration deep into the lungs. Particulate matter has a wide range of adverse health effects, including premature death.

Stratospheric Ozone Depletion. A layer of ozone located in the upper atmosphere (stratosphere) protects the surface of the earth (troposphere) from excessive ultraviolet radiation. Tropospheric emissions of nitrous oxide (N2O) are very stable and slowly migrate to the stratosphere, where solar radiation breaks it into nitric oxide (NO) and nitrogen (N). The nitric oxide reacts with ozone to form nitrogen dioxide and oxygen. Thus, additional N2O emissions would result in a slight decrease in stratospheric ozone.

Toxics. In the atmosphere, NO_X emissions react to form nitrogen compounds, some of which are toxic. Compounds of concern include transformation products, nitrate radical, peroxyacetyl nitrates, nitroarenes, and nitrosamines.

Visibility and Regional Haze. NO_X emissions can interfere with the transmission of light, limiting visual range and color discrimination. Most visibility and regional haze problems can be traced to carbon, nitrates, nitrogen dioxide, organics, soil dust, and sulfates.

Cost-Effectiveness

1. Cost-Effectiveness of Phase II RFG NO_X Standard

To update its evaluation of the cost-effectiveness of the Phase II RFG NO_X standard, EPA asked DOE to update the 1994 DOE study. EPA used the Bonner & Moore refinery model to estimate costs in the RFG rulemaking, and included the 1994 DOE study and additional industry cost studies in its consideration. EPA determined to update the DOE study for purposes of considering API's petition, rather than the Bonner & Moore analysis, because since the 1994 study, EPA, DOE, and API have worked closely to improve the refinery modeling used by DOE to develop cost estimates. Over 200 improvements and changes to the model have been made in response to suggestions from API.

EPA notified each party that commented on the API petition when DOE's draft report became available and sent copies to interested parties for their review. EPA also reopened the comment period and held a meeting with interested parties to discuss the draft DOE report.

DOE's improved model provides a range of cost-effectiveness, rather than a single number. DOE's regionally-weighted cost range per summer ton of NO_X removed is $5,400 to $11,300. Based on that range, EPA calculated the annual incremental cost range at $2,180 to $6,000 per ton of NO_X removed. Although the high end of EPA's cost-effectiveness range exceeds $5,000, EPA does not consider that to be significant, since the midpoint of the range is $4,090. EPA views DOE's updated estimate as new information that confirms the information relied upon in the RFG rulemaking to evaluate the cost-effectiveness of the Phase II RFG NO_x standard. The improvements to the DOE model and EPA's updated cost-effectiveness calculations are described in detail in an EPA technical memorandum available in the docket for this action. [93]

EPA received comments from the oil and automotive industries on DOE's draft report. Both the oil and automotive industries' comments are critical of certain technical aspects of DOE's refinery modeling. These comments and EPA's responses are discussed in an EPA technical memorandum, and in DOE's final report; both documents are available in the docket for this action. [94]

Overall, oil industry comments argued that the lower end of the DOE cost range should be dropped because the model form that produced it is not representative. DOE produced a cost range by using both a ''ratio free'' and ''ratio constrained'' form of its refinery model. The ratio free form is similar to the model version used for the 1994 DOE study, with improvements in process descriptions. The ratio free model includes a modeling concept in which refinery streams with identical

[93] See A–96–27, Memorandum dated February 1997 from Lester Wyborny, Chemical Engineer, Fuels and Energy Division, ''Cost of Phase II RFG NO_X Control,'' to Charles Freed, Director, Fuels and Energy Division.

[94] Ibid and U.S. DOE, Re-estimation of the Refining Cost of Reformulated Gasoline NO_X Control, February 1997.

distillation cut points are kept separate through different processes, and this modeling concept may produce over-optimized results. The ratio constrained form has the same improvements in process descriptions as the ratio free form, with added constraints on the proportions of streams entering a process, to avoid unrealistic stream separation; however, the ratio constrained form may under-optimize refinery operations. DOE has concluded that both model forms can provide credible estimates of the refining cost range, given the variations within and among refineries, uncertainties in the range of refinery costs, and the over-optimization and under-optimization possibilities of the model forms. EPA agrees with DOE that both model forms are useful in exploring the plausible range of refining costs.

Oil industry comments argue that the upper end of DOE's range exceeds a benchmark of $5,000 per ton of NO_X removed. DOE's regionally-weighted cost-effectiveness estimate for the ratio constrained model form is $11,300 per summer ton of NO_X removed, which DOE calculates as $5,200 per annual ton, and which EPA calculates as $6,000 per annual ton.[95] Both EPA and DOE believe that the high end of the range reflected by the ratio constrained model estimate is not significantly different from the benchmark of $5,000 per annual ton.

EPA believes that the updated DOE cost study is the best available evidence concerning the costs of the Phase II RFG NO_X standard, including the desulfurization processes that drive those costs. This evidence indicates that the cost-effectiveness analysis used by EPA when setting the standard continues to be valid. The detailed information on desulfurization costs submitted by API to support its petition was previously submitted during the RFG rulemaking and was considered at that time; it is not new information and does not change EPA's view, based on the updated DOE cost modeling, that the Phase II RFG NO_X standard remains cost-effective.

API argues that the 1994 DOE study supports its argument that EPA's desulfurization costs are too low, citing the study's observation that: ''The actual NO_X reduction standard for Phase II RFG should reflect margins for enforcement tolerance, temporal production variations* * *, variations among refiners of differing capability, and potential inaccuracies and over-optimization in the refinery yield model* * *,[96] However, the 1994 DOE study supports EPA's view that the 6.8 percent average NO_X emission reduction standard will cost approximately $5,000 per annual ton of NO_X removed. The 1994 DOE study's reference to $10,000 per summer ton is equivalent to EPA's $5,000 per annual ton.[97] Furthermore, the 1994 DOE study used inflated year 2000 dollars, while EPA's estimates were in 1990 dollars.

Oil industry comments also point out that DOE's updated report states that its cost estimates do not include the impact of the requirement that RFG achieve a three percent minimum NO_X reduction per batch under the averaging provisions, or the impact of any potential enforcement tolerance associated with that three percent minimum NO_X standard. EPA believes that any costs associated with the minimum NO_X reduction requirement and any associated enforcement tolerance compliance costs are separate costs associated with these provisions and do not change the cost-effectiveness analysis of the 6.8 percent average NO_X emission reduction standard. While EPA is denying API's petition to reconsider the 6.8 percent average standard, it will continue to evaluate and plans to reach a decision on the separate issues associated with the three percent minimum requirement under the averaging provisions.

As discussed above, NO_X reductions from Phase II RFG in several cities with NO_X waivers are expected to contribute to ozone attainment in those areas, downwind areas, or both. As discussed previously, EPA believes that the benefits of NO_X reduction in these and other RFG areas far outweigh the disbenefits. Thus, EPA does not believe that the benefit of the NO_X reductions in Chicago, Milwaukee, and Houston should be calculated as zero when analyzing the cost-effectiveness of the Phase II RFG NO_X reduction standard.

API also argues that the Phase II RFG NO_X emission reduction standard interferes with refining flexibility and leaves refiners with unduly costly and narrow choices for producing RFG. However, as the updated DOE study indicates, as discussed above, the Phase II RFG NO_X standard is not unduly costly even considering the high end of the range reflected by the ratio constrained model estimate. In the final rule, EPA clarified that the Phase II RFG standards are performance standards and may be met by the refiner's choice of fuel parameter controls. In addition, EPA elected to allow both a per gallon and an averaging standard for NO_X to provide greater flexibility to refiners. API has provided no compelling new evidence or argument to the contrary.

2. Stationary Source Cost-Effectiveness

API argues that EPA understated the relative cost-effectiveness of major stationary source NO_X controls. API cites incremental cost-effectiveness estimates for coal-fired utility boilers of $1,300 to $2,200 per ton for selective non-catalytic reduction and $1,250 to $6,600 per ton for selective catalytic reduction.[98] For gas and oil-fired utility boilers, API cites $2,100 to $5,650 per ton for selective catalytic reduction, and for gas-fired industrial boilers, $3,300 to $5,500 per ton for selective catalytic reduction.[99] In its RIA, EPA cited cost-effectiveness estimates for stationary source NO_X emission controls based on utility boilers. Low NO_X burner technology was cited at $1,000 per ton and selective catalytic reduction at $3,000 to $10,000 per ton.[100]

In stationary source regulations promulgated since the RFG rule, cost-effectiveness estimates have ranged from $200 per ton for certain coal fired power plants[101] to about $3,000 per ton for municipal waste combustors.[102] Recent NO_X control estimates developed by the Mid-Atlantic Regional Air Management Association (MARAMA) and Northeast States for Coordinated Air Use Management (NESCAUM) for those regions for retrofits range from a low of $320 to $1,800 for natural gas reburn for oil and gas boilers to $3,400 to $6,900 for natural gas conversion for coal-fired boilers.[103]

API and other oil industry sources cited cost-effectiveness estimates and rankings that were developed in the OTAG process for Phase II RFG and other NO_X reduction programs, as evidence that the Phase II RFG NO_X standard is not cost-effective compared to other NO_X reduction programs, particularly stationary source programs.

[95] The annual per ton cost estimates of DOE and EPA differ because EPA uses a different method of annualizing costs than DOE. EPA's calculations are described in a technical memorandum to docket A–96–27; see the memorandum dated February 1997 from Lester Wyborny, Chemical Engineer, Fuels and Energy Division, ''Cost of Phase II RFG NO_X Control,'' to Charles Freed, Director, Fuels and Energy Division. Although Phase II RFG NO_X emission reductions are required only during the summer ozone season, EPA annualizes the cost so that it may be compared with other emission reduction programs.

[96] Pet. at p. 20, citing the 1994 DOE study at xii.

[97] 1994 DOE study, pp. 56–58.

[98] Pet. at p. 26.

[99] Ibid.

[100] RIA at p. 385.

[101] 60 FR 18751 (April 13, 1995).

[102] 54 FR 52293 (December 20, 1989); 60 FR 65387 (December 19, 1995).

[103] Phase II NO_X Controls for the MARAMA and NESCAUM Regions, EPA–453/R–96–002, November 1995, Table 1–7.

API argues these other programs offer a larger potential for overall reduction in NO_X emissions. The figure of $25,000 to $45,000 per ton of NO_X reduced developed in the OTAG process ascribes all the costs of RFG to NO_X control, including costs incurred to reduce toxics and VOCs, and to meet the various content requirements. If VOC and NO_X reductions are valued equally, as OTAG has done, the incremental cost per ton of NO_X removed falls by more than a factor of four to under $7,000 per ton, and the average cost falls to $3,000 to $4,000 per ton. That incremental cost is higher than projected by EPA for the Phase II RFG NO_X standard because it assumes that all the gasoline in the 37 state OTAG region, over 90 percent of the gasoline sold in the U.S. outside of California, would be included in the RFG program. Costs rise rather than fall as volume of RFG produced increases because less efficient refineries would be drawn into producing RFG. Moreover, EPA's $5,000 per ton cost estimate for the Phase II RFG NO_X standard applies to the final increment of emission reduction pursued under the program, while API compares this incremental cost to average costs of other control programs. Average costs are always less than incremental costs; if Phase II RFG costs are evaluated on an average-cost basis, the cost per ton for RFG areas falls to between $2,000 and $3,000.

Based on the evidence presented, EPA concludes that some stationary source NO_X controls are more cost-effective than the Phase II RFG NO_X standard, and some are not. The fact that some stationary source NO_X controls are more cost-effective does not vitiate the cost-effectiveness of the Phase II RFG NO_X standard. EPA cited stationary source costs both above and below the cost of Phase II RFG NO_X standard in the RFG rulemaking. EPA does not find that it understated the relative cost-effectiveness of stationary source NO_X controls.

API argues that stationary sources offer more potential for reducing air pollution. API argues that EPA should sequence NO_X controls and target major stationary sources first, since stationary source NO_X control is more cost-effective and can be targeted geographically to avoid controls where controls are not needed. Other NO_X controls should not be considered until major stationary source controls are employed and evaluated, according to API.

As discussed previously, some stationary source NO_X controls are more cost-effective than the Phase II RFG NO_X standard, and some are not. However, OTAG has projected that, in 2007, mobile sources will still contribute 42 percent of all NO_X after implementation of 1990 CAAA controls for mobile and stationary sources. These measures include the retrofit of reasonably available control technology on existing major stationary sources of NO_X and implementation of enhanced inspection and maintenance programs under Title I; new emission standards for new motor vehicles and nonroad engines, and the RFG program under Title II; and controls on certain coal-fired electric power plants under Title IV. Given the challenges facing so many areas in identifying and implementing programs that will lead to attainment of the ozone standard, and the need for additional NO_X controls, EPA believes that NO_X reductions in urban areas where mobile sources are concentrated, as part of a region-wide NO_X reductions, are still essential to achieve ozone attainment. In addition, OTAG modeling demonstrates that even with unrealistically large NO_X reductions, such as an 80 percent reduction in elevated NO_X plus a 60 percent reduction in low level NO_X, without VOC reductions, attainment still would not be reached throughout the OTAG region. EPA believes that both stationary source and mobile source controls will be necessary for many areas to reach attainment.

3. Executive Order 12866

API argues that the Phase II RFG NO_X emission reduction standard does not satisfy the provisions of Executive Order 12866. API argues that the Phase II RFG NO_X standard is not compelled by statute or necessary to interpret the statute, or made necessary by public need, or the most cost-effective NO_X control to achieve the regulatory objective.

EPA believes the Phase II RFG NO_X reduction standard meets the substantive requirements of the Executive Order 12866. Although the Phase II RFG NO_X standard is not required by statute, it is ''made necessary by compelling public need'' [104] and is a cost-effective standard. As discussed earlier, the authority EPA used to establish the standard, section 211(c)(1)(A), allows EPA to regulate fuels or fuel additives if their emission products cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare. EPA used this authority based on scientific evidence regarding the benefits of NO_X control and the cost-effectiveness of NO_X reductions. The preceding discussion indicates that EPA's RFG rulemaking properly complied with Executive Order 12866.

V. Conclusion

A detailed discussion of the determination of the need for, scientific justification for, and cost-effectiveness of NO_X control is presented in the RIA for the final rule.[105] EPA's review here of the air quality benefits and cost-effectiveness of the Phase II RFG NO_X reduction standard does not show that the prior rulemaking determinations supporting this standard were inappropriate. After considering API's petition, public comment, and other relevant information available to EPA, API's petition for reconsideration of the Phase II RFG NO_X emission reduction standard is denied.

Dated: February 28, 1997.

Mary D. Nichols,

Assistant Administrator, Office of Air and Radiation.

[FR Doc. 97–6217 Filed 3–11–97; 8:45 am]

BILLING CODE 6560–50–P

[104] 58 FR 51735 (October 4, 1993), section 1(a) at 51735.

[105] RIA at pp. 313–326.

40 CFR Part 180

[OPP–300458; FRL–5593–1]

RIN 2070–AB78

Clopyralid; Pesticide Tolerance for Emergency Exemption

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: This regulation establishes a time-limited tolerance for residues of the herbicide clopyralid in or on the raw agricultural commodity cranberries in connection with EPA's granting of emergency exemptions under section 18 of the Federal Insecticide, Fungicide, and Rodenticide Act authorizing use of clopyralid on cranberries in the states of Massachusetts, Oregon, and Washington. This regulation establishes maximum permissible levels for residues of clopyralid in this food. The tolerance will expire July 31, 1998.

DATES: This regulation becomes effective March 12, 1997. This regulation expire on July 31, 1998. Objections and requests for hearings must be received by EPA on or before May 12, 1997.

ADDRESSES: Written objections and hearing requests, identified by the docket control number, [OPP–300458], must be submitted to: Hearing Clerk (1900), Environmental Protection