APPENDIX G

NITROGEN OXIDES SUBSTITUTION

NOx SUBSTITUTION GUIDANCE

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Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

Section 1: Background

Title I of the Clean Air Act Amendments (CAAA) mandates a 15% reduction of volatile organic compound (VOC) emissions from the 1990 base inventory by November, 1996 in all ozone nonattainment areas classified moderate and above. Areas classified serious and above must achieve the 3% per year VOC reductions past November, 1996 as part of the reasonable further progress (RFP) provisions (§ 182 [c][2][B]). However, Section 182 (c)(2)(C) allows the post-1996 RFP plan to accommodate a less than 3% per year VOC reduction if it can be demonstrated that substitution of NOx emission reductions (for VOC reductions) yields equivalent ozone reductions. Underlying this substitution provision is the recognition that NOx controls may effectively reduce ozone in many areas, and that the design of strategies is more efficient when the characteristic properties responsible for ozone formation and control are evaluated for each area.

The purpose of this document is to provide a procedure that can be applied to meet the post-1996 Section 182(c)(2)(B) RFP requirement as well as the Section 182 (c)(2)(C) equivalency demonstration requirements. The intent of this guidance is to facilitate implementation of the most effective ozone precursor control strategies, while meeting the intent of the CAA RFP provisions.

The guidance consists of two basic steps that are established in Sections 2 and 3 of this document. First, an equivalency demonstration requires that cumulative RFP emission reductions must be consistent with the NOx and VOC emission reductions determined in the ozone attainment modeling demonstration. Second, specified reductions in NOx and VOC emissions should be accomplished in the interim period between 1996 and the attainment date, consistent with the continuous RFP emission reduction requirement. Section 4 provides the legal rationale underlying this guidance and the guidance is summarized in Section 5.

Section 2: Test for Equivalency - Use of Strategies Aimed at the Mandated Attainment Year

[The condition for demonstrating equivalency is that State-proposed emission control strategies must be consistent with emission reductions required to demonstrate attainment of the ozone NAAQS for the designated year of attainment.]

The provision for NOx substitution recognizes that a VOC-only control pathway may not be the most effective approach for effecting attainment in all areas. Consequently, NOx reductions are placed on a near equal footing with VOC through substitution. This document establishes two conditions pursuant to both the substitution and RFP provisions in the Act. The first condition requires that control strategies incorporating NOx emission reduction measures must demonstrate that the ozone NAAQS will be attained within time periods mandated by the Act. This condition reflects the Title I provision for gridded photochemical model demonstrations (Section 182(c)).

The second condition, addressed below in Section 3, maintains the requirement for periodic emission reductions in order to realize progress toward attainment. Flexibility is introduced by allowing VOC and NOx reductions rather than VOC reductions alone. A third condition exists in which the periodic emission reductions must be consistent with the model attainment demonstration.

The basis for equivalency is the ability of a given control strategy (i.e., any particular mix of NOx and VOC emission reductions) to effect attainment of the ozone NAAQS by the designated attainment year. Section 182(c) of the CAA requires that State implementation plans (SIPs) for serious and above nonattainment areas include a demonstration of attainment of the ozone National Ambient Air Quality Ambient Standard (NAAQS) with gridded photochemical modeling. These SIP revisions are due by November 15, 1994 and provide the framework for demonstrating equivalent ozone reductions through the substitution of NOx emission reductions for VOCs. Model application procedures for demonstrating attainment are provided in EPA's Guideline for Regulatory Application of the Urban Airshed Model, (EPA-450/4-91-013).

This modeling requirement already exists as a Title I provision for areas classified serious and above. Due to the flexibility described below in Section 3.0 which permits virtually any set of NOx and VOC RFP reductions in years prior to the attainment date, a linkage to the attainment year control strategy is required. This linkage provides assurance that the RFP reductions

are consistent with the SIP attainment demonstration. States are required to justify substitution by illustrating "consistency" between the cumulative emission changes emerging from the RFP/substitution proposal and the emission reductions in the model attainment demonstration (or comparable modeling analysis). The EPA will approve substitution proposals on a case-by-case basis. Generally speaking, any reasonable substitution proposal will be approved. Linkage to the modeling demonstration provides a screen to remove unrealistic (and inefficient) substitution proposals.

Section 3: Reasonable Further Progress (RFP) Requirements

[The condition for meeting the RFP emissions reduction provision is that the sum of all creditable VOC and NOx emission reductions must equal 3% per year averaged every three years.]

The RFP provisions require periodic emissions reductions until attainment is reached. In the absence of the NOx substitution provision, an area classified serious or above would be required to reduce VOC emissions after 1996 an average of 3% per year every three year period until attainment. This guidance maintains the 3% per year emissions reduction requirement. However, no specified set of VOC or NOx controls is mandated. Reasons for not requiring specific "exchange" rates among VOC and NOx emissions include:

1. The strong likelihood that optimum "exchange" rates vary from year to year and across a geographic area as an area's emissions distribution and atmospheric chemistry change over time;

2. Uncertainty in modeling analyses, particularly when attempting to ascertain responses from small percentage perturbations in emissions; and

3. Resource limitations associated with modeling specific control measures during interim years before attainment dates.

Any combination of VOC and NOx emission reductions which totals 3% per year, and meet other SIP consistency requirements described in this document are allowed. These requirements ensure that the cumulative RFP reductions are consistent with the emission reduction measures identified in the model attainment demonstration. A percentage basis rather than a mass basis is used for calculating the RFP emission reductions. A percentage basis is applied to avoid "absurd" calculations. For example, substitution of NOx reductions for VOC on a ton for ton basis could yield calculated NOx reduction requirements which exceed the available NOx inventory in cases where the base VOC inventory greatly exceeds the NOx inventory. To illustrate, a 50% VOC reduction is analogous to a 100% NOx reduction assuming the VOC inventory is twice the NOx inventory and substitution is based on mass rather than percentage equivalency. The percentage basis also is consistent with the RFP "percent" reduction requirement, therefore buoying the legal justification underlying this guidance. The calculation to determine yearly VOC and NOx emission reduction totals must be based on typical summer day inventories (same basis used for RFP and modeling

inventories). Specific details regarding calculation procedures and emission inventory definitions are found in separate documents, including EPA's forthcoming Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration. The following equation generally describes the method to calculate the total 3% per year emission reductions:

$$R_V/VOCBASE + R_N/NOxBASE >= 0.03$$

where; R_V = typical summer day VOC reductions in mass units

R_N = typical summer day NOx reductions in mass units

VOCBASE = the mass of anthropogenic VOC emissions in the 1990 adjusted base inventory, and

NOxBASE = the mass of anthropogenic NOx emissions in the 1990 adjusted base inventory

[note, the cumulative mass reductions are not constrained to 3% per year so that RFP reductions greater than 3% per year are not discouraged.]

The values of R_V and R_N include only the creditable emission reductions from the nonattainment area of concern. For instance, VOC or NOx reductions from the pre-enactment Federal Motor Vehicle Control Program (FMVCP), which are not creditable toward the 3% per year requirement are not included. Potential "creditable" NOx emission reductions which are available for substitution purposes are described in EPA's forthcoming Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration.

The attainment strategy requirements must be met in addition to the RFP condition. Total emission reductions are determined by the attainment demonstration, implying that reductions averaging greater than 3% per year averaged from 1996 to the specified attainment year are required if shown to be necessary by the model demonstration. The 3% per year RFP requirement is thus a minimum requirement. Further, the NOx emission reductions credited toward RFP may be capped by the cumulative reductions dictated by the model demonstration. For example, an approved control strategy emerging from a model demonstration for a serious area might show reductions of 6% NOx and 80% VOC, relative to 1990 emissions, are needed by 1999. Assuming zero creditable NOx emission reductions from 1990 through 1996, NOx reductions averaging 2% per year over

the 3 years from 1996 to 1999 represent a cap on the NOx RFP reductions. The reason for linking the RFP reductions to the attainment strategy is to avoid RFP reductions which are not consistent with the model demonstration. Note that the sum of emissions totalling 3% per year are required to meet the basic RFP provisions -- they are not capped by the attainment demonstration. Thus, cases might exist where VOC reductions from the RFP provisions might exceed the cumulative VOC emission reductions in the attainment strategy. Such cases do not conflict with the attainment demonstration since additional VOC reductions will not increase peak ozone. On the other hand, the NOx cap is necessary because NOx reductions have the potential for increasing peak ozone.

Section 4: Discussion of Equivalency

[The following discussion provides the legal rationale underlying the interpretation of "equivalency" and the linkage between the RFP and NOx substitution provisions within the Act.]

"Equivalency" is not defined strictly in the context of, "What specified level of NOx reductions, compared to VOC, results in equivalent ozone reduction?" Instead, any combination of VOC and NOx reductions is "equivalent" so long as the reductions are consistent with those identified as necessary to attain the NAAQS in the modeling demonstration and provide for steady progress in leading to the emission reductions identified as necessary to attain the NAAQS by the specified attainment year.

In allowing a combination of NOx and VOC controls or the substitution of NOx emissions reductions for VOC emissions reductions, Section 182(c)(2)(C) of the statute states that the resulting reductions "in ozone concentrations" must be "at least equivalent" to that which would result from the 3% VOC reductions required as a demonstration of reasonable further progress (RFP) under Section 182(c)(2)(B). This provision could be interpreted to mean that the amount of NOx reductions appropriate for substitution purposes is an amount which, when compared to predicted VOC reductions, results in the same reductions in ozone concentrations that the VOC reductions would achieve in that area. However, such an interpretation could result in a demonstration showing that very small NOx reductions provide an adequate substitute for large VOC reductions. This is because under some conditions substantial VOC reductions produce only small - even insignificant - reductions in ozone concentrations, while minimal NOx reductions under the same conditions may produce the same degree of ozone reductions. EPA believes Congress would not have intended States to meet the Act's progress requirements with emissions reductions that would produce only minimal improvement in ozone concentrations.

The second sentence of Section 182(c)(2)(C) requires EPA to issue guidance "concerning the conditions under which NOx control may be substituted for [or combined with] VOC control." In particular, the Agency is authorized to address in the guidance the appropriate amounts of VOC control and NOx control needed, in combination, "in order to maximize the reduction in ozone air pollution." Further, the Act explicitly provides that the guidance may permit RFP demonstrations which allow a lower percentage of VOC emission reductions. The implicit assumption under that language is that such lesser levels of VOC reductions would be allowed only because of the correspondingly higher percentage of NOx emission

reductions to be authorized as a full or partial substitution for the otherwise required VOC reductions. In light of the entire set of language and Congress's evident intent under this subsection to maximize the opportunity for ozone reductions, EPA believes that Section 182(c)(2)(C) confers on the Agency the discretion to select, for purposes of determining equivalent reductions, a percentage of NOx emission reductions which is reasonably calculated to achieve both the ozone reduction and attainment progress goals intended by Congress. Nothing in the Act or in the legislative history directly addresses the case where NOx reductions that are substituted for VOC reductions, and which meet the plain grammatical meaning of "equivalency," nonetheless result in insignificant ozone reductions. To avoid such a result and give meaningful effect to what Congress likely intended regarding the substitution provision, EPA has decided to rely in its NOx substitution guidance on the only point of reference provided by Congress concerning what may constitute an appropriate quantitative reduction target for RFP purposes, namely the 3 percent per year required under Section 182(c)(2)(B). Under that approach, EPA would approve substitutions of NOx for VOC that would ensure that the sum of the respective creditable percent reductions of each of these pollutants areawide, averaged over 3 years, would be no less than 3 percent from the baseline.

As additional evidence that Congress was concerned with getting more than minimal reductions in ozone concentrations through substitution, EPA notes that the RFP demonstration described in Section 182(c)(2)(B) focuses on reductions of a specified quantity of VOC emissions per year. (Similarly, the 15 percent RFP reductions required for Moderate ozone nonattainment areas focuses on reductions of that specific quantity of VOC emissions per year.) By contrast, the alternative RFP demonstration in Section 182(c)(2)(C) allows flexible VOC/NOx emission reduction strategies, but only so long as the overall quantitative reduction in ozone concentrations is equivalent to the amount which, for Serious ozone nonattainment areas, Congress initially determined must be met (i.e., the ozone concentrations achieved by VOC reductions of 3 percent per year) in order to ensure expeditious progress towards attainment. In this regard the House Committee Report states: "NOx reductions may not be substituted for VOC reductions in a manner that delays attainment of the ozone standard or that results in lesser annual reductions in ozone concentration than provided for in the attainment demonstration." H.R. Resp NO. 490, 101st Cong., 2d Sess. 239 (1990).

Section 5: Summary

The RFP requirements under Section 182(c)(2)(B) of the CAA are intended to insure that the SIP "provide for such specific annual reductions in emissions of VOC and NOx as necessary to attain the NAAQS for ozone by the applicable attainment date." This language is interpreted to mean that, to meet the RFP requirement, it is necessary to show that steady progress is being made toward implementing measures called for in an area's attainment strategy. Further, the Act also specifies minimal annual percentage reductions in creditable emissions which must be realized in an RFP program. Section 182(c)(2)(C) increases the flexibility in which the annual emission reductions can be derived by allowing NOx emission reductions substitution for VOC after 1996. The recommended procedure responds to these concerns by imposing two requirements.

1. Establish a strategy incorporating reductions in VOC and/or NOx sufficient to meet the NAAQS within timeframes specified by the Act. This is to be done using approved photochemical grid models in a manner consistent with published Agency guidance on the use of such models in attainment demonstrations. In the context of the NOx substitution guidance, the purpose of this first step is to establish an ultimate target toward which the RFP program is aimed.

2. For interim years, any mix of annual reductions in VOC and NOx is permissible so long as it reflects

(a) a logical step toward implementing the attainment strategy identified in (1), and

(b) results in a combined annual VOC and NOx reduction of 3% per year.

The requirement for continuous VOC emission reductions amounting to 3% per year has been modified to allow flexibility in the mix of VOC and NOx emission reductions, while maintaining a 3% per year reduction in the <u>sum</u> of NOx and VOC emissions. A principal assumption underlying this guidance is that optimum control strategy designs may differ among various nonattainment areas.

The NOx substitution provision permits greater flexibility for States in designing effective emissions control strategies. Furthermore, because the test for equivalency is identical to the NAAQS attainment test for serious and above areas, the demonstration imposes negligible additional resource burdens for those areas already required to perform gridded photochemical modeling.