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MEMORANDUM

SUBJECT: Fuel Switching to Meet the Reasonably Available Control Technology (RACT) Requirements for Nitrogen Oxides (NOx)

FROM: Michael H. Shapiro
Acting Assistant Administrator
for Air and Radiation (ANR-443)

TO: Director, Air, Pesticides and Toxics
Management Division, Regions I and IV
Director, Air and Waste Management Division,
Region II
Director, Air, Radiation and Toxics Division,
Region III
Director, Air and Radiation Division,
Region V
Director, Air, Pesticides and Toxics Division,
Region VI
Director, Air and Toxics Division,
Regions VII, VIII, IX, and X

I. Purpose

The purpose of this memorandum is to provide guidance to States on the use of fuel switching to meet the NOx RACT requirements. As described below, States can meet the NOx RACT requirements by adopting rules which use a long-term emissions averaging approach in a manner consistent with the Environmental Protection Agency's (EPA's) interim guidance for economic incentive programs (EIP's). The EIP guidance was published in the Federal Register (58 FR 11110, February 23, 1993).

II. Background

Title I of the Clean Air Act (Act) Amendments of 1990 contains new requirements for areas that have not attained the national ambient air quality standards (NAAQS). These new requirements include application of RACT on existing major stationary sources of NOx in certain areas that have not attained the ozone NAAQS and in the ozone transport region. The EPA

guidance on these requirements is contained in 57 FR 55620, November 25, 1992.

The EPA guidance identifies presumptive RACT for certain types of electric utility boilers in pounds of NOx per million British thermal units (Btu) on a 30-day rolling average:

1. 0.45 for tangentially-fired coal burning.

2. 0.50 for dry bottom, wall-fired (other than cell burner) coal burning.

3. 0.20 for tangentially-fired gas/oil burning.

4. 0.30 for wall-fired gas/oil burning.

For other source categories, the EPA guidance states that NOx RACT may be set at levels that are comparable to the above levels for certain utility boilers.

The EIP guidance is intended to stimulate the adoption of incentive-based, innovative programs that will assist States in meeting air quality goals through flexible approaches which allow for less costly control strategies and which provide stronger incentives for the development and implementation of innovative emissions reductions technology. As described in that guidance, long-term emissions averaging programs can be used by States to meet the Act's RACT requirements. Key provisions of the EIP guidance, with respect to the use of fuel switching to meet the NOx RACT requirements, are described below.

III. Definitions

A. Fuel Switching

As used in this guidance, fuel switching refers to instances where a unit historically burned one primary fuel, such as coal, and under a "fuel switching" program the unit would burn a cleaner fuel, such as natural gas, during the ozone season and may switch back to the "historic" fuel for some or all of the non-ozone season.

B. Base Year Fuel

For purposes of this guidance, the historical fuel refers to the fuel that a unit primarily used during calendar year (CY) 1990. The EPA believes that CY 1990 is appropriate since many Act requirements (such as reasonable further progress) stem from

this date. States are required to develop a comprehensive 1990 inventory, and the CY 1990 inventory is likely to be the most accurate information readily available. Further, since this guidance utilizes an annual emissions equivalency (described below), the historical fuel needs to be based on an annual period.

More precisely, the historical fuel is defined as the fuel burned most, on a Btu-weighted basis, during CY 1990. Where CY 1991 or CY 1992 is demonstrated to be more representative of historic actual operating conditions, those years may be used. For example, where a unit burned 90 percent coal during 1990-1992, that unit is considered subject to the presumptive NOx RACT limits for coal-fired units; if the same unit used 60 percent gas in later years, it would still be subject to the presumptive NOx RACT limits for coal-fired units.

C. Ozone Season

For purposes of this guidance, the ozone season generally means the period of time that ozone monitoring is required for an area as defined in 40 CFR part 58, appendix D, section 2.5.

D. Presumptive NOx RACT

For purposes of this guidance, presumptive NOx RACT means the more stringent of the requirements:

1. adopted by the State into the State implementation plan (SIP) to meet the NOx RACT requirements, or

2. defined in EPA's guidance published in 57 FR 55620, November 25, 1992.

IV. NOx RACT for Fuel Switchers

Limited data indicate that, in some cases, a switch to natural gas from coal could result in emissions in the 0.10 to 0.40 (pounds of NOx per million Btu) range as compared to the EPA presumptive NOx RACT emissions rates for gas/oil of 0.20 to 0.30 and for coal of 0.45 to 0.50. This is a relatively broad range and is based on very little data. The EPA has determined that there is not enough data available to establish a presumptive NOx RACT level for a fuel-switcher category.

As a result, units that switch, for example, from coal (historic fuel) to gas could fall under either the presumptive coal or gas/oil NOx RACT limits. However, if fuel-switcher units were required to meet the presumptive gas RACT limits, those

units would face the costs of both fuel switching and add-on controls, which would remove an important incentive for coal units to switch to gas. In these cases, EPA believes that the presumptive RACT limits for coal are appropriate for establishing the program baseline in an EIP because it is consistent with the EIP guidance, data are not available to set a fuel switcher presumptive NOx RACT level, there are clear environmental benefits (noted below) when units switch to clean fuels, and fuel switching might only occur under a coal baseline.

V. Fuel Switching to Meet NOx RACT Through Long-Term Averaging

A. EIP Approach

State rules which allow fuel switching to meet the NOx RACT requirements are approvable where the rules are consistent with the EIP guidance for long-term averaging and the guidance in this memorandum. This approach is applicable to utility boilers as well as any other source subject to the NOx RACT requirements. Any source which meets the NOx RACT requirements through a long-term averaging EIP must also meet all other relevant Act requirements.

B. Emissions Limitation Requirements

The State rules must include emissions limits on both an annual and ozone season basis, as described below.

C. Annual Emissions Limit

The EIP guidance provides States with the flexibility to meet new RACT requirements, such as the NOx RACT requirements, through an EIP that yields reductions in emissions at least equivalent to those which would result from unit-by-unit compliance with the presumptive RACT limit for that source category. Under a long-term emissions averaging EIP to meet NOx RACT, annual emissions of NOx must be less than or equal to annual emissions that would result from compliance with presumptive NOx RACT. The specific calculation methodology for determining annual equivalence is described in the enclosed appendix to this guidance.

D. Ozone Season Emissions Limit

An EIP that uses long-term emissions averaging to meet the RACT requirements must include long-term emissions requirements, as described above, and other requirements to show that the EIP is equivalent to the presumptive RACT on a short-term basis. For purposes of NOx RACT, a short-term emissions limit, in

conjunction with an annual emissions limit, satisfies these EIP requirements. The short-term emissions limit must be applicable in the ozone season and at least as stringent as the presumptive NOx RACT limit. The more stringent of the State-adopted or EPA presumptive NOx RACT must be required during the ozone season.

As discussed in the long-term averaging section of the EIP guidance, a 24-hour averaging time is generally used to construct attainment demonstrations in ozone nonattainment plans. Accordingly, EPA believes that daily emissions limits should be considered in the development of the EIP short-term emissions limit requirements.

VI. EIP Cost/Environmental Considerations

In general, the EIP guidance indicates (58 FR 11121) that savings in compliance costs can result from EIP's and that consideration might be given to the sharing of that benefit between the regulated sources and the environmental goals of the Act. The EIP guidance also states (58 FR 11117) that new RACT requirements must be based on an analysis that considers the incentive mechanism upon which the EIP is based. The EPA's assessment of these issues for fuel switching is summarized below.

A. Fuel-Switching Cost Considerations

In general, a fuel-switching program would provide new flexibility to States and industry in meeting certain Act requirements, including the NOx RACT requirements. Fuel switching is a viable option for units where natural gas is readily available since the price of natural gas in the ozone season may be competitive with other fuels. While still meeting the Act requirements, industry could, in some cases, avoid much of the initial capital and operating costs associated with combustion modifications.

As described above, fuel switching is expected to reduce the cost to industry of meeting the NOx RACT requirements in some cases. In other cases, the cost of a fuel-switching program may exceed the cost of compliance with a presumptive RACT technology such as a low-NOx burner and overfire air. The costs of a fuel-switching program to industry will vary greatly from unit to unit due to the availability of gas, price of gas, extent of needed modifications to the boiler, and monitoring requirements.

B. Fuel-Switching Environmental Considerations

The EPA has considered the relative environmental benefits for fuel switching and presumptive NOx RACT. In terms of the primary purpose of NOx RACT, that is reducing ozone effects in areas of high concentrations, it is clear that the increased NOx emissions reductions due to burning a cleaner fuel during the ozone season would be much more effective than lesser emissions reductions at the presumptive NOx RACT levels, which would be evenly spread over an entire year. The use of natural gas instead of coal could also substantially reduce annual and summertime emissions of sulfur dioxide (SO_2), carbon dioxide (CO_2), PM-10 (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers), and associated toxic emissions such as mercury. Further, emissions reductions of these pollutants may be especially effective in the summer with respect to reducing regional haze and sulfate-related PM-10, both of which tend to peak in the summer. Thus, the potential benefits that go beyond the title I ozone and NOx RACT goals include helping attain/maintain the NAAQS for SO_2 and PM-10, reducing mercury and other air toxic emissions, improving visibility, and cutting emissions of CO_2, a global warming gas.

The EPA has also considered evidence suggesting that, for certain ecosystems, reductions in nitrogen deposition that occur only during the summer would be less effective at reducing acid deposition and nutrient impacts than reductions that occur uniformly throughout the year. It is not possible at this time to fully determine or quantify this relative ecological impact. Moreover, due to the inherent limits on the amount of fuel switching that can occur and the effect of titles II and IV NOx reductions, wintertime nitrogen deposition would be projected to decrease in most areas regardless of fuel switching. In contrast, the ozone related and many of the additional potential benefits of fuel switching noted above are well known and quantifiable. In EPA's judgment, substantial additional ozone reductions occur from fuel switching; this benefit and the accompanying improvements in visibility, PM-10, air toxics, and global warming that also occur from fuel switching clearly outweigh the reduced wintertime benefits.

C. Conclusion

The above environmental and cost considerations are important in interpreting the EIP guidance for the use of fuel switching to meet NOx RACT. Based on these considerations, EPA believes that, in cases where fuel switching results in a lower cost to the source, requiring further environmental benefits would not be necessary for fuel switching. Moreover, the potential cost savings may need to be preserved to provide some

incentive to sources to achieve these substantial environmental benefits.

VII. Enforcement

Each affected source in a long-term averaging program must comply with all requirements imposed by the program. Each long-term averaging program must:

1. Specify credible, workable, replicable and otherwise fully enforceable methodologies for appropriately determining compliance at all emissions units participating in the averaging program, including methodologies for quantifying emissions, where appropriate.

2. Require recordkeeping and reporting, consistent with the required compliance determination methodologies, including emissions quantification methodologies sufficient for determining and documenting compliance with the program. These requirements must contain a mechanism for determining required data, including emissions at subject emissions units when data are missing, inadequate, or erroneous. This mechanism must ensure that owners of emissions units have a strong incentive to properly perform monitoring, recordkeeping, and reporting in the first instance.

3. Provide adequate civil and criminal sanctions for failure to comply with applicable program requirements, including emissions limitations and monitoring, recordkeeping, and reporting requirements. The program regulatory requirements and enforcement authorities must preserve the level of deterrence to noncompliance, at both the State and Federal levels, which would have otherwise applied in the absence of the averaging program.

VIII. Projected Results and Audit Procedures

A SIP revision that contains an EIP must include projections of the emissions reductions the State expects to achieve through implementation of the program. All EIP submittals must include documentation which clearly states how sources in an EIP are or will be addressed in the emissions inventory, reasonable further progress (RFP) plan (i.e., where the 3 percent RFP plan includes NOx substitution for required volatile organic compounds reductions) and attainment or maintenance plan, as applicable.

All EIP's must also contain program audit procedures designed to evaluate program implementation and track program results in terms of the actual emissions reductions obtained during program implementation. The program audit provisions must include a State commitment to ensure timely implementation of

programmatic revisions or other measures which the State, in response to the audit, deems necessary for the successful operation of the program.

IX. Emissions Reduction Credits (ERC)

Annual emissions reductions achieved through the EIP that exceed the annual emissions reductions that would result from compliance with presumptive RACT may be used to establish ERC. However, this guidance does not address establishing or trading of seasonal ERC.

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Appendix: Annual Equivalency Calculation Methodology

A. Emissions Averaging or Emissions Cap

As described below, a long-term averaging EIP may use either an emissions averaging or emissions cap basis to establish annual equivalency. Under emissions averaging, if production increases, emissions may increase proportionately; and if production decreases, emissions must decrease accordingly. Shutdowns and curtailments do not provide credit under an emissions averaging program. Where an emissions cap is set, actual emissions must be within the emissions cap for all appropriate averaging periods in the future. Shutdowns and curtailments may provide credit under an emissions cap under circumstances that will be described in future guidance.

Both of these options assume that the State has determined a RACT emissions rate value for each fuel i (up to N fuels) burned in equipment j (for M types of equipment). The constraints in this guidance presume that RACT is designated as an emissions rate per unit of production (in this case heat input). The RACT may also be designated as a percent reduction from representative historical emissions rates.[1] If a source wishes to implement a long-term average percent reduction, the values must be converted to emissions rate limits per unit of production.

Note, where multiple fuels are used in the base year, EPA generally expects the presumptive RACT to be applicable to the one primary fuel, and that different emissions rate limits would be used for other fuels. For example, where coal has been historically used 80 percent and oil 20 percent of the time in a wall-fired boiler, the EPA presumptive RACT emissions limit of 0.5 (pounds of NOx per million Btu) might be used in the coal-fired portion of the calculation; however, the EPA presumptive RACT of 0.30 for oil might not be appropriate for the oil-fired portion of the calculation since the presumed low NOx burner technology designed to meet 0.5 when burning coal might not be designed to meet 0.3 when burning oil. In this example, 0.35 might be more appropriate to include in the oil-fired portion of the calculation; the State needs to determine the appropriate emissions rate for the secondary fuel(s), considering the control equipment designed to meet the primary fuel limit.

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[1] Generally speaking, the term "historical" means calendar year 1990 unless another 12-month period is more representative of normal source operation. This alternative 12-month period must fall between January 1990 and December 1992.

B. Emissions Averaging

Emissions averaging allows an emissions unit to use a production-weighted average to meet the prescribed emissions rate limitation (in this case the presumptive RACT limit) on an **annual** basis. Actual annual emissions in each future compliance period (mass per year) must be less than the emissions that would have occurred if the presumptive RACT limit was met.

If RACT is designated as an emissions rate limitation, then mathematically the constraint that must be met for every annual compliance period in the future is as follows:

$$\Sigma_{i=1\rightarrow N}\Sigma_{j=1\rightarrow M}RACT_{ij} \text{ X Annual Heat Input}_{ij} \geq \text{Total Annual Actual } NO_x \text{ Emissions}$$

Where $RACT_{ij}$ generally equals the lowest federally enforceable emissions rate limitation that applies to unit j using fuel i. There are limited exceptions to this generalization where an emissions rate lower than $RACT_{ij}$ would apply (e.g., see the baseline section of the EIP guidelines). Further guidance is expected to be released on this soon.

C. Emissions Cap

An emissions cap is an averaging approach that imposes a limit on annual mass emissions from an emissions unit. The cap is set using historical production rates and RACT emissions rate limitations as shown below:

$$\text{Emissions Cap} = \Sigma_{i=1\rightarrow N}\Sigma_{j=1\rightarrow M}\text{Historical Production Rate}_{ij} \text{ X } RACT_{ij}$$

Where $RACT_{ij}$ is defined the same as above.

D. Example Determinations of Annual Equivalency

a. Single Fuel Emissions Averaging Example

$$\Sigma_{i=1\rightarrow N}\Sigma_{j=1\rightarrow M}RACT_{ij} \text{ X Annual Heat Input}_{ij} \geq \text{Total Annual Actual } NO_x \text{ Emissions}$$

i = 100% coal
j = wall-fired utility boiler
assume presumptive coal RACT = 0.5 (pounds NOx/MMBtu)

if 1996 actual annual heat input = $4 \text{ X } 10^6$ MMBtu
then actual 1996 annual emissions could not exceed:
$(0.5) \text{ X } (4 \text{ X } 10^6)$ = 2 million pounds or 1000 tons NOx

b. Single Fuel Emissions Cap Example

i = 100% coal
j = wall-fired utility boiler
assume presumptive coal RACT = 0.5 (pounds NOx/MMBtu)

if historic (CY-90) production rates = 3 X 10^6 MMBtu/year
then the emissions cap is:
(3 X 10^6) X (0.5) = 1.5 million pounds or 750 tons NOx/year

Annual emissions must, therefore, not exceed 750 tons for all future years.

c. Multiple Fuel Emissions Averaging Example

$\Sigma_{i=1\to N}\Sigma_{j=1\to M}RACT_{ij}$ X Annual Heat $Input_{ij} \geq$
Total Annual Actual NO_x Emissions

i = 75% coal; 25% oil
j = wall-fired utility boiler
assume presumptive coal RACT = 0.5 (pounds NOx/MMBtu)
assume the State has determined that the low NOx burner technology designed for coal will result in a 0.35 emissions rate when burning oil

if 1996 actual annual heat input (coal) = 3 X 10^6 MMBtu and
1996 actual annual heat input (oil) = 1 X 10^6 MMBtu

then actual 1996 annual emissions could not exceed:
(0.5) X (3 X 10^6) = 1.5 million pounds plus
(0.35) X (1 X 10^6) = 0.35 million pounds

which = 1.85 million pounds or 925 tons NOx

d. Multiple Fuel Emissions Cap Example

Emissions Cap = $\Sigma_{i=1 \to N}\Sigma_{j=1 \to M}$Historical Production Rate$_{ij}$ X RACT$_{ij}$

i = 66.6% coal; 33.3% oil
j = wall-fired utility boiler
assume presumptive coal RACT = 0.5 (pounds NOx/MMBtu)
assume the State has determined that the low NOx burner technology designed for coal will result in a 0.35 emissions rate when burning oil

if historic (CY 1990) production rates for coal = 2 X 10^6 MMBtu/year and
historic (CY 1990) production rates for oil = 1 X 10^6 MMBtu/year,
then the emissions cap is:
(2 X 10^6) X (0.5) = 1 million pounds plus
(1 X 10^6) X (0.35) = 0.35 million pounds
which = 1.35 million pounds or 675 tons NOx

Annual emissions must, therefore, not exceed 675 tons for all future years.