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MEMORANDUM

SUBJECT: Cost-Effective Nitrogen Oxides (NOx) Reasonably Available Control Technology (RACT)

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This memorandum provides guidance for determining NOx RACT [required by section 182(f) of the Clean Air Act (Act)] as it relates to nonutility sources and utility boilers which were not addressed by the Environmental Protection Agency's (EPA's) previous guidance. The document entitled, "State Implementation Plans; Nitrogen Oxides Supplement to the General Preamble; Clean Air Act Amendments of 1990 Implementation of Title I; Proposed Rule," (NOx supplement) (November 25, 1992, 57 FR 55625) identifies emission rates that presumptively meet the NOx RACT requirement for tangential and dry bottom wall-fired utility boilers. The guidance goes on to state that, for other major NOx sources, EPA expects that NOx RACT will be set at levels that are "comparable" to the levels specified for tangential and dry bottom wall-fired utility boilers. The guidance states that: "Comparability shall be determined on the basis of several factors including, for example, cost, cost-effectiveness, and emission reductions." This memorandum primarily addresses <u>one</u> of the factors in a NOx RACT determination--cost effectiveness--and provides guidance on how to determine which control techniques are of "comparable cost-effectiveness for NOx RACT." In addition, this memorandum provides limited discussion of other factors, including emission reductions.

It should also be noted that, in certain areas, States may require NO_X controls based on advanced control technologies; i.e., control technologies that reduce emissions beyond RACT or title IV (acid rain) requirements. For example, advanced controls would be required as part of a serious ozone nonattainment area's 1994 State implementation plan if modeling found such controls to be necessary to provide for expeditious attainment of the ozone national ambient air quality standards. In order to avoid or minimize potentially incremental or repetitive control requirements, States and regulated sources should consider in advance the implications of all relevant requirements.

In general, the actual cost, emission reduction, and cost-effectiveness levels that an individual source will experience in meeting the NOx RACT requirements will vary from unit to unit and from area to area. These factors will differ from unit to unit because the sources themselves vary in age, condition, and size, among other considerations. The EPA's general RACT guidance urges States to judge the feasibility of imposing specific controls based on the economic and technical circumstances of the particular unit being regulated. In many cases, these factors are not the same in all States since the specific NOx RACT emission limitations and averaging times will differ from State to State. The EPA's presumptive NOx RACT levels for certain utility boilers are based on capabilities and problems which are general to the industry on a national basis. States may adopt statewide NOx RACT levels which are more stringent than the EPA levels based on statewide industry conditions. For these reasons, a single cost, emission reduction, or cost-effectiveness figure cannot fully describe the NOx RACT requirement. Thus, the information provided in this memorandum does not prescribe a single cost-effectiveness figure, but rather provides additional guidance which States may use as they make NOx RACT determinations.

For NOx RACT, cost effectiveness is a figure in dollars per ton of NOx emissions reductions per year. In order to clarify the "comparable cost-effectiveness for NOx RACT" referred to in the NOx supplement, EPA reviewed the December 1992 EPA/Northeast States for Coordinated Air Use Management (NESCAUM) report (EPA/NESCAUM report) on utility boilers entitled, "Evaluation and Costing of NOx Controls for Existing Utility Boilers in the NESCAUM Region" (EPA 453/R-92-010). This report identifies various NOx control technologies for existing utility boilers and their associated costs, cost effectiveness, and emission reductions. As described below, EPA has extracted from the report the cost effectiveness of controls that are expected to meet the EPA's presumptive NOx RACT for tangential and dry bottom wall-fired utility boilers at least cost. These cost figures generally define the "comparable cost-effectiveness for NOx RACT" referred to in the NOx supplement.

The November 1992 NOx supplement to the General Preamble specifies the following areawide presumptive NOx RACT emission limits (lbs NOx per million Btu determined on a rolling 30-day average) for utility boilers:

Coal:	**tangential--0.45**	**wall--0.50**
Gas/Oil:	**tangential--0.20**	**wall--0.30**

Technologies available to meet these NOx RACT levels are described in section 4 of the EPA/NESCAUM report. Section 5 of that report describes the cost algorithm used, which includes consideration of process capital equipment, total plant cost and investment, fixed and variable operating cost, total capital requirement and consumable costs. The cost-effectiveness figures in the report are based on data from different geographic regions and represent a variety of averaging times. The EPA believes the data are appropriate to use with respect to the EPA presumptive NOx RACT 30-day rolling average or to a daily average.

As described in tables 1-4 and 1-5 of the EPA/NESCAUM report, the combustion-modification technologies available to meet EPA's presumptive NOx RACT levels show a range of cost effectiveness of about $160 to $5100 per ton; and the post-combustion technologies, excluding selective catalytic reduction, show a range of about $320 to $5200 per ton. These are national estimates based on constant 1991 (1st quarter) dollars. Some States may need to make regional adjustments to this range to reflect prevailing installation and operating labor costs which are higher or lower than the national average. The data indicate that some coal burning wall-fired boilers can meet EPA's presumptive NOx RACT levels by application of low NOx burners at a cost effectiveness as low as $160 per ton. The data also indicate that certain tangentially-fired utility boilers may approach a cost-effectiveness level of $1300 per ton in order to meet the EPA presumptive NOx RACT levels. Application of selective catalytic reduction to utility boilers does not appear necessary in order to meet the EPA presumptive NOx RACT levels.

In determining the NOx RACT comparable cost-effectiveness level, EPA believes that it is appropriate to focus on the range of cost effectiveness. The range is appropriate due to the variability of the actual cost effectiveness that is expected from unit to unit. Therefore, NOx technologies with a cost-effectiveness range that overlaps the $160 to $1300 range should, at a minimum, be considered by States in the development of their NOx RACT requirements.

In some cases, States will need to consider a broader cost-effectiveness range. For example, where States adopt NOx RACT requirements that are more stringent than the EPA's presumptive RACT, the associated control technologies may result in higher cost-effectiveness figures and, thus, States should expect to

apply a broader cost-effectiveness range. In addition, since the EPA's presumptive RACT levels are expected to be met by a majority of (but not all) sources, States should expect some sources to experience higher cost-effectiveness levels in order to meet the NOx RACT requirements.

While cost effectiveness, as described above, is an important consideration, it must be noted that other factors should be integrated into a RACT analysis. For example, emission reductions and environmental impact should be considered. Regarding emission reductions, a comparison of uncontrolled NOx emission levels (from the EPA/NESCAUM report) with EPA's presumptive RACT levels indicates that the utility boilers are expected to achieve emission reductions of about 30 to 50 percent. If control technologies in the $160 to $1300 range are inadequate to achieve emission reductions in the 30 to 50 percent range, then the State should consider alternate technologies which achieve those reduction levels. For example, if a RACT analysis indicates that a cost effectiveness of $2000 per ton is necessary to achieve emission reductions in the 30 to 50 percent range, the State may need to adopt that requirement in order to achieve comparable emission reductions, consistent with EPA's guidance.

The environmental impact of various control technologies should be included in the RACT determination in some cases. For example, sources that operate intermittently, but whose peak operating times coincide with the peak ozone periods, should be considered separately from sources with relatively constant year-round emissions. In addition, where an otherwise acceptable control technology might significantly increase carbon monoxide (CO) emissions in a CO nonattainment area, the State should consider alternate technologies.

Questions concerning this memorandum can be addressed to John Silvasi at (919) 541-5666; questions on specific technologies and costs can be addressed to Bill Neuffer at (919) 541-5435.

bcc: NOx Work Group

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