TCEQ

Air Permits Division
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Technical Information

Engineering Analysis – Best Available Retrofit Technology

(Title 30 Texas Administrative Code Sections 116.1500 - 116.1540)

This document outlines information and requirements for acceptable submittals of the Engineering Analysis (EA) to demonstrate Best Available Retrofit Technology (BART), pursuant to Title 30 TAC, Sections 116.1500-1540. This document is organized to provide information about:

- regulatory background
- applicability
- general considerations and requirements for EA submittals
- BART analysis process
- control alternative selection
- enforceable limits and compliance dates

The information provided is applicable as of the date of this document, but ~~are~~ subject to revision during the application preparation and review period. It is the applicants' responsibility to remain abreast of regulation developments which may affect their industries.

This document was compiled by the Texas Commission on Environmental Quality (TCEQ) based on guidance previously developed by the Minnesota Pollution Control Agency and is intended for instructional use only. The pertinent rules, application forms, related publications, and other useful material are available at: www.tceq.state.tx.us

In this document you will find information about:

I. Regulatory Background 2
II. Applicability 2
III. Engineering Analysis Submittal Considerations 3
IV. BART Analysis Process 4
V. Selection of Best Control Alternative 22
VI. Upgrade Options and Control Limits for Various Source Types 23
VII. Enforceable Limits and Compliance Dates 26

Disclaimer*:* ***This document is provided for informational purposes only. It is offered to assist BART-eligible sources prepare for the requirements of the new BART rule in Chapter 116, if ultimately adopted by TCEQ. This document may change as a result of the adoption of the rules. BART engineering analyses will not be accepted prior to adoption of the rule.***

I. Background

The Federal Clean Air Act (FCAA), § 169A, Visibility Protection for Federal Class I Areas, and § 169B, Visibility (42 United States Code (USC), § 7491 and § 7492), require the EPA to adopt regulations to address visibility impairment due to regional haze at 156 federally designated parks and scenic areas of national importance (Class I areas). Regional haze is caused by natural events and by the emission of air pollutants from numerous sources located over a wide geographic area.

The EPA promulgated regulations to address these statutory requirements in 40 Code of Federal Regulations (CFR) Part 51, Subpart P, Protection of Visibility, on July 1, 1999 (64 FR 35763). The EPA also promulgated amendments to Subpart P and a new Appendix Y to Part 51 (Guidelines for BART Determinations Under the Regional Haze Rule) on July 6, 2005 (70 FR 39156). The FCAA and implementing regulations require states to submit State Implementation Plans (SIP) to address visibility impairment caused by regional haze and include guidelines for determining BART.

On August 9, 2006, the TCEQ proposed revisions to 30 TAC Chapter 116 (new Subchapter M) to implement these requirements. The proposed revisions will require owners or operators of subject sources perform a BART EA to determine the appropriate level of control technology and subsequently implement any required BART controls. The proposed rules also provide mechanisms for BART-eligible sources to demonstrate that they do not significantly affect visibility in Class I areas and are therefore not subject to BART control requirements.

The TCEQ is required to submit a Regional Haze SIP to the EPA no later than December 17, 2007. In order to develop this SIP in a timely manner, the TCEQ must receive the BART EA or BART exemption modeling from each BART-eligible source no later than April 30, 2007. A corresponding deadline is proposed in the rules. As part of the SIP, states must identify BART-eligible sources.

II. Applicability

BART-eligible sources belong to one of 26 named source categories, have the potential to emit 250 tons per year or more of a visibility-impairing pollutant (nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulate matter (PM)), and were built or reconstructed between August 7, 1962, and August 7, 1977. These sources must be evaluated to determine whether they cause or contribute to visibility impairment at any Class I area. BART-eligible sources that cause or contribute to visibility impairment at any Class I area are subject to BART; owners or operators must therefore conduct a technology evaluation to determine the appropriate level of BART controls.

BART is determined case-by-case for each source, based on considerations of the technology available, the costs of compliance, the energy and non-air quality environmental impacts of controls, any existing pollution control technology used by the source, the remaining useful life of the source, and the degree of visibility improvement that would result from the use of the technology.

III. Engineering Analysis Submittal - General Considerations

Case-by-Case BART Analysis

The BART analysis identifies the best system of continuous emission reduction by considering several steps in a case-by-case review of available and technically feasible control options:

(1) Available retrofit control options
(2) Technical feasibility
(3) Control effectiveness
(4) Cost impacts analysis
(5) Visibility effects analysis

See **Section IV (Case-by-Case BART Analysis)** for additional detail on each of these elements.

Scope of BART Review

Once it is determined that a source is subject to BART for a particular pollutant, then BART must be established for each affected emission unit. The BART determination must address air pollution control measures for each emissions unit or pollutant emitting activity subject to review.

> Example: Plant-wide emissions from emission units within the listed categories that began operation within the BART "time window" (i.e., defined for those emission units in existence on August 7, 1977, and which began actual operation on or after August 7, 1962) are 300 tons/yr of NO_x, 200 tons/yr of SO_2, and 150 tons/yr of PM.
>
> Emission unit A emits 200 tons/yr of NO_x, 100 tons/yr of SO_2, and 100 tons/yr of PM. Other emission units (B through H) began operating in 1966, emitting the same three pollutants, but in less amounts of each.
>
> A BART review is required for NO_x, SO_2, and PM, and control options must be analyzed for all emission units A through H.

Relationship to MACT and Other FCAA Requirements

For those visibility-impairing pollutants addressed by Maximum Achievable Control Technology (MACT) standards, TCEQ will in most cases probably defer to these standards as representative of BART-level controls unless cost-effective new technologies are subsequently developed and recognized. Units and/or groups of units emitting visibility-impairing pollutants addressed by a MACT standard(s) should be listed on Table 2: MACT as BART for Eligible Units, of TCEQ Form BART EA-1 (see this Form's Section III, *Guidelines for Engineering Analysis Submittals*). The applicable standard, the limit it imposes on the subject unit, the conversion of the limit into a pounds/day value, and the rationale for why the standard represents BART should be included in the submittal. No further analysis is needed of those units for that visibility-impairing pollutant.

For volatile organic compounds (VOC) and PM sources subject to MACT standards, TCEQ will streamline the analysis by including a discussion of the MACT controls and whether any major new technologies have been developed subsequent to the MACT standards. There may be many VOC and PM sources that are well controlled because they are regulated by the MACT standards, which EPA developed under FCAA Section 112. For a few MACT standards, this may also be true for SO_2. Any source subject to MACT standards must meet controls no less stringent than those used for the best-controlled 12% of sources in the industry. Examples of these hazardous air pollutant sources which effectively control VOC and PM emissions include secondary lead facilities, organic chemical plants subject to the Hazardous Organic National Emission Standard for Hazardous Air Pollutants (HON), pharmaceutical production facilities, and equipment leaks and wastewater operations at petroleum refineries.

This rationale also applies to emissions standards developed for municipal waste incinerators under FCAA Section 111(d), and for many New Source Review (NSR) / Prevention of Significant Deterioration (PSD) determinations and NSR/PSD settlement agreements. Technology determinations from the 1970s or early 1980s, however, including New Source Performance Standards (NSPS), should not be considered as representative of best control for existing sources; best control levels for recent plant retrofits are more stringent than these older levels. Reliance on these standards to represent a BART level of control should also provide to the public a discussion of whether any new technologies have subsequently become available.

IV. Case-by-Case BART Analysis

Identify All Available Retrofit Technologies

Available retrofit control options are those air pollution control technologies with a practical potential for application to the emissions unit and the regulated pollutant under evaluation. Air pollution control technologies can include a wide variety of available methods, systems, and techniques for control of the affected pollutant. Technologies required as Best Available Control Technology (BACT) or for purposes of Lowest Achievable Emission Rates (LAER) are available as BART options and must be included as control alternatives in this analysis. The control alternatives can include not only existing controls for the source category in question but may also consider controls applied to similar source categories and gas streams. Technologies that have not yet been applied to or permitted for full scale operations need not be considered as available.

In the typical case where a NSPS exists for a source category, a level of control equivalent to the NSPS should be included as one of the control options. Although NSPS standards may have previously been considered to represent the best level of control for BART, this exclusive conclusion is no longer appropriate given the scope of technology advancements for control of various visibility impairing pollutants. Analysis of the BART factors may indeed result in the selection of a NSPS level of control, but this conclusion may be reached only after considering the full range of control strategy options. The NSPS standards are codified in 40 CFR 60. There are situations, however, where NSPS standards do not require the most stringent level of available control for all sources within a category. For example, post-combustion NO_X controls are not required under Subpart GG of the NSPS for Stationary Gas Turbines. However, such controls must still be considered available technologies for the BART selection process.

Potentially applicable retrofit control alternatives can be categorized in three ways:

1. Pollution prevention: use of inherently lower-emitting processes/practices, including the use of control techniques (e.g., low-NO_X burners) and work practices that prevent emissions and result in lower “production-specific” emissions,

2. Use and improvement in the performance of add-on controls such as scrubbers, fabric filters, thermal oxidizers and other devices that control and reduce emissions after they are produced, and

3. Combinations of inherently lower-emitting processes and add-on controls.

One or more of the available control options may be eliminated from consideration during BART review if they are demonstrated to be technically infeasible or to have unacceptable energy, cost, or non-air quality environmental effects on a case-by-case or site-specific basis. However, all control options with potential application to the emissions unit under review should be identified at the outset.

BART review does not require re-design of the source when considering available control alternatives. For example, if the source subject to BART is a coal-fired electric generator, the BART analysis does not require consideration of replacing the generator with a natural gas-fired electric turbine, even if natural gas fired turbines are inherently cleaner than coal-fired generators.

For emission units subject to a BART review, there will often be control measures or devices already in place. For such emission units, it is important to include control options that involve improvements to existing controls and not to limit the control options only to those measures that involve a complete replacement of control devices.

> Example: For a power plant with an existing wet scrubber, the current control efficiency is 66%. Part of the reason for the relatively low control efficiency is that 22% of the gas stream bypasses the scrubber. A BART review identifies options for improving the performance of the wet scrubber by redesigning the internal components of the scrubber and by eliminating or reducing the fraction of the gas stream that bypasses the scrubber. Four control options are identified: (1) 78% control based upon improved scrubber performance while maintaining the 22% bypass, (2) 83% control based upon improved scrubber performance while reducing the bypass to 15%, (3) 93% control based upon improving the scrubber performance while eliminating the bypass entirely, (this option results in a “wet stack” operation in which the gas leaving the stack is saturated with water), and (4) 93% as in option 3, with the addition of an indirect reheat system to reheat the stack gas above the saturation temperature. Each of these four options must be considered in a BART analysis for this source.

The BART analysis should include the identification of potentially applicable retrofit control technologies that represent the full range of demonstrated alternatives. General information sources include:

- The EPA's Clean Air Technology Center, which includes the RACT/BACT/LAER Clearinghouse (RBLC);

- State and Local Best Available Control Technology Guidelines many agencies have online information—for example South Coast Air Quality Management District, Bay Area Air Quality Management District, TCEQ, MPCA;

- Control technology vendors;

- Federal/State/Local NSR permits and associated inspection/performance test reports;

- Environmental consultants;

- Technical journals, reports and newsletters, air pollution control seminars; and

- The EPA's NSR bulletin board; www.epa.gov/ttn/nsr;

- Department of Energy's Clean Coal Program technical reports;

- The NO_X Control Technology "Cost Tool" Clean Air Markets Division Web page www.epa.gov/airmarkets/arp/nox/controltech.html;

- Performance of Selective Catalytic Reduction on Coal-Fired Steam Generating Units; Final Report; OAR/ARD, June 1997 (also available at www.epa.gov/airmarkets/arp/nox/controltech.html);

- Cost Estimates for Selected Applications of NO_X Control Technologies on Stationary Combustion Boilers. OAR/ARD June 1997. (Docket for NO_X SIP Call, A–96–56, item II–A–03);

- Investigation of Performance and Cost of NO_X Controls as Applied to Group 2 Boilers. OAR/ARD, August 1996. (Docket for Phase II NO_X rule, A–95–28, item IV–A–4);

- Controlling SO_2 Emissions: A Review of Technologies. EPA–600/R–00–093, USEPA/ORD/NRMRL, October 2000; and

- The Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual.

There may be situations where a specific set of units within a fence line constitutes the logical set to which controls would apply; some units in the set, however, may not be BART-eligible. (For example, some units in that set may not have been constructed between 1962 and 1977.)

If controls already in place on a BART source are the most stringent available (i.e., all possible improvements to any control devices have been made), it is not necessary to comprehensively complete each of the following steps of the BART analysis in this section. As long as these controls are federally enforceable for the purpose of implementing BART for that source, the remaining analyses in this section, including the visibility analysis in Step 5, can be skipped. Similarly, if a source commits to a BART determination that consists of the most stringent controls available, there is no need to complete the remaining analyses in this section.

On a case-by-case basis, the TCEQ will consider whether a BACT determination or NSPS limit for a particular pollutant at a BART-eligible unit satisfies BART requirements. The TCEQ will consider the age of the BACT determination or NSPS limit, whether any new technologies have subsequently become available (including work practices that reduce emissions), and the visibility analysis that was performed for the BACT determination. The TCEQ encourages facilities to consult with TCEQ staff during the development of their BART analysis if they believe a BACT determination or NSPS limit represents BART, and that no further analyses are required for a particular visibility-impairing pollutant.

Determine Technical Feasibility of Options Identified

The technical feasibility determination should begin with the evaluation of the technical difficulties that would preclude the successful use of the control option of interest on the emission unit. The evaluation should rest on physical, chemical, or engineering principles, as well as on considerations described below. Options determined to be technically infeasible by these methods may be eliminated from further consideration in the BART analysis.

Technical Feasibility

A control technology is technically feasible if either of the following conditions applies to it:

(1) the technology has been installed and operated successfully for the type of source under review, under circumstances similar to those in which the source of interest is operated, or

(2) the technology could be applied to the source under review.

Two key concepts in determining whether a technology could be applied to a source under review are "availability" and "applicability."

Available Technology

A technology is considered "available" if the source owner can obtain it through commercial channels, or it is otherwise available within the common sense meaning of the term. The typical stages for bringing a control technology concept to reality as a commercial product are:

- Concept stage;
- Research and patenting;
- Bench scale or laboratory testing;
- Pilot scale testing;
- Licensing and commercial demonstration; and
- Commercial sales.

A control technique is considered available, within the context presented above, if it has reached the stage of licensing and commercial availability. Similarly, we do not expect a source owner to conduct extended trials to learn how to apply a technology on a totally new and dissimilar source type. Consequently, technologies in the pilot scale testing stages of development would not be considered "available" for purposes of BART review.

Commercial availability by itself, however, is not necessarily a sufficient basis for concluding a technology to be applicable and therefore technically feasible. Technical feasibility, as determined in Step 2, also means a control option may reasonably be deployed on or "applicable" to the source type under consideration.

A new technology may become available anytime during the BART analysis process (e.g., during the public comment period on the State's rule development process, after the close of the State's public comment period and before submittal of the SIP to EPA, during EPA's review process on the SIP submittal). Technologies should be considered if available before the close of the State's public comment period. The analysis should also consider any technologies addressed in public comments. Applicants' basis of disagreements with public comments that the technology is available should be explained for the public record.

For the purpose of the BART analysis, all technologies should be considered available as of the date of submittal of the BART analysis.

Applicable Technology

An available technology is "applicable" if it can reasonably be installed and operated on the source type under consideration. A technology that is available and applicable satisfies the second of the foregoing conditions and is therefore technically feasible.

In general, a commercially available control option will be presumed applicable if it has been used on the same or a similar source type. Absent a showing of this type, technical feasibility is evaluated by examining the physical and chemical characteristics of the pollutant-bearing gas stream and comparing them to the gas stream characteristics of the source types to which the technology had been applied previously. Deployment of the control technology on a new or existing source with similar gas stream characteristics is generally a sufficient basis from which to conclude that the technology is technically feasible barring a demonstration to the contrary as described below.

Demonstrations of Technical Infeasibility

The designation of an identified control option as technically infeasible should be submitted with documentation that demonstrates that the option is either commercially unavailable or that specific circumstances preclude its application to a particular emission unit. Generally, such a demonstration involves an evaluation of the characteristics of the pollutant-bearing gas stream and the capabilities of the technology. Alternatively, a demonstration of technical infeasibility may indicate insurmountable technical difficulties in application of the control to the source (e.g., size of the unit, location of the proposed site, operating problems related to specific circumstances of the source, space constraints, reliability, and adverse side effects on the rest of the facility). Where the resolution of technical difficulties is a matter of increased cost, the technology should be considered technically feasible; the cost of a control alternative is considered later in the process.

The determination of technical feasibility is sometimes influenced by recent air quality permits. In some cases, a permit may require a certain level of control that is not expected to be achieved in practice (e.g., a source has received a permit but the project was canceled, or every operating source at that permitted level has been physically unable to achieve compliance with the limit). In these cases, supporting documentation should be provided to demonstrate why such limits are not technically feasible, and why the level of control (but not necessarily the technology) may therefore be eliminated from further consideration. However, if a permit requires application of a certain technology or emission limit to be achieved for such technology, this is typically sufficient basis from which to reasonably assume the technical feasibility of that technology or emission limit.

Physical modifications needed to resolve technical obstacles do not, in and of themselves, provide a justification for eliminating the control technique on the basis of technical infeasibility. The cost of such modifications, however, should be considered in the option's overall cost estimates, which in turn may form or contribute to the basis for eliminating a control technology (see later discussion).

Vendor guarantees may provide an indication of commercial availability and the technical feasibility of a control technique and could contribute to a determination of technical feasibility or technical infeasibility, depending on circumstances. However, a vendor guarantee alone is not considered to be sufficient justification that a control option will work. Conversely, lack of a vendor guarantee by itself does not present sufficient justification that a control option or an emissions limit is technically infeasible. Generally, decisions about technical feasibility should be based on the engineering analysis of stream and control technology characteristics, in conjunction with information about vendor guarantees.

A possible outcome of the BART procedures discussed here is the evaluation of multiple control technology alternatives which result in essentially equivalent emissions; evaluation of large numbers of control alternatives for every emissions unit, however, may not be necessary. Consequently, applicants should use judgment in deciding on those alternatives for which the detailed impacts analysis will be conducted. For example, if two or more control techniques result in control levels that are essentially identical, considering the uncertainties of emissions factors and other parameters pertinent to estimating performance, evaluation of only the less costly of these options may be sufficient. The scope of the BART analysis may be narrowed in this way only if there are negligible differences in emissions and in the energy and non-air quality environmental effects among the various control alternatives.

Evaluate Control Effectiveness of Technically Feasible Options

This step involves the evaluation of the control effectiveness of all the technically feasible control alternatives identified for the pollutant and emissions unit under review.

Two key elements of this process include:

(1) Ensuring that the degree of control is expressed in consistent metrics (i.e., an "apples to apples" comparison of emissions performance levels among options), and

(2) Appropriate treatment of and consideration to control techniques that can operate over a wide range of emission performance levels.

Appropriate Comparison Metrics

This consideration is especially important when comparing inherently lower-polluting processes to one another or to add-on controls. In such cases, it is generally most effective to express emissions performance as an average steady state emissions level per unit of product produced or processed.

Note: For EGUs, emissions comparisons should be provided in units of pounds per million Btu heat input. All emissions should also be provided on a lb/day basis as these are the units that will be used for modeling purposes. In evaluating the reductions attainable from the use of a NO_x CEM on indurating furnaces to improve combustion practices, a 20% reduction may be assumed unless information to support another value is available. Reasonable reductions in the range of 15 to 35% may be attributable to improved operational information.

Evaluation of Control Techniques with Widely-Ranged Emission Performance

Many control techniques, including both add-on controls and inherently lower polluting processes, can perform at a wide range of levels. Scrubbers and high and low efficiency electrostatic precipitators (ESPs) are two of the many examples of such control techniques that can perform at a wide range of levels. The analysis of each possible level of efficiency for a given control strategy is not an intended requirement, as such an analysis would result in a large number of options. The analysis of any given technology, however, should consider the most stringent emission control level that the technology can provide. Recent regulatory decisions and performance data (e.g., manufacturer's data, engineering estimates and the experience of other sources) should be considered when identifying an emissions performance level or levels to evaluate.

In assessing the capability of the control alternative, applicants may consider special circumstances pertinent to the specific source under review, or regarding the prior application of the control alternative. However, the basis for choosing the alternate level (or range) of control in the BART analysis should be explained. Without a showing of differences between the source and other sources that have achieved more stringent emissions limits, the level being achieved by those other sources should be considered representative of the achievable level for the source being analyzed.

Cases where applicants may wish to evaluate other levels of control in addition to the most stringent level for a given device may be encountered. While the most stringent level must be considered as one of the control options, less stringent levels of control may also be considered as additional options. These additional considerations would be particularly useful in cases where the selection of additional options would have widely varying costs and other impacts.

For the retrofit of existing sources in addressing BART, alternatives for improvement of the performance of existing control devices should be considered, particularly when a control device is not achieving the level of control that other similar sources are achieving with the same device. For example, sources with electrostatic precipitators (ESPs) performing below currently achievable levels may be required to improve their performance.

Assess the Impacts of Each Control Option Identified

After identifying the available and technically feasible control technology options, the following analyses should be conducted in making a BART determination:

(1) Cost of Control Option Analysis
(2) Energy Impacts Analysis
(3) Non Air Quality Environmental Impacts Analysis
(4) Remaining Useful Life Analysis

This section describes each of these analyses in more detail; each area's evaluation should be presented, along with appropriate supporting information. Beneficial and adverse impacts should be discussed and quantified. In general, the analysis should focus on the direct impact of the control alternative.

Collateral increases in another regulated pollutant may result from a given control alternative. For example, use of furnace sorbet injection to control SO_2 in a boiler could result in an increase of PM emissions. This increase could trigger other air quality requirements such as NSPS or NSR. Any such collateral increases in other regulated pollutants should be documented; submittals in which the selected proposed BART control strategy results in collateral increases should include identification of any regulatory requirements applicable to the increases.

Cost of Control Option Analysis

- *Identify the emissions units being controlled* - Specify a well-defined area or process segment within the plant. In some cases, multiple emission units can be controlled jointly. However, in other cases, it may be appropriate in the cost analysis to consider whether multiple units will be required to install separate and/or different control devices. The analysis should provide a clear summary list of equipment and the associated control costs. Inadequate documentation of the equipment whose emissions are being controlled is a potential cause for confusion in comparison of costs of the same controls applied to similar sources.

- *Identify design parameters for emission controls* - Potential sources of these design parameters include equipment vendors, background information documents used to support NSPS development, control technique guidelines documents, cost manuals developed by EPA, control data in trade publications, and engineering and performance test data. Examples of design parameters for control measures include sorbet types, gas pressure drop, and gas/liquid ratio (wet scrubbers) and NH_3/NOx molar ratio and catalyst life (selective catalytic reduction). The value selected for the design parameter should ensure that the control option will achieve the level of emission control being evaluated. Documentation of any assumptions regarding design parameters should be included in the analysis. Examples of supporting references would include the EPA OAQPS Control Cost Manual (see below) and background information documents used for NSPS and hazardous pollutant emission standards. If the specified design parameters differ from typical designs, the difference should be documented by supplying performance test data for the control technology in question applied to the same source or a similar source.

- *Develop cost estimates based upon identified design parameters* - The basis for capital and annual equipment cost estimates should be documented, either with data supplied by an equipment vendor (i.e., budget estimates or bids) or by a referenced source (such as the OAQPS Control Cost Manual, Fifth Edition, February 1996, EPA 453/B–96–001)[14]. In order to maintain and improve consistency, cost estimates should be based on the OAQPS Control Cost Manual where possible[15]. The Control Cost Manual addresses most control technologies in sufficient detail for a BART analysis. The cost analysis should also consider any site-specific design or other conditions identified above that affect the cost of a particular BART technology option. All costs should be reflected in year 2005 dollars.

[14] The *OAQPS Control Cost Manual* is updated periodically. While this citation refers to the latest version at the time this guidance was written, the version that is current at the time the impact analysis is conducted should be the standard reference. This document is available at the following Web site: www.epa.gov/ttn/catc/dir1/cs1ch2.pdf.

[15] Documentation should be provided for any additional information used for cost calculations, including any information supplied by vendors that affects assumptions regarding purchased equipment costs, equipment life, replacement of major components, and any other element of the calculation that differs from the *Control Cost Manual*.

Cost Effectiveness Considerations

Cost effectiveness is a parameter used to assess the potential for achieving an objective in the most economical way. For purposes of air pollutant analysis, "effectiveness" is measured in terms of tons of pollutant emissions removed, and "cost" is measured in terms of annualized control costs.

Two types of cost-effectiveness calculations are recommended—average cost effectiveness, and incremental cost effectiveness.

Average Cost Effectiveness

Average cost effectiveness is the total annualized costs divided by the annual emissions reductions, derived in turn as the difference between baseline annual emissions and the annual emissions after the applied control option is considered:

Average cost effectiveness (dollars per ton removed) =
Control option annualized cost / (Baseline annual emissions – Post-control annual emissions)

Whenever annual costs are calculated or reported, the year for which the costs are estimated should be indicated. For example, if the year 2000 is the basis for cost comparisons, an annualized cost of $20 million would be reported as $20 million (year 2000 dollars). Because costs in (annualized) dollars are calculated in ($/yr), and because emissions rates are calculated in tons per year (tons/yr), the result is an average cost-effectiveness number in (annualized) dollars per ton ($/ton) of pollutant removed.

Cost effectiveness calculations should be based on 2005 dollars. The methodology provided in EPA's Air Pollution Control Cost Manual, Sixth Edition (EPA/452/B-02-001, January 2002), should be used to determine the "annualized cost." Seven percent should be used as the interest rate in these calculations, with an assumed equipment life of 20 years; if this period is not appropriate for the equipment and scenario being considered, the rationale of an alternative value should be documented.

Baseline Emissions

The baseline emissions rate should represent a realistic depiction of anticipated annual emissions for the source. In general, for the existing sources subject to BART, the anticipated annual emissions estimate should be based upon actual emissions from a baseline period.

When projected future operating parameters (e.g., limited hours of operation or capacity utilization, type of fuel, raw materials or product mix or type) differ from past practice, and if this projection has a deciding effect in the BART determination, these parameters and/or assumptions must be considered as enforceable limitations. In the absence of enforceable limitations, baseline emissions can be calculated based upon continuation of past practice.

For example, the baseline emissions calculation for an emergency standby generator may consider the fact that the source owner would not operate more than past practice of two weeks a year. On the other hand, baseline emissions associated with a base-loaded turbine should be based on its past practice which would indicate a large number of hours of operation. This produces a significantly higher level of baseline emissions than in the case of the emergency/standby unit and results in more cost-effective controls. As a consequence of the dissimilar baseline emissions, the BART determination for the two cases could be significantly different.

To estimate the baseline tons per year for units other than electric generating units (EGU), the actual annual emissions should be calculated on the basis of the highest emissions in 24-consecutive months from January 1996 to December 2005 for each of the visibility-impairing pollutants. The baseline emission factor should be correlated to the appropriate operational parameters over this 24-month period. For example, if the baseline NO_X emission rate from a furnace is 1000 lb/hour and the maximum number of operating hours over 24-consecutive months was 16,000 hours, then the NO_X baseline tons per year for the furnace would be 4000 tons.

For EGU, baseline annual emissions should be calculated based on the highest emissions in 12-consecutive months from January 2001 to December 2005 for each of the visibility-impairing pollutants. CEM data should be used if it is available to determine the highest emissions in 12 consecutive months. If CEM data is not available (e.g., PM_{10}), the baseline emission factor should be correlated to the appropriate operational parameters over the 12-month period. For example, if the baseline PM_{10} emission rate from an EGU is 0.04 lb/MMBtu and the maximum heat input is 5,000,000 MMBtu over a 12-month period, then the PM_{10} baseline tons per year would be 100 tons.

Incremental Cost Effectiveness

In addition to the average cost effectiveness of a control option, incremental cost effectiveness should also be calculated. The incremental cost effectiveness should be considered in combination with the average cost effectiveness in deciding whether to eliminate a control option. As shown in the following formula, the incremental cost effectiveness calculation compares the costs and performance of a control option to those of the next most stringent option in terms of cost per emissions reduction:

Incremental Cost Effectiveness (dollars per incremental ton removed) =
[(Total annualized costs of control option) - (Total annualized costs of next control option)] /
[(Control option annual emissions) - (Next control option annual emissions)]

Example 1: Assume that Option F (Figure 1) has total annualized costs of $1 million to reduce 2000 tons of a pollutant, and that Option D has total annualized costs of $500,000 to reduce 1000 tons of the same pollutant.

The incremental cost effectiveness of Option F relative to Option D then is ($1 million - $500,000) / (2000 tons -1000 tons), or $500,000 divided by 1000 tons, which is $500/ton.

Example 2: Assume that two control options exist, Option 1 and Option 2. Option 1 achieves a 1,000 ton/yr reduction at an annualized cost of $1,900,000. This represents an average cost of ($1,900,000/1,000 tons) = $1,900/ton. Option 2 achieves a 980 tons/yr reduction at an annualized cost of $1,500,000. This represents an average cost of ($1,500,000/980 tons) = $1,531/ton. The incremental cost effectiveness of Option 1 relative to Option 2 is ($1,900,000 - $1,500,000) divided by (1,000 tons - 980 tons). The adoption of Option 1 instead of Option 2 results in an incremental emission reduction of 20 tons per year at an additional cost of $400,000 per year. The incremental cost of Option 1, then, is $20,000 per ton 11 times the average cost of $1,900 per ton. While $1,900 per ton may still be deemed reasonable, it is useful to consider both the average and incremental cost in making an overall cost-effectiveness finding. Of course, there may be other differences between these options, such as, energy or water use, or non-air environmental effects, which also should be considered in selecting a BART technology.

Incremental cost-effectiveness comparisons should focus on annualized cost and emission reduction differences between “dominant” alternatives. To identify dominant alternatives, a graphical plot of total annualized costs for total emissions reductions for all control alternatives identified in the BART analysis is generated, and a “least-cost envelope” is identified as shown in Figure 1. (A “least-cost envelope” represents the set of options that should be dominant in the choice of a specific option.)

Example 3: Eight technically feasible control options for analysis are listed. These are represented as Options A through H in Figure 1. The dominant set of control options, B, D, F, G, and H, represent the least-cost envelope, as depicted by the cost curve connecting them. Points A, C and E are inferior options, and should not used in calculating incremental cost effectiveness. Points A, C and E represent inferior controls because B will buy more emissions reductions for less money than A; similarly, D and F will buy more reductions for less money than C and E, respectively.

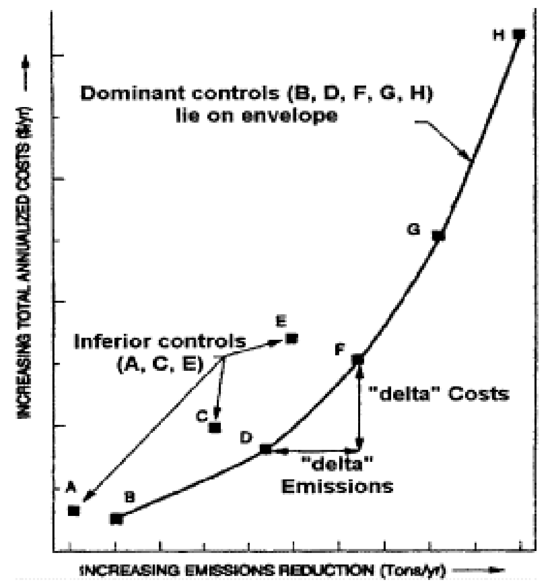

Figure 1

In calculating incremental costs, it may be useful to develop a "least cost envelope" chart as depicted in Figure 1. The steps in this development are listed:

(1) Array the control options in ascending order of annualized total costs,
(2) Develop a graph of the most reasonable smooth curve of the control options, as shown in Figure 1 (i.e., show the "least-cost envelope")
(3) Calculate the incremental cost effectiveness for each dominant option, which is the difference in total annual costs between that option and the next most stringent option, divided by the difference in emissions, after controls have been applied, between those two control options. Using Figure 1, incremental cost effectiveness would be calculated for the difference between options B and D, options D and F, options F and G, and options G and H.

Although it may be helpful, this exercise is not a requirement; TCEQ anticipates the top-down nature of the BART analysis and the information requested in the analysis should be sufficient for BART determination purposes.

A comparison of incremental costs can also be useful in evaluating the viability of a specific control option over a range of efficiencies. For example, depending on the capital and operational cost of a control device, total and incremental cost may vary significantly (either increasing or decreasing) over the operational range of a control device. Also, the greater the number of possible control options that exist, the more weight should be given to the incremental costs vs. average costs. Average and incremental cost effectiveness are identical when only one candidate control option is known to exist.

The cost evaluation results from these techniques should be interpreted judiciously. For example, a choice may develop between two available control devices at a source, control A and control B, where control B achieves slightly greater emission reductions. The average cost (total annual cost/total annual emission reductions) for each may be deemed to be reasonable. However, the incremental cost (total annual cost A – B/total annual emission reductions A – B) of the additional emission reductions to be achieved by control B may be very great. In such an instance, even though its average cost may be considered reasonable, selection of control B may be inappropriate because of its high incremental cost.

Reasonable and supportable assumptions regarding control efficiencies should be made in evaluating the average or incremental cost effectiveness of a control alternative. Unrealistically low assessments of the emission reduction potential of a certain technology could result in inflated cost-effectiveness figures.

Additional Considerations and Information to Provide in the Cost Impacts Analysis

Selective interpretation of results should be avoided. For example, a control option's large capital cost, in and of itself, would not necessarily preclude the option's selection if large emissions reductions are projected. In such a case, low or reasonable cost effectiveness numbers may validate the option as an appropriate BART alternative irrespective of the large capital costs. Similarly, projects with relatively low capital costs may not be cost effective if there are few emissions reduced.

Unusual circumstances pertinent to the source potentially resulting in cost-effectiveness estimates exceeding those for recent retrofits should be documented. This documentation is especially important in cases where recent retrofits have cost-effectiveness values that are within what has been considered a reasonable range, but which are not considered reasonable as indicated by the prepared analysis. (A reasonable range would be a range that is consistent with the range of cost effectiveness values used in other similar permit decisions over a period of time.)

Example: In an arid region, large amounts of water are needed for a scrubbing system. Acquiring water from a distant location could greatly increase the cost per ton of emissions reduced of wet scrubbing as a control option.

Analysis and Reporting of Energy Costs

The energy requirements of the control technology should be examined to determine whether the use of that technology results in energy penalties or benefits. A source owner may, for example, benefit from the combustion of a concentrated gas stream rich in volatile organic compounds; on the other hand, extra fuel or electricity is often required to power a control device or incinerate a dilute gas stream. If such benefits or penalties exist, they should be quantified to the extent practicable. Because energy penalties or benefits can usually be quantified in terms of additional cost or income to the source, the energy impacts analysis can in most cases be factored into the cost impacts analysis. Energy use in and of itself does not disqualify a technology.

The energy impact analysis should consider only direct energy consumption and not indirect energy impacts. For example, the direct energy impacts of the control alternative could be estimated in units of energy consumption at the source (e.g., BTU, kWh, barrels of oil, tons of coal). The energy requirements of the control options should be shown in terms of total (and in certain cases, also incremental) energy costs per ton of pollutant removed. These terms may then be converted into dollar costs and factored into the control cost analysis where appropriate.

Indirect energy impacts are not generally considered (e.g., energy to produce raw materials for construction of control equipment). However, if the indirect energy impact is determined to be unusual or significant and can be well quantified, it may be considered in the analysis.

The energy impact analysis may also address concerns over the use of locally scarce fuels. The designation of a scarce fuel may vary from region to region. In general, however, a scarce fuel is one which is in short supply locally and can be better used for alternative purposes, or one which may not be reasonably available to the source either at the present time or in the near future.

Finally, the energy impacts analysis may consider whether there are relative differences between alternatives regarding the use of locally or regionally available coal, and whether a given alternative would result in significant economic disruption or unemployment. For example, where two options are equally cost effective and achieve equivalent or similar emissions reductions, one option may be preferred if the other alternative results in significant disruption or unemployment.

Energy impacts should be reported on a $ per ton of pollutant removed basis. All assumptions made in calculating energy costs should be documented.

Non-Air Quality Environmental Impacts Analysis

Environmental impacts other than to air quality due to emissions of the pollutant in question should be addressed in this section of the BART analysis. These environmental effects include solid or hazardous waste generation and discharges of polluted water from a control device.

A control alternative's environmental effects with the potential to affect the alternative's selection or elimination should be identified. Some control technologies may have potentially significant secondary environmental effects. Scrubber effluent, for example, may affect water quality and land use. Alternatively, water availability may affect the feasibility and costs of wet scrubbers.

Other examples of secondary environmental impacts could include hazardous waste discharges, such as spent catalysts or contaminated carbon. Generally, these concerns become important when sensitive site-specific receptors exist or when the incremental emissions reductions potential of the more stringent control is only marginally greater than the next most-effective option. However, the fact that a control device creates liquid and solid waste that must be disposed of does not necessarily argue against selection of that technology as BART, particularly if the control device has been applied to similar facilities elsewhere and the solid or liquid waste is similar to those other applications. Conversely, where it can be shown that unusual circumstances at the proposed facility create greater problems than experienced at other facilities, there may be a basis for the elimination of that control alternative as BART.

The procedure for conducting an analysis of non-air quality environmental impacts should be based on a consideration of site-specific circumstances. If the most stringent alternative is proposed, it is not necessary to perform this environmental impacts analysis for the entire list of technologies prioritized in Step 3. In general, the analysis need only address those control alternatives with any significant or unusual environmental effects that have the potential to affect the selection of a control alternative or the elimination of a more stringent control alternative.

In general, the analysis of impacts starts with the identification and quantification of the solid, liquid, and gaseous discharges from the control device or devices under review. Initially, a qualitative or semi-quantitative screening to narrow the analysis to discharges with potential for causing adverse environmental effects should be performed. The mass and composition of any such discharges should then be assessed and quantified to the extent possible, based on readily available information. Pertinent information about the public or environmental consequences of releasing these materials should also be assembled.

Additional Examples of Non-Air Quality Environmental Impacts

The following are several more examples of non-air quality environmental impacts, listed with considerations pertinent to their assessment:

- Water Impact
  Identify the relative quantities of water used and water pollutants produced and discharged as a result of the use of each alternative emission control system. Where possible, the effect on ground water and such local surface water quality parameters as pH, turbidity, dissolved oxygen, salinity, toxic chemical levels, and temperature should be assessed. The analysis could consider whether applicable water quality standards will be met and the availability and effectiveness of various techniques to reduce potential adverse effects.

- Solid Waste Disposal Impact
  The quality and quantity of solid waste (e.g., sludges, solids) that must be stored and disposed of or recycled as a result of the application of each alternative emission control system could be compared. The composition and various other characteristics of the solid waste (such as permeability, water retention, rewatering of dried material, compression strength, leachability of dissolved ions, bulk density, ability to support vegetation growth and hazardous characteristics) should be considered along with any others significant to potential surface or subsurface transport.

- Irreversible or Irretrievable Commitment of Resources
  The extent to which the alternative emission control systems may involve a trade-off between short-term environmental gains at the expense of long-term environmental losses may be considered, along with the extent to which the alternative systems may result in irreversible or irretrievable commitment of resources (for example, use of scarce water resources).

- Other Adverse Environmental Impacts
  Significant differences in noise levels, radiant heat, or dissipated static electrical energy of pollution control alternatives may be considered. Other examples of non-air quality environmental impacts would include hazardous waste discharges such as spent catalysts or contaminated carbon.

Remaining Useful Life Analysis

The requirement to consider the source's “remaining useful life” for BART determinations may be treated as one element of the overall cost analysis. The “remaining useful life” of a source, if it represents a relatively short time period, may affect the annualized costs of retrofit controls. For example, the methods for calculating annualized costs in EPA's OAQPS Control Cost Manual

(Manual) require the use of a specified time period for amortization that varies based upon the type of control. If the remaining useful life will clearly exceed this time period, the remaining useful life has essentially no effect on control costs and on the BART determination process. Where the remaining useful life is less than the time period for amortizing costs, this shorter time period should be used in the cost calculations.

For units being evaluated in the OAQPS Control Cost Manual, the use of any time period that is less than the lifetime specified by the Manual (e.g., the remaining life of the equipment) should be supported with a rationale that includes an assessment of why it is not reasonable to assume the facility will be maintained or reconstructed for continued operation.

For purposes of this information document, the remaining useful life is the difference between:

(1) The date that controls will be put in place (capital and other construction costs incurred before controls are put in place can be rolled into the first year the BART analysis is conducted); and

(2) The date the facility permanently stops operations. Where this affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation.

There may be situations where a source operator intends to shut down a source by a given date, but wishes to retain the flexibility to continue operating beyond that date in case market conditions change. The BART analysis may consider cases such as these, but it must maintain consistency with the statutory requirement to install BART within 5 years. Where the source chooses not to accept a federally enforceable condition requiring the source to shut down by a given date, it is necessary to determine whether a reduced time period for the remaining useful life changes the level of controls that would have been required as BART.

If the reduced time period does change the level of BART controls, the more stringent level of control that would be required as BART if there were no assumption that reduced the remaining useful life may be identified and included as part of the BART emission limitation. This more stringent level may be incorporated into the BART emission limit, which would serve as a contingency should the source continue operating more than 5 years after the date EPA approves the relevant SIP. The source would not be allowed to operate after the 5-year mark without such controls. If a source does operate after the 5-year mark without BART in place, the source is considered to be in violation of the BART emissions limit for each day of operation.

Determine the Visibility Effects

General Considerations

Sources subject to BART must have a visibility improvement demonstration submitted as part of the BART determination. In making this demonstration, applicants have some flexibility in setting absolute thresholds, target levels of improvement, or de minimis levels since the deciview improvement must be weighed among the five factors; the weight and significance to be assigned to each factor is to an extent a matter of the applicant's discretion. For example, a 0.3 deciview improvement may merit a stronger weighting in one case versus another, so one “bright line” may not be appropriate. Sources electing to apply the most stringent controls available need not conduct an air quality modeling analysis for the purpose of determining its visibility impacts.

An appropriate dispersion model (e.g., CALPUFF; model code and its documentation available as a free download at: www.epa.gov/scram001/tt22.htm#calpuff) should be used to determine the visibility improvement expected at a Class I area from the potential BART control technology applied to the source. Modeling should be conducted for SO_2, NO_X, and direct PM emissions ($PM_{2.5}$ and/or PM_{10}). If the source is making the visibility determination, TCEQ will review and approve or disapprove the source's analysis before making the expected improvement determination.

Several steps for determining the visibility impacts from an individual source using a dispersion model are detailed below:

Development of a Modeling Protocol

Critical items to include in an acceptable modeling protocol are meteorological and terrain data, as well as source-specific information (stack height, temperature, exit velocity, elevation, and allowable and actual emission rates of applicable pollutants), and receptor data from appropriate Class I areas. For parameter settings and meteorological data inputs, adherence to EPA's Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts[18] is recommended; the use of other settings from those in IWAQM should be identified and explained in the protocol.

[18] Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts, U.S. Environmental Protection Agency, EPA–454/R–98–019, December 1998.

An important element of the protocol is the determination of the receptors that will be used in the model. The receptors should be located in the nearest Class I area with sufficient density to identify the likely visibility effects of the source.

Some receptors within the relevant Class I area may be less than 50 km from the source while other receptors within that same Class I area may be greater than 50 km from the same source. As indicated by the Guideline on Air Quality Models, this situation may call for the use of two different modeling approaches for the same Class I area and source (consult TCEQ air dispersion modeling staff for further instruction). In situations where visibility impacts are being assessed for source-receptor distances less than 50 km, consideration should be given to both CALPUFF and other EPA-approved methods.

The applicant is advised to consult with EPA and the regional planning organization (RPO) during the protocol development process. Up-front consultation will help ensure that key technical issues are resolved before modeling is conducted.

Modeling the Pre- and Post-Control Emission Rates

Air dispersion modeling should be conducted according to the accepted methodology in the protocol (See TCEQ Guidance Document - *Modeling Protocol to Determine Sources Subject to BART in the State of Texas*). Use the 24-hour average actual emission rate from the highest emitting day of the meteorological period modeled (for the pre-control scenario). Calculate the model results for each receptor as the change in deciviews compared against natural visibility conditions. Post-control emission rates are calculated as a percentage age of pre-control emission rates. For example, if the 24-hr. pre-control emission rate is 100 lb/hr of SO_2, then the post control rate is 5 lb/hr if the control efficiency being evaluated is 95%.

The pre-control and post-control inputs used for the modeling runs should be provided on Tables 3, 4, 6, and 7 of TCEQ Form BART EA-1 (see tables and format suggested in Section III, *Guidelines for Engineering Analysis;* Baseline Conditions and Visibility Impacts for BART-Eligible Units; BART Analysis for Eligible Emission Units).

Determination of Net Visibility Improvement

The visibility improvement should be assessed on the basis of the modeled change in visibility impacts for the pre-control and post-control emission scenarios. Visibility improvements due to BART controls may be assessed by one or more methods; the frequency, magnitude, and duration of the components of impairment are eligible for consideration.

Use of a Comparison Threshold

Comparison thresholds can be used in various ways to evaluate visibility improvement (e.g., the number of days or hours that the threshold was exceeded, a single threshold for determining whether a change in impacts is significant, or a threshold representing a percent-change in improvement).

The TCEQ will not be providing comparison threshold for evaluating visibility improvement. The TCEQ does not believe that the degree of visibility improvement should be contingent upon perceptibility. This approach is consistent with EPA's Guidelines and EPA's subsequent clarification of the Guidelines.

Comparison of the 98 Percentile Days, Pre- and Post-Control

The results of the 98 percentile days for the pre-and post-control runs for each model year and combination of model years should be provided on Tables 5 and 8 of TCEQ Form BART EA-1 (see tables and format suggested in Section III, *Guidelines for Engineering Analysis;* Baseline Conditions and Visibility Impacts for BART-Eligible Units; BART Analysis for Eligible Emission Units).

Additionally, the TCEQ requests that the number of days above 0.5 deciviews be reported for each of the three model years as well as the combination of all three model years. The use of 0.5 is not intended as a threshold, but merely another metric by which to understand visibility modeling results. Each of the modeling options may also be supplemented with source apportionment data or source apportionment modeling.

V. Selection of the Best Alternative

Summarize the Impacts Analysis

Characterize the Technically Feasible Alternatives

1. Expected emission rate (tons per year, pounds per hour)
2. Emissions performance level (e.g., % pollutant removed, emissions per unit product, lb/MMBtu, ppm)
3. Expected emissions reductions (tons per year)
4. Costs of compliance; i.e., total annualized costs ($), cost effectiveness ($/ton), incremental cost effectiveness ($/ton), and/or any other cost-effectiveness measures (such as $/deciview)
5. Energy impacts
6. Non-air quality environmental impacts
7. Modeled visibility impacts

Select a "Best" Alternative

1. Display the options evaluated
2. Identify the average and incremental costs of each option
3. Consider the energy and non-air quality environmental impacts of each option
4. Consider the remaining useful life
5. Consider the modeled visibility impacts
6. Provide a justification for adopting the technology selected as the "best" level of control including an explanation of the FCAA factors that led to the option selected over the others

The traditional "top-down" approach to evaluation of control strategies is recommended. If the most stringent alternative in the ranking does not impose unreasonable costs of compliance, considering both average and incremental costs, the analysis begins with the presumption that this level is selected. Considerations then proceed to whether energy and non-air quality environmental impacts would justify selection of an alternative control option.

If there are no outstanding issues regarding energy and non-air quality environmental impacts, the analysis is ended and the most stringent alternative is identified as the "best system of continuous reduction." If the most stringent alternative is unacceptable due to such effects, this approach would require documentation of the rationale for this finding. The next most effective alternative in the listing then becomes the new control candidate and is similarly evaluated.

This process continues until a technology that does not pose unacceptable costs of compliance, energy and/or non-air quality environmental impacts is identified. In making the BART determination itself, all factors will be considered, including the degree of visibility improvement.

In the case where a BART determination is being conducted for two regulated pollutants on the same source, if the result is two different BART technologies that do not work well together, a different technology or combination of technologies may be substituted for the original options.

In selecting a "best" alternative, affordability of controls may be eligible for consideration. Even if the control technology is cost effective, there may be cases where the installation of controls would affect the viability of continued plant operations. Also, there may be unusual circumstances that justify taking into consideration the conditions of the plant and the economic effects of requiring the use of a given control technology. These effects would include effects on product prices, market share, and profitability of the source.

Where unusual circumstances such as these will affect plant operations, the conditions of the plant and the economic effects of requiring the use of a control technology may be considered. Where these effects are judged to have a severe impact on plant operations, it may be appropriate to consider these effects in the selection process. An economic analysis that demonstrates the specific economic effects, parameters, and reasoning should be provided in support of these considerations. The demonstration should be in sufficient detail for public review and understanding, although the preservation of the confidentiality of sensitive business information is a reasonable consideration in the development of these submittals. Any analysis may also consider whether other competing plants in the same industry have been required to install BART.

VI. Upgrade Options and Control Limits for Various Source Types

Wet Scrubber Systems

The following upgrade options should be considered for this control type:

A. Elimination of Bypass Reheat
B. Installation of Liquid Distribution Rings
C. Installation of Perforated Trays
D. Use of Organic Acid Additives
E. Improvement or Upgrade of Scrubber Auxiliary System Equipment
F. Redesign of Spray Header or Nozzle Configuration

Dry Scrubber Systems

The following upgrade options should be considered for this control option:

A. Use of Performance Additives
B. Use of more Reactive Sorbet
C. Increase of Sorbet Pulverization
D. Engineering Redesign of Atomizer or Slurry Injection System

Sulfur Dioxide Limits for Utility Boilers

Utility boilers at electric generating units (EGU) rated at 750 MW or greater are required to meet specific control levels for SO_2. Either 95 percent control or 0.15 lbs/MMBtu fired applies to each EGU greater than 200 MW that is currently uncontrolled unless an alternative control level is justified based on a careful consideration of statutory factors. If, for example, the source demonstrates circumstances affecting its ability to cost-effectively reduce its emissions, this consideration applies to the determination of whether the presumptive levels of control are appropriate for that facility. For a currently uncontrolled EGU greater than 200 MW but located at a power plant smaller than 750 MW, such controls are generally cost-effective and could be used in the BART determination considering the five factors specified in FCAA section 169A(g)(2). While these levels may represent current control capabilities, the expectation is that scrubber technology will continue to improve as control costs continue to decline. The best achievable levels of control currently available should be considered when the BART analysis is being conducted.

For coal-fired EGUs with existing post-combustion SO_2 controls achieving less than 50% removal efficiencies, evaluation of a new flue gas de-sulfurization system to meet 95% removal or 0.15 lb/mmBtu is recommended, along with the evaluation of the scrubber upgrades discussed below. For oil-fired units, regardless of size, the option of limiting the sulfur content of the fuel oil burned to 1% or less (wt. basis) should also be evaluated.

For BART-eligible EGUs with pre-existing post-combustion SO_2 controls achieving removal efficiencies of at least 50%, the BART determination should consider cost effective scrubber upgrades designed to improve the system's overall SO_2 removal efficiency. There are numerous scrubber enhancements available to upgrade the average removal efficiencies of all types of existing scrubber systems.

Evaluation of scrubber upgrade options should be based on the five-step BART analysis process. In the process of defining an “upgrade,” options that not only improve the removal efficiency of the scrubber vessel itself, but also improve the overall SO_2 removal efficiency of the scrubber system should be considered. Increasing a scrubber system's reliability, and conversely decreasing its downtime, by way of optimizing operation procedures, improving maintenance practices, adjusting scrubber chemistry, and increasing auxiliary equipment redundancy, are all ways to improve average SO_2 removal efficiencies.

Nitrogen Oxide Limits for Utility Boilers

Specific limits for NO_X control for each BART determination should be established. For power plants with a generating capacity greater than 750 MW currently using selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) for part of the year, use of those same controls year-round should be presumed to satisfy BART control requirements. For other sources currently using SCR or SNCR to reduce NO_X emissions during part of the year, the requirement to use these controls year-round should be favored on the basis of the consideration that the additional costs of operating the equipment throughout the year would be relatively modest.

Presumptive NO_X limits are provided in Table 1 below, differentiated by boiler design and type of coal burned. Alternative control levels may be appropriate based on a careful consideration of the statutory factors. These limits apply to coal-fired EGUs of greater than 200 MW capacity operating without post-combustion controls (i.e., SCR or SNCR), regardless of the capacity of the power plants at which they are located (i.e., power plant more or less than 750 MW capacity is immaterial in the presumed applicability and cost-effectiveness of these limits).

The following NO_X emission rates were determined based on various assumptions, including that the EGU boiler has enough volume to allow for installation and effective operation of separated overfire air ports. For boilers where these assumptions are incorrect, these emission limits may not be cost-effective.

Table 1
Presumptive NO_X Emission Limits (PNEL) for BART-Eligible Coal-Fired Units[19]

Unit type	Coal type	PNEL (lb/MMBtu)[20]
Dry-bottom wall fired	Bituminous	0.39
	Sub-bituminous	0.23
	Lignite	0.29
Tangential-fired	Bituminous	0.28
	Sub-bituminous	0.15
	Lignite	0.17
Cell burners	Bituminous	0.40
	Sub-bituminous	0.45
Dry-turbo-fired	Bituminous	0.23
Wet-bottom tangential-fired	Bituminous	0.62

19 No Cell burners, dry-turbo-fired units, nor wet-bottom tangential-fired units burning lignite were identified as BART-eligible, thus no presumptive limit was determined. Similarly, no wet-bottom tangential fired units burning sub-bituminous were identified as BART-eligible.

20 These limits reflect the design and technological assumptions discussed in the technical support document for NO_X limits for these guidelines. See Technical Support Document for BART NO_X Limits for Electric Generating Units and Technical Support Document for BART NO_X Limits for Electric Generating Units Excel Spreadsheet, Memorandum to Docket OAR 2002-0076, April 15, 2005.

Most EGUs can meet these PNEL through the use of current combustion control technology, i.e., the careful control of combustion air and low-NO_X burners. For units that cannot meet these limits using such technologies, the consideration of whether advanced combustion control technologies such as rotating opposed fire air should be used to meet these limits.

Because of the relatively high NO_X emission rates of cyclone units, SCR is more cost-effective than current combustion control technology for these units. The use of SCRs at cyclone units burning bituminous, sub-bituminous, and lignite coals should enable the units to cost-effectively meet NO_X rates of 0.10 lbs/MMBtu. As a result, a presumptive NO_X limit for coal-fired cyclone units greater than 200 MW located at 750 MW power plants is 0.10 lbs/MMBtu based on the use of SCR. As with the other presumptive limits established in this guideline, alternative level of control may be appropriate based on considerations of the relevant statutory factors. For other cyclone units, the use of SCR should be reviewed for whether these post-combustion controls should be required as BART.

For oil-fired and gas-fired EGUs larger than 200MW, installation of current combustion control technology to control NO_X is generally highly cost-effective and should be considered in BART determinations for these sources. Many such units can make significant reductions in NO_X emissions that are highly cost-effective through the application of current combustion control technology (see Technical Support Document for BART NO_X Limits for Electric Generating Units and Technical Support Document for BART NO_X Limits for Electric Generating Units Excel Spreadsheet, Memorandum to Docket OAR 2002–0076, April 15, 2005).

Note: TCEQ considers compliance with the Clean Air Interstate Rule (CAIR) program an adequate substitute for BART analysis and control of NO_X and SO_2 emissions from EGU. Accordingly, submittals of BART analyses for CAIR EGU emissions of these pollutants are not currently necessary.

VII. Enforceable Limits and Compliance Dates

Completion of the BART process requires the establishment of enforceable emission limits that reflect the BART requirements and demonstrate compliance within a given period. Specifically, an enforceable emission limit should be established for each subject emission unit at the source and for each pollutant subject to review that is emitted from the source. Additionally, compliance with the BART emission limitations is required by no later than five years after EPA approves the applicable regional haze SIP.

If technological or economic limitations in the application of measurement methods to a particular emission unit make a conventional emissions limit infeasible, a design, equipment, work practice, or operation standard, or combination of these types of standards, may be prescribed instead. States should consider allowing sources to “average” emissions across any set of BART-eligible emission units within a fenceline, provided that the emission reductions from each pollutant being controlled for BART would be equal to those reductions that would be obtained by simply controlling each of the BART-eligible units that constitute a BART-eligible source.

BART requirements should specify the individual emission unit(s) subject to BART regulation. Because the BART requirements themselves are “applicable” requirements of the FCAA, they must be included as conditions of Title V permits according to the procedures established in 40 CFR part 70 and 40 CFR part 71.

Section 302(k) of the FCAA requires that emissions limits such as BART are met on a continuous basis. Although this provision does not necessarily require the use of continuous emissions monitoring (CEMs), sources must employ techniques that ensure compliance on a continuous basis. Monitoring requirements generally applicable to sources, including those that are subject to BART, are governed by other regulations [e.g., Compliance Assurance Monitoring - 40 CFR part 64; Periodic Monitoring - 40 CFR 70.6(a)(3); Sufficiency Monitoring - 40 CFR 70.6(c)(1)].

Although CEMs would not necessarily be required for all BART sources, the vast majority of electric generating units potentially subject to BART already employ CEM technology for other programs (e.g., acid rain). Additionally, emissions limits must be enforceable; the use of appropriate averaging times, compliance verification procedures and recordkeeping requirements are significant elements of practical enforceability.

To facilitate compliance demonstrations, applicable permits must specify and monitor:

- Times of operation, fuel input, or other indices of operating conditions and practices
- Reasonable averaging times consistent with established reference methods
- Methods for determining compliance
- Adequate reporting and recordkeeping methods

Permits authorizing EGU should specify a rolling 30-day averaging time and contain a definition of “boiler operating day” consistent with the definition in the proposed revisions to the NSPS for utility boilers in 40 CFR Part 60, subpart Da. The definition of a boiler operating day as any 24-hour period between 12:00 midnight and the following midnight during which any fuel is combusted at the steam generating unit should be favored to allow 30-day rolling average emission rates to be calculated consistently across sources.