

Washington State Regional Haze State Implementation Plan

Appendix J

**Annotated Version of Environmental Protection Agency Best
Available Retrofit Technology Guidance**

Regional Haze BART Guidance

BEST AVAILABLE RETROFIT TECHNOLOGY Determinations Under the Federal Regional Haze Rule



Annotated with the views of the Department of Ecology on specific aspects of the BART process.

Issued June 12, 2007
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Regional Haze BART Guidance

Guidelines for Best Available Retrofit Technology (BART) Determinations under the
Regional Haze Rule

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The following guidance is based on 40 CFR Part 51, Appendix Y, Sections IV and V. The EPA guidance is presented in sections II and III of this document essentially as EPA published it. We have slightly revised the text to clarify which actions are the responsibility of the BART source owner, Ecology and the permitting authority, We have also made it clearer which views and opinions are those of EPA where we feel it is necessary to prevent those views and opinions being misinterpreted as those of Ecology.

Highlighted text identifies Ecology's preferred approach or viewpoint on specific aspects of the BART technology analysis and selection process described by EPA.

I. Introduction and Overview

A. What is the purpose of the guidelines?

The purpose of this guidance is to assist sources and their consultants in developing BART technology analyses. The Guidance contained in sections II and III of this document are the Environmental Protection Agency's (EPA's) approach for determining BART technology and emission limitations for large fossil fueled power plants. The BART determination process described is recommended by EPA for states to use in making BART determinations for other BART eligible facilities. The federal guideline is annotated with the views and positions of Ecology where such information will clarify a requirement or express a preferred approach to an analysis.

Ecology is requiring the use of the control technology determination process in this guideline for all BART eligible sources in Washington, subject to the minor modifications that are noted in this document.

B. Who is the target audience for these guidelines?

This guidance is primarily for the benefit of the sources that are subject to BART and the consultants assisting those sources. Secondly, they provide information on the content and considerations involved in the development of the BART technical analyses to be submitted to Ecology.

C. What is included in the guidelines?

1. Sections II and III of this document contain EPA's guidance on how to perform a BART determination and how a state is to require implementation of BART determinations.

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2. The BART determination process is described in Section II. The section includes a discussion of various actions and evaluations necessary to complete the BART determination process. Ecology will be the final reviewer of the BART analyses submitted by the sources with emission units that are subject to BART. Ecology will make final BART determinations based on the BART analyses developed and submitted by the sources.

3. Section III of these guidelines covers compliance with the BART determination made by Ecology. EPA requires the states to establish federally enforceable emission limits based on the BART determination. The permit or order establishing the emission limitation must include a deadline for compliance, consistent with the BART determination process for each source subject to BART.

D. What is the format of this guidance?

EPA's guidance (40 CFR Part 51, Appendix Y), uses a question and answer format to make the guidelines simpler to understand. EPA recognized that States have the authority to require source owners to assume part of the analytical burden, and that there will be differences in how the supporting information is collected and documented.

Throughout this guideline, are questions starting like "How do I * * *?" and answer with phrases "you should * * *" or "you must * * *" In Washington, the "I" and "you" means the source conducting the analysis.

Note: In the EPA version of this guidance "you" refers to the state, not the source and we always refers to EPA. Ecology has clarified the text to be clear when the source, Ecology or EPA is being referenced.

E. Do the EPA regulations require the use of these guidelines?

Section 169A(b) of the fCAA requires EPA to issue guidelines for States to follow in establishing BART emission limitations for fossil-fuel fired power plants having a capacity in excess of 750 megawatts. Section IV and V of 40 CFR Part 51, Appendix Y fulfills that requirement. The guidelines establish an approach to implementing the requirements of the BART provisions of the regional haze rule. EPA believes that these procedures and the discussion of the requirements of the regional haze rule and the CAA should be useful to the States in evaluating BART for other categories of sources.

Ecology has chosen to adopt the EPA BART guidance for use by all sources that are subject to BART.

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II. The BART Determination: Analysis of BART Options

This section describes the process for the analysis of control options for sources subject to BART.

A. What factors must I address in the BART review?

The visibility regulations define BART as follows:

Best Available Retrofit Technology (BART) means an emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant which is emitted by . . . [a BART-eligible source]. The emission limitation must be established, on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

The BART analysis identifies the best system of continuous emission reduction taking into account:

- (1) The available retrofit control options,
- (2) Any pollution control equipment in use at the source (which affects the availability of options and their impacts),
- (3) The costs of compliance with control options,
- (4) The remaining useful life of the facility,
- (5) The energy and non-air quality environmental impacts of control options
- (6) The visibility impacts analysis.

B. What is the scope of the BART review?

Once you have determined that the BART eligible emission units at your source are subject to BART for a particular pollutant, then for each BART eligible emission unit, you must establish BART for that pollutant. The BART determination must address air pollution control measures for each emissions unit or pollutant emitting activity subject to review.

Example: Plantwide emissions from emission units within the listed categories that began operation within the "time window" for BART¹ are 300 tons/yr of NOX, 200 tons/yr of SO₂, and 150 tons/yr of primary particulate. Emissions unit A emits 200 tons/yr of NOX, 100 tons/yr of SO₂, and 100 tons/yr of primary particulate. Other emission units, units B through H, which began operating in 1966, contribute lesser amounts of each pollutant. For this example, a BART

¹ That is, emission units that were in existence on August 7, 1977 and which began actual operation on or after August 7, 1962.

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review is required for NOX, SO₂, and primary particulate, and control options must be analyzed for units B through H as well as unit A.

C. How does a BART review relate to Maximum Achievable Control Technology (MACT) Standards under CAA section 112, or to other emission limitations required under the CAA?

For VOC and PM sources subject to MACT standards, you may 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. Many VOC and PM sources are well controlled because they are regulated by MACT standards. For a few MACT standards, this may also be true for SO₂ emissions. Any source subject to MACT standards must meet a level that is as stringent as the best-controlled 12 percent of sources in the industry. Examples of these hazardous air pollutant sources which effectively control VOC and PM emissions include (among others) secondary lead facilities, organic chemical plants subject to the hazardous organic NESHAP (HON), pharmaceutical production facilities, and equipment leaks and wastewater operations at petroleum refineries. EPA anticipates that, in many cases, it will be unlikely that emission controls more stringent than the MACT standards are available that will be cost effective to implement on a particular emission unit. Unless there are new technologies subsequent to the MACT standards which would lead to cost-effective increases in the level of control, you may rely on the MACT standards for purposes of BART.

Compliance with MACT standards issued in the last 10 years are likely to represent the best available technology to control hazardous air pollutants. Many MACT rules use criteria (BART) air pollutants as surrogates for groups of hazardous air pollutants for compliance purposes. However, Ecology wants BART sources to evaluate whether there are available, technically feasible emission controls that are better at controlling the BART pollutants than the MACT level of control. If there are available, technically feasible controls that result in lower emissions than MACT, these controls must be evaluated for cost effectiveness per Steps 3 and 4.

EPA believes that the same rationale also holds true for emissions standards developed for municipal waste incinerators under CAA section 111(d), and for many NSR/PSD determinations and NSR/PSD settlement agreements. However, EPA does not believe that technology determinations from the 1970s or early 1980s, including new source performance standards (NSPS), should be considered to represent best control for existing sources, as best control levels for recent plant retrofits are more stringent than these older levels.

Where you are relying on these standards to represent a BART level of control, you should provide Ecology and the public with a discussion of whether any new

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technologies have become available subsequent to the time the controls were installed to meet these standards.

Emission controls installed as a result of a recent state NSR or PSD determination or recent implementation of a consent decree or in response a compliance order are likely to be the BART level of control for that pollutant from that unit. However, you should provide a review of technically feasible controls as part of the BART analysis to support this assumption. If the analysis shows that your BART emission unit(s) are utilizing the best controls (top case) the remaining BART steps need not be completed for that unit.

Ecology will not consider compliance with a NSPS standard as a BART level of control.

D. What Are the Five Basic Steps of a Case-by-Case BART Analysis?

The five steps are:

- STEP 1--Identify All² Available Retrofit Control Technologies,
- STEP 2-- Eliminate Technically Infeasible Options,
- STEP 3-- Evaluate Control Effectiveness of Remaining Control Technologies,
- STEP 4-- Evaluate Impacts and Document the Results, and
- STEP 5--Evaluate Visibility Impacts.

STEP 1: How do I identify all available retrofit emission control techniques?

1. 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 BACT or LAER are available for BART purposes and must be included as control alternatives. The control alternatives can include not only existing controls for the source category in question but also take into account technology transfer of controls that have been applied to similar source categories and gas streams. Technologies which have not yet been applied to (or permitted for) full scale operations need not be considered as available; we do not expect the source owner to purchase or construct a process or control device that has not already been demonstrated in practice.

2. Where a NSPS exists for a source category (which is the case for most of the categories affected by BART), you should include a level of control equivalent to the

² In identifying "all" options, you must identify the most stringent option and a reasonable set of options for analysis that reflects a comprehensive list of available technologies. It is not necessary to list all permutations of available control levels that exist for a given technology--the list is complete if it includes the maximum level of control each technology is capable of achieving.

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NSPS as one of the control options.³ The NSPS standards are codified in 40 CFR Part 60. We note that there are situations where NSPS standards do not require the most stringent level of available control for all sources within a category. For example, post-combustion NOX controls (the most stringent controls for stationary gas turbines) 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.

In no case should your proposed BART level of control be less stringent than the level of control for the visibility pollutants required by a NSPS or MACT standard that covers the particular emission unit and pollutant. BART eligible emission units that are replaced rather than being upgraded or having controls added are required to install a BACT level of control.

3. Potentially applicable retrofit control alternatives can be categorized in three ways.
 - Pollution prevention: use of inherently lower-emitting processes/practices, including the use of control techniques (e.g. low-NOX burners) and work practices that prevent emissions and result in lower "production-specific" emissions (note that it is not EPA's intent to direct States to require sources to switch fuel forms, e.g. from coal to gas),
 - Use of (and where already in place, 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
 - Combinations of inherently lower-emitting processes and add-on controls.

4. In the course of the BART review, one or more of the available control options may be eliminated from consideration because they are demonstrated to be technically infeasible or to have unacceptable energy, cost, or non-air quality environmental impacts on a case-by-case (or site-specific) basis. However, at the outset, you should initially identify all control options with potential application to the emissions unit under review.

5. We do not consider BART as a requirement to redesign the source when considering available control alternatives. For example, where the source subject to BART is a coal-fired electric generator, we do not require the BART analysis to consider building a natural gas-fired electric turbine although the turbine may be inherently less polluting on a per unit basis.

³ In EPA's 1980 BART guidelines for reasonably attributable visibility impairment, EPA concluded that NSPS standards generally, at that time, represented the best level sources could install as BART. In the 20 year period since this guidance was developed, there have been advances in SO2 control technologies as well as technologies for the control of other pollutants, confirmed by a number of recent retrofits at Western power plants. Accordingly, EPA no longer concludes that the NSPS level of controls automatically represents "the best these sources can install." Analysis of the BART factors could result in the selection of a NSPS level of control, but you should reach this conclusion only after considering the full range of control options.

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Ecology recognizes that a source may be able to use the BART analysis as justification to replace an old inefficient unit with a new, more efficient unit that is inherently less polluting or capable of being installed with current emission controls. We encourage you to consider such an opportunity for old emission units.

If you choose to replace a BART emission unit with a new unit, the new unit will need to employ a BACT level of control and as noted in Section III, a schedule for removal of the old unit and installation of the replacement will be needed.

6. 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 percent. Part of the reason for the relatively low control efficiency is that 22 percent 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 percentage of the gas stream that bypasses the scrubber. Four control options are identified: (1) 78 percent control based upon improved scrubber performance while maintaining the 22 percent bypass, (2) 83 percent control based upon improved scrubber performance while reducing the bypass to 15 percent, (3) 93 percent 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 percent as in option 3, with the addition of an indirect reheat system to reheat the stack gas above the saturation temperature. You must consider each of these four options in a BART analysis for this source.

7. You are expected to identify potentially applicable retrofit control technologies that represent the full range of demonstrated alternatives. Examples of general information sources to consider 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, and Texas Natural Resources Conservation Commission;
- Control technology vendors;
- Federal/State/Local NSR permits and associated inspection/performance test reports;
- Environmental consultants;

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- Technical journals, reports and newsletters, air pollution control seminars; and
- The EPA's NSR bulletin board--<http://www.epa.gov/ttn/nsr>;
- Department of Energy's Clean Coal Program--technical reports;
- The NOX Control Technology ``Cost Tool"-- Clean Air Markets Division Web page--
<http://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
<http://www.epa.gov/airmarkets/arp/nox/controltech.html>);
 - Cost estimates for selected applications of NOX control technologies on
stationary combustion boilers. OAR/ARD June 1997. (Docket for NOX SIP Call, A-
96-56, item II-A-03);
- Investigation of performance and cost of NOX controls as applied to group 2
boilers. OAR/ARD, August 1996. (Docket for Phase II NOX rule, A-95-28, item
IV-A-4);
- Controlling SO2 Emissions: A Review of Technologies. EPA-600/R-00-093,
USEPA/ORD/NRMRL, October 2000; and
- The OAQPS Control Cost Manual.

In the above list, EPA has cited specific documents which do not reflect the current state of the art for emission controls for BART sources. Newer emission control information is available through EPA, the National Association of Clean Air Agencies, the Northeast States for Coordinated Air Use Management (NESCAUM), Western Regional Air Partnership (WRAP), Lake Michigan Air Directors Consortium (LADCO), National Council on Air and Stream Improvement (NCASI), Institute of Clean Air Companies, and other organizations have reports and other information which reflects current knowledge about the availability and use of emission controls for various source types and industries. Your review of controls system availability should reference these newer information sources. Ecology engineers reviewing the BART analyses will make use of these newer information sources in their reviews.

You are expected to compile appropriate information from these information sources.

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

While you are required to evaluate and install BART controls on only those units that are BART eligible, there may be plant specific situations where expanding the number of individual emission units or emission points beyond the BART eligible units makes more process or economic sense. While we cannot require such an expanded evaluation, we encourage you to evaluate implementation of such control opportunities when they present themselves.

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While reductions in emissions from non-BART emission units are not part of BART, these additional reductions are evidence of your facility going beyond the BART minimum and will be reflected in the Regional Haze Implementation Plan as part of our 'reasonable further progress' to reduce haze from non-BART emission units.

9. If you find that a BART eligible emission unit has controls already in place which are the most stringent controls available (note that this means that all possible improvements to any control devices have been made), then it is not necessary to comprehensively complete each following step of the BART analysis in this section. As long as these most stringent controls available are or can be made federally enforceable for the purpose of implementing BART for that source, you may skip the remaining analyses in this section, including the visibility analysis in step 5. Likewise, if a source commits to a BART determination that consists of the most stringent controls available, then there is no need to complete the remaining analyses in this section.

Ecology will consider whether a recent BACT determination, compliance order, or Consent Order based limitation on a particular emission unit satisfies the BART requirements for that unit. You will need to document your rationale that the required controls are BART for that unit.

We encourage you to work with the appropriate Ecology staff during development of your BART analysis if you believe a BACT determination, compliance order, or Consent Order limit represents BART.

STEP 2: How do I determine whether the options identified in Step 1 are technically feasible?

In Step 2, you evaluate the technical feasibility of the control options you identified in Step 1. You should document a demonstration of technical infeasibility and should explain, based on physical, chemical, or engineering principles, why technical difficulties would preclude the successful use of the control option on the emissions unit under review. You may then eliminate such technically infeasible control options from further consideration in the BART analysis.

In general, what do we mean by technical feasibility?

Control technologies are technically feasible if either (1) they have been installed and operated successfully for the type of source under review under similar conditions, or (2) the technology could be applied to the source under review. Two key concepts are important in determining whether a technology could be applied: "availability" and "applicability." As explained in more detail below, a technology is considered "available" if the source owner may obtain it through commercial channels, or it is otherwise available within the common sense meaning of the term. 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 is technically feasible.

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What do we mean by "available" technology?

1. 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.

2. 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, you would not consider technologies in the pilot scale testing stages of development as "available" for purposes of BART review.

3. 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.

Because a new technology may become available at various points in time during the BART analysis process, we believe that guidelines are needed on when a technology must be considered. For example, a technology may become available during the public comment period on the State's rule development process. Likewise, it is possible that new technologies may become available after the close of the public comment period on the State's BART determination, and before submittal of the SIP to EPA, or during EPA's review process on the SIP submittal. In order to provide certainty in the process, all technologies should be considered if available before the close of the BART determination's public comment period. You need not consider technologies that become available after this date. As part of Ecology's analysis, we must consider any technologies brought to our attention in public comments. If Ecology disagrees with public comments asserting that the technology is available, we will provide an explanation for the public record as to the basis for our conclusion.

The source owner need only consider technologies that are available as of the date you submit your BART analysis. You need not consider technologies that become available after your BART analysis is submitted to Ecology. However, Ecology must consider all information received during public comment that may affect its determination of BART for a particular source's emission unit(s).

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What do we mean by “applicable” technology?

You need to exercise technical judgment in determining whether a control alternative is applicable to the source type under consideration. 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, you evaluate technical feasibility 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 for concluding the technology is technically feasible barring a demonstration to the contrary as described below.

What type of demonstration is required if I conclude that an option is not technically feasible?

1. Where you conclude that a control option identified in Step 1 is technically infeasible, you should demonstrate 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 involve a showing that there are unresolvable technical difficulties with applying 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 merely a matter of increased cost, you should consider the technology to be technically feasible. The cost of a control alternative is considered later in the process.

2. The determination of technical feasibility is sometimes influenced by recent air quality permits. In some cases, an air quality permit may require a certain level of control, but the level of control in a permit 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). Where this is the case, you should provide supporting documentation showing why such limits are not technically feasible, and, therefore, why the level of control (but not necessarily the technology) may be eliminated from further consideration. However, if there is a permit requiring the application of a certain technology or emission limit to be achieved for such technology, this usually is sufficient justification for you to assume the technical feasibility of that technology or emission limit.

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3. 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. However, you may consider the cost of such modifications in estimating costs. This, in turn, may form the basis for eliminating a control technology (see later discussion).

4. 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, we do not consider a vendor guarantee alone 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, you should make decisions about technical feasibility based on chemical, and engineering analyses (as discussed above), in conjunction with information about vendor guarantees.

5. A possible outcome of the BART procedures discussed in these guidelines is the evaluation of multiple control technology alternatives which result in essentially equivalent emissions. It is not our intent to encourage evaluation of unnecessarily large numbers of control alternatives for every emissions unit. Consequently, you should use judgment in deciding on those alternatives for which you will conduct the detailed impacts analysis (Step 4 below). 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, you may evaluate only the less costly of these options. You should narrow the scope of the BART analysis in this way only if there is a negligible difference in emissions and energy and non-air quality environmental impacts between control alternatives.

If you consider limiting the number of control options evaluated in Step 3 based on these considerations in the preceding paragraph, discuss your approach and rationale with Ecology prior to proceeding with Step 3.

There may be situations where a greater total pollutant reduction in all pollutants may be achieved by one technology choice while greater visibility improvement may be achieved at a lower emission reduction for some pollutants with another technology. Since this program is to reduce visibility impairment in our Class I areas, it would be reasonable to propose the emission control technology resulting in the greatest visibility improvement as BART.

STEP 3: How do I evaluate technically feasible alternatives?

Step 3 involves evaluating the control effectiveness of all the technically feasible control alternatives identified in Step 2 for the pollutant and emissions unit under review.

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Two key issues in this process include:

- (1) Making sure that you express the degree of control using a metric that ensures an "apples to apples" comparison of emissions performance levels among options, and
- (2) Giving appropriate treatment and consideration of control techniques that can operate over a wide range of emission performance levels.

What are the appropriate metrics for comparison?

This issue is especially important when you compare 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.

Examples of common metrics:

- Pounds of SO₂ emissions per thousand pounds of Black Liquor Solids
- Pounds of SO₂ emissions per million Btu heat input, and
- Pounds of NO_x emissions per ton of cement produced.

In all cases, emission rates are also to be reported as pounds or kilograms/hour to provide the information necessary for dispersion modeling.

How do I evaluate control techniques with a wide range of emission performance levels?

1. 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. It is not our intent to require analysis of each possible level of efficiency for a control technique as such an analysis would result in a large number of options. It is important, however, that in analyzing the technology you take into account the most stringent emission control level that the technology is capable of achieving. You should consider recent regulatory decisions and performance data (e.g., manufacturer's data, engineering estimates and the experience of other sources) when identifying an emissions performance level or levels to evaluate.

2. In assessing the capability of the control alternative, latitude exists to consider special circumstances pertinent to the specific source under review, or regarding the prior application of the control alternative. However, you should explain the basis for choosing the alternate level (or range) of control in the BART analysis. Without a showing of differences between the source and other sources that have achieved more

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stringent emissions limits, you should conclude that the level being achieved by those other sources is representative of the achievable level for the source being analyzed.

3. You may encounter cases where you may wish to evaluate other levels of control in addition to the most stringent level for a given device. While you must consider the most stringent level as one of the control options, you may consider less stringent levels of control as additional options. This would be useful, particularly in cases where the selection of additional options would have widely varying costs and other impacts.

4. Finally, we note that for retrofitting existing sources in addressing BART, you should consider ways to improve the performance of existing control devices, particularly when a control device is not achieving the level of control that other similar sources are achieving in practice with the same device. For example, you should consider requiring those sources with electrostatic precipitators (ESPs) performing below currently achievable levels to improve their performance.

STEP 4: For a BART review, what impacts are expected to calculate and report? What methods does EPA recommend for the impacts analysis?

After you identify the available and technically feasible control technology options, you are expected to conduct the following analyses when you make a BART determination:

- Impact analysis part 1: Costs of compliance,
- Impact analysis part 2: Energy impacts, and
- Impact analysis part 3: Non-air quality environmental impacts.
- Impact analysis part 4: Remaining useful life.

In this section, we describe how to conduct each of these analyses. You are responsible for presenting an evaluation of each impact along with appropriate supporting information. You should discuss and, where possible, quantify both beneficial and adverse impacts. In general, the analysis should focus on the direct impact of the control alternative.

In your BART analysis, identify any collateral emission increases in other regulated air pollutants resulting from use of a particular control technology. This analysis includes increases in the emissions of Toxic Air Pollutants regulated under Chapter 173-460 WAC. When analyzing alternative control technologies and levels at this point in the overall analysis, the collateral impacts need only be qualitatively analyzed.

If the emissions controls that you propose as BART results in collateral air pollutant increases, you must quantify the resulting emission change and identify the regulatory requirements that are triggered. The level of accuracy need not be equal to what would be required for a permit application, but must be accurate enough to determine whether permitting requirements are triggered.

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To determine if the collateral emission increase is subject to the state Notice of Construction program, use the standard procedures used by your permitting authority.

To determine if the collateral emission increase is subject to the Prevention of Significant Deterioration program, use the calculation procedures in the rules for that program.

a. Impact analysis part 1: how do I estimate the costs of control?

1. To conduct a cost analysis, you:
 - a. Identify the emissions units being controlled,
 - b. Identify design parameters for emission controls, and
 - c. Develop cost estimates based upon those design parameters.

2. It is important to identify clearly the emission units being controlled, that is, to 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.

3. You then specify the control system design parameters. 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. The following are a few examples of design parameters for two example control measures:

Control device	Examples of design parameters
Wet Scrubbers.....	Type of sorbent used (lime, limestone, etc.). Gas pressure drop. Liquid/gas ratio.
Selective Catalytic Reduction	Ammonia to NOx molar ratio. Pressure drop. Catalyst life.

4. The value selected for the design parameter should ensure that the control option will achieve the level of emission control being evaluated. You should include in your

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analysis documentation of your assumptions regarding design parameters. 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 design parameters you specified differ from typical designs, you should document the difference by supplying performance test data for the control technology in question applied to the same source or a similar source.

5. Once the control technology alternatives and achievable emissions performance levels have been identified, you then develop estimates of capital and annual costs. The basis for equipment cost estimates also 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, EPA/452/B-02-001, January, 2002)⁴. In order to maintain and improve consistency, cost estimates should be based on the OAQPS Control Cost Manual, where possible⁵. The Control Cost Manual addresses most control technologies in sufficient detail for a BART analysis. The cost analysis should also take into account any site- specific design or other conditions identified above that affect the cost of a particular BART technology option.

This step in the BART determination process is where site specific design and other conditions that affect the cost to install and operate a particular control option are considered. The ability to evaluate site specific cost issues related to the retrofitting of an emission control on an existing emission unit is an extremely important aspect of the BART cost analysis.

Where site specific conditions exist that significantly affect the cost to utilize an emission control technique, clearly document the site specific conditions and rationale for the capital or annual costs related to that condition.

i. What do we mean by cost effectiveness?

Cost effectiveness, in general, is a criterion 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. We recommend two types of cost-effectiveness calculations--average cost effectiveness, and incremental cost effectiveness.

⁴ The OAQPS Control Cost Manual is updated periodically. While this citation refers to the latest version at the time this guidance was written, you should use the version that is current as of when you conduct your impact analysis. This document is available at the following Web site: <http://www.epa.gov/ttn/catc/dir1/cs1ch2.pdf> .

⁵ You should include documentation for any additional information you used for the cost calculations, including any information supplied by vendors that affects your 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.

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ii. How do I calculate average cost effectiveness?

Average cost effectiveness means the total annualized costs of control divided by annual emissions reductions (the difference between baseline annual emissions and the estimate of emissions after controls), using the following formula:

$$\text{Average cost effectiveness (dollars per ton removed)} = \frac{\text{Control option annualized cost}^6}{(\text{Baseline annual emissions} - \text{Annual emissions with Control option})}$$

Because you calculate costs in (annualized) dollars per year (\$/ yr) and because you calculate emissions rates in tons per year (tons/yr), the result is an average cost-effectiveness number in (annualized) dollars per ton (\$/ton) of pollutant removed.

All cost analyses need to use 2006 dollars and a capital recovery factor of 7 %. Consider "average cost effectiveness" to be the same as "cost effectiveness" since this guideline does not indicate what is to be averaged.

To determine annualized cost, follow the procedures in the EPA Air Pollution Control Cost Manual, Sixth edition (EPA/452/B-02-001, January, 2002).

Unless there is a characteristic of the control technology that requires a different lifetime or the Control Cost Manual lists a different equipment lifetime, utilize a control equipment lifetime of at least 10 years. If a different lifetime is used, document your rationale for the use of the different lifetime.

iii. How do I calculate baseline emissions?

1. 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, you will estimate the anticipated annual emissions based upon actual emissions from a baseline period.

2. When you project that future operating parameters (e.g., limited hours of operation or capacity utilization, type of fuel, raw materials or product mix or type) will differ from past practice, and if this projection has a deciding effect in the BART determination, then you must make these parameters or assumptions into enforceable limitations. In the absence of enforceable limitations, you calculate baseline emissions based upon continuation of past practice.

⁶ Whenever you calculate or report annual costs, you should indicate the year for which the costs are estimated. For example, if you use the year 2000 as the basis for cost comparisons, you would report that an annualized cost of \$20 million would be: \$20 million (year 2000 dollars).

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3. 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 2 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, BART for the two cases could be very different.

In general the baseline emissions should be the “actual emissions”⁷ for the 2 year period preceding the BART analysis. A different 24 month period may be accepted by Ecology as more representative of normal operations. Examples of reasons to choose a different 24 month period to determine baseline emissions would be an extended unit or plant outage, a labor strike, raw material supply disruption, etc.

It is appropriate to adjust a unit’s baseline emission rates to reflect the impact of recently installed modifications or emission control equipment that is not reflected in the baseline emissions determined based on the preceding paragraph.

Work with Ecology to define and document the basis for using a different 2 year period or adjusting baseline emission rates.

In the case of a fossil fueled power plant, the actual emissions for SO₂ and NO_x emissions for each BART eligible unit will be based on the emissions during the most recent 8 calendar quarters reported to the EPA Clean Air Markets Division. A different time period may be used for a unit if the plant can demonstrate that one of those years was not representative of normal operation.

iv. How do I calculate incremental cost effectiveness?

1. In addition to the average cost effectiveness of a control option, you should also calculate incremental cost effectiveness. You should consider the incremental cost effectiveness in combination with the average cost effectiveness when considering whether to eliminate a control option. The incremental cost effectiveness calculation compares the costs and performance level of a control option to those of the next most stringent option, as shown in the following formula (with respect to 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)

⁷ As defined in WAC 173-400-030(1).

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Example 1: Assume that Option F on Figure 2 has total annualized costs of \$1 million to reduce 2000 tons of a pollutant, and that Option D on Figure 2 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 is $(\$1 \text{ million} - \$500,000) \div (2000 \text{ tons} - 1000 \text{ tons})$, or $\$500,000 \div 1000 \text{ tons}$, 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 $(\$1,900,000/1,000 \text{ tons}) = \$1,900/\text{ton}$. Option 2 achieves a 980 tons/ yr reduction at an annualized cost of \$1,500,000. This represents an average cost of $(\$1,500,000/980 \text{ tons}) = \$1,531/\text{ton}$. The incremental cost effectiveness of Option 1 relative to Option 2 is $(\$1,900,000 - \$1,500,000) \div (1,000 \text{ tons} - 980 \text{ tons})$. 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.

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2. You should exercise care in deriving incremental costs of candidate control options. Incremental cost-effectiveness comparisons should focus on annualized cost and emission reduction differences between "dominant" alternatives. To identify dominant alternatives, you generate a graphical plot of total annualized costs for total emissions reductions for all control alternatives identified in the BART analysis, and by identifying a "least-cost envelope" as shown in Figure 2. (A "least-cost envelope" represents the set of options that should be dominant in the choice of a specific option.)

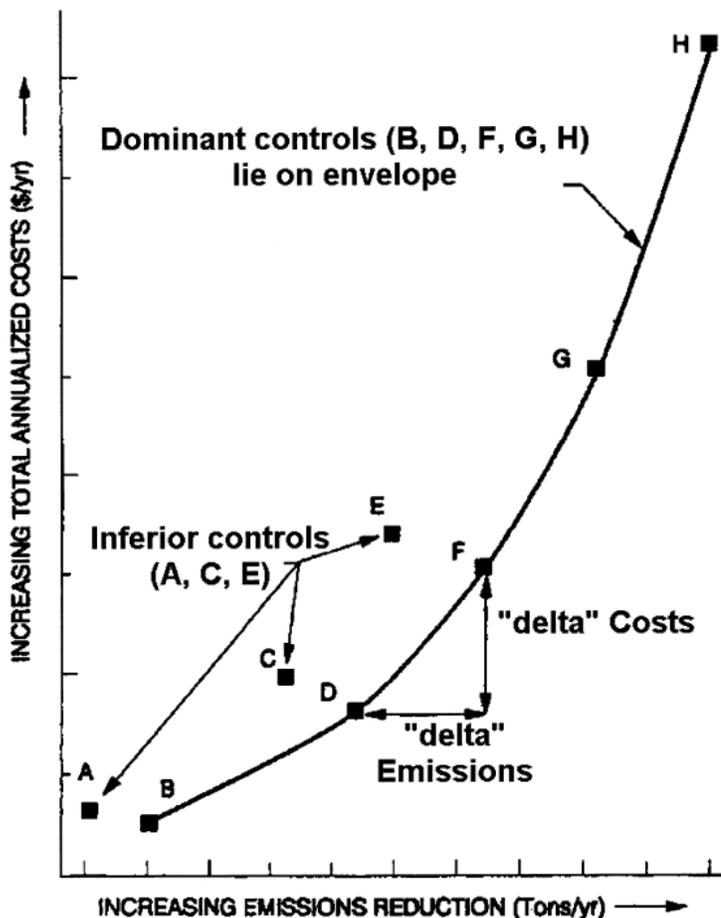


Figure 2. Least-cost Envelope.

Example: Eight technically feasible control options for analysis are listed. These are represented as A through H in Figure 2. The dominant set of control options, B, D, F, G, and H, represent the least-cost envelope, as we depict by the cost curve connecting them. Points A, C and E are inferior options, and you should not use them in calculating incremental cost effectiveness. Points A, C and E represent inferior controls because B will buy more emissions reductions

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for less money than A; and similarly, D and F will buy more reductions for less money than C and E, respectively.

3. In calculating incremental costs, you:

- (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 2. This is to show the “least- cost envelope” discussed above; and
- (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. For example, using Figure 2, you would calculate incremental cost effectiveness for the difference between options B and D, options D and F, options F and G, and options G and H.

4. 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. It should be noted that average and incremental cost effectiveness are identical when only one candidate control option is known to exist.

5. You should exercise caution not to misuse these techniques. For example, you may be faced with a choice 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, it may be inappropriate to choose control B, based on its high incremental costs, even though its average cost may be considered reasonable.

6. In addition, when you evaluate the average or incremental cost effectiveness of a control alternative, you should make reasonable and supportable assumptions regarding control efficiencies. An unrealistically low assessment of the emission reduction potential of a certain technology could result in inflated cost-effectiveness figures.

Ecology does not expect that you will develop a least cost envelope such as that shown in Figure 2 for each emission unit and pollutant. We anticipate that due to the top-

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down analysis approach of the BART technology analysis, the information necessary for you to propose a technology as BART will be adequate for Ecology to make a BART determination.

v. What other information should I provide in the cost impacts analysis?

You should provide documentation of any unusual circumstances that exist for the source that would lead to cost-effectiveness estimates that would exceed that for recent retrofits. This is especially important in cases where recent retrofits have cost-effectiveness values that are within what has been considered a reasonable range, but your analysis concludes that costs for the source being analyzed are not considered reasonable. (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.

vi. What other things are important to consider in the cost impacts analysis?

In the cost analysis, you should take care not to focus on incomplete results or partial calculations. For example, large capital costs for a control option alone would not preclude selection of a control measure 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.

There are some control technologies or techniques that control multiple visibility impairing pollutants. Where such a technology or technique is available, the cost effectiveness analysis should evaluate the technology for the total of all visibility impairing pollutants controls. This cost effectiveness would be compared the total effectiveness of the best pollutant specific technologies that can be operated together and control the same visibility impairing pollutants.

b. Impact analysis part 2: How should I analyze and report energy impacts?

1. You should examine the energy requirements of the control technology and 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, more often extra fuel or electricity is 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

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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, simply be factored into the cost impacts analysis. The fact of energy use in and of itself does not disqualify a technology.

2. Your energy impact analysis should consider only direct energy consumption and not indirect energy impacts. For example, you could estimate the direct energy impacts of the control alternative 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. You can then convert these units into dollar costs and, where appropriate, factor these costs into the control cost analysis.

3. You generally do not consider indirect energy impacts (such as energy to produce raw materials for construction of control equipment). However, if you determine that the indirect energy impact is unusual or significant and that the impact can be well quantified, you may consider the indirect impact.

4. 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. However, in general, 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.

5. 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.

Two options may be equally cost effective but result in differing regional haze improvements. The option with the best regional haze improvement may also be preferred over the other option.

Please document all assumptions utilized in calculating energy costs. As suggested above, include the energy costs in the overall cost effectiveness analysis.

c. Impact analysis part 3: How do I analyze "non-air quality environmental impacts?"

1. In the non-air quality related environmental impacts portion of the BART analysis, you address environmental impacts other than air quality due to emissions of the

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pollutant in question. Such environmental impacts include solid or hazardous waste generation and discharges of polluted water from a control device.

2. You should identify any significant or unusual environmental impacts associated with a control alternative that have the potential to affect the selection or elimination of a control alternative. Some control technologies may have potentially significant secondary environmental impacts. 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 types of environmental 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. On the other hand, where you can show that unusual circumstances at the proposed facility create greater problems than experienced elsewhere, this may provide a basis for the elimination of that control alternative as BART.

3. The procedure for conducting an analysis of non-air quality environmental impacts should be made based on a consideration of site-specific circumstances. If you propose to adopt the most stringent alternative, then it is not necessary to perform this analysis of environmental impacts for the entire list of technologies you ranked in Step 3. In general, the analysis need only address those control alternatives with any significant or unusual environmental impacts that have the potential to affect the selection of a control alternative, or elimination of a more stringent control alternative. Thus, any important relative environmental impacts (both positive and negative) of alternatives can be compared with each other.

4. 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, you should perform a qualitative or semi-quantitative screening to narrow the analysis to discharges with potential for causing adverse environmental effects. Next, you should assess the mass and composition of any such discharges and quantify them to the extent possible, based on readily available information. You should also assemble pertinent information about the public or environmental consequences of releasing these materials.

The BART program does not contain a requirement to look at other air quality impacts, just non-air quality impacts. Ecology is requiring a review of collateral emission changes and (in a deferred way) the air quality impacts of a particular BART control technique.

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We encourage you to evaluate air quality impacts of BART emission controls as part of the overall evaluation of what is BART for a specific emission unit.

d. Impact analysis part 4: What are examples of non-air quality environmental impacts?

The following are examples of how to conduct non-air quality environmental impacts:

(1) Water Impact

You should 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, you should assess the effect on ground water and such local surface water quality parameters as ph, turbidity, dissolved oxygen, salinity, toxic chemical levels, temperature, and any other important considerations. 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.

(2) Solid Waste Disposal Impact

You could also compare 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. You should consider 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) which are significant with regard to potential surface water pollution or transport into and contamination of subsurface waters or aquifers.

(3) Irreversible or Irretrievable Commitment of Resources

You may consider 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 and the extent to which the alternative systems may result in irreversible or irretrievable commitment of resources (for example, use of scarce water resources).

(4) Other Adverse Environmental Impacts

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

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There are many other non-air quality impacts that could be listed. If there are non-air quality impacts specific to your facility or the area around it that need to be minimized, we encourage you to include those impacts in your evaluation.

e. How do I take into account a project's "remaining useful life" in calculating control costs?

1. You may decide to treat the requirement to consider the source's "remaining useful life" of the source for BART determinations 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 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, you should use this shorter time period in your cost calculations.

If the remaining useful life is less than the time used to annualize/amortize the costs of the potential emission controls, you need to document why the useful life of the emission unit is shorter.

2. For purposes of these guidelines, 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, as suggested in EPA's OAQPS Control Cost Manual); you are conducting the BART analysis; 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.

3. EPA recognizes that there may be situations where you intend to shut down a source (or emission unit) by a given date, but wishes to retain the flexibility to continue operating beyond that date in the event, for example, that market conditions change. Where this is the case, your BART analysis may account for this, but it must maintain consistency with the statutory requirement to install BART within 5 years. Where you choose to not accept a federally enforceable condition requiring the source (or emission unit) 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 be required as BART.

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

When a source justifies a remaining lifetime of less than 5 years, Ecology intends to issue an enforceable order as described above.

Similarly if you propose to convert a primary unit to a back-up mode, an enforceable order will be issued establishing the date for the change to back-up mode and limiting the operation to the rate at which you demonstrated no additional emission controls constitute BART.

Timing for issuance of these orders is covered in Section III.

Step 5: How should I determine visibility impacts in the BART determination?

The following is an approach you may use to determine visibility impacts (the degree of visibility improvement for each source subject to BART) for the BART determination. Once you have determined that your source or sources are subject to BART, you must conduct a visibility improvement determination for the source(s) as part of the BART determination. When making this determination, EPA believes the state has flexibility in setting absolute thresholds, target levels of improvement, or de minimis levels since the deciview improvement must be weighed among the five factors, and the state is free to determine the weight and significance to be assigned to each factor. 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. [Note that if you have elected to apply the most stringent controls available, consistent with the discussion in section E. step 1. below, you need not conduct an air quality modeling analysis for the purpose of determining its visibility impacts.]

Use CALPUFF,⁸ or other appropriate dispersion model 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 SO₂, NO_x, and direct PM emissions (PM_{2.5} and/or PM₁₀). If the source is making the visibility determination, you

⁸ The model code and its documentation are available at no cost for download from <http://www.epa.gov/scram001/tt22.htm#calpuff>.

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should review and approve or disapprove of the source's analysis before making the expected improvement determination. There are several steps for determining the visibility impacts from an individual source using a dispersion model:

- Develop a modeling protocol.

Ecology the Oregon and Idaho Departments of Environmental Quality, and EPA Region 10 have developed the modeling protocol for you to utilize in all CALPUFF modeling performed for the BART determination process. The final protocol is available at <http://www.deq.state.or.us/aq/haze/docs/bartprotocol.pdf> or from Ecology.

The protocol incorporates specific considerations based on the cumulative experience of the 3 states and EPA in modeling visibility impacts in the northwestern US. The protocol and its referenced documents contain specific criteria and requirements for addressing direct PM emissions.

Some critical items to include in a 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. We recommend following EPA's Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts⁹ for parameter settings and meteorological data inputs; the use of other settings from those in IWAQM should be identified and explained in the protocol.

One important element of the protocol is in establishing the receptors that will be used in the model. The receptors that you use should be located in the nearest Class I area with sufficient density to identify the likely visibility effects of the source. For other Class I areas in relatively close proximity to a BART-eligible source, you may model a few strategic receptors to determine whether effects at those areas may be greater than at the nearest Class I area. For example, you might chose to locate receptors at these areas at the closest point to the source, at the highest and lowest elevation in the Class I area, at the IMPROVE monitor, and at the approximate expected plume release height. If the highest modeled effects are observed at the nearest Class I area, you may choose not to analyze the other Class I areas any further as additional analyses might be unwarranted.

You should bear in mind that 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

⁹ 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.

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for the same Class I area and source, depending upon the State's chosen method for modeling sources less than 50 km. In situations where you are assessing visibility impacts for source- receptor distances less than 50 km, you should use expert modeling judgment in determining visibility impacts, giving consideration to both CALPUFF and other EPA-approved methods.

Contact the state modeler for advice on approaches to evaluate regional haze impacts on Class I area receptors within 50 km of your source.

In developing your modeling protocol, you may want to consult with EPA and your regional planning organization (RPO). Up-front consultation will ensure that key technical issues are addressed before you conduct your modeling.

- For each source, run the model, at pre-control and post-control emission rates according to the accepted methodology in the protocol.

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 of pre-control emission rates. For example, if the 24-hr pre-control emission rate is 100 lb/hr of SO₂, then the post control rate is 5 lb/hr if the control efficiency being evaluated is 95 percent.

As covered in the Modeling protocol, the actual emissions to use are those from each BART eligible unit. Where Ecology agreed to specific approaches to modeling your BART eligible units in the 'exemption modeling' step, you may use those same approaches in determining the effects of BART on your facility's regional haze impacts.

- Make the net visibility improvement determination.

The visibility improvement analysis need not be done for each control scenario evaluated for each BART eligible emission unit at your source. If the top case (lowest emission rate) emission control technology is proposed as BART, the next lower case need not be modeled. If you propose as BART emission controls that are less effective than the most effective, technically feasible controls, visibility improvement modeling of the proposed BART controls plus the most effective controls must be presented.

The visibility impact modeling is of the cumulative effect of BART controls you propose for all the BART eligible units at your facility.

If your facility is a power plant larger than 750 MW, Ecology will accept a BART analysis report that contains visibility improvement modeling completed for only the most effective, technically feasible control technology evaluated, and proposed as BART.

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Assess the visibility improvement based on the modeled change in visibility impacts for the pre-control and post-control emission scenarios. You have flexibility to assess visibility improvements due to BART controls by one or more methods. You may consider the frequency, magnitude, and duration components of impairment. Suggestions for making the determination are:

- Use of a comparison threshold, as is done for determining if BART-eligible sources should be subject to a BART determination. Comparison thresholds can be used in a number of ways in evaluating 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 an x percent change in improvement).

Ecology will not provide you with a comparison threshold for evaluating visibility improvement. We do not believe that the degree of visibility improvement alone should be a governing criterion in making a BART determination. As noted above, visibility improvement might be appropriate to use as a 'tie-breaker' between otherwise equivalent control technologies.

- Compare the 98th percent days for the pre- and post-control runs.

Note that each of the modeling options may be supplemented with source apportionment data or source apportionment modeling.

Ecology suggests making the comparison between the modeled 98th percentile days in the pre and post control scenarios to determine the degree of visibility improvement anticipated to occur due to the installation and operation of your proposed BART emission controls.

E. How do I select the "best" alternative, using the results of Steps 1 through 5?

1. Summary of the Impacts Analysis

From the alternatives you evaluated in Step 3, we recommend you develop a chart (or charts) displaying for each of the alternatives:

- (1) Expected emission rate (tons per year, pounds per hour);
- (2) Emissions performance level (e.g., percent pollutant removed, emissions per unit product, lb/MMBtu, ppm);
- (3) Expected emissions reductions (tons per year);
- (4) Costs of compliance--total annualized costs (\$), cost effectiveness (\$/ton), and incremental cost effectiveness (\$/ton), and/or any other cost-effectiveness measures (such as \$/deciview);

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- (5) Energy impacts;
- (6) Non-air quality environmental impacts; and
- (7) Modeled visibility impacts.

While not required as part of a BART analysis you should look at the air quality impacts resulting from the control technologies evaluated and use that as part of your determination of BART for a each emission unit (or collection of similar or identical units).

2. Selecting a ``best" alternative

- (1.) You have discretion to determine the order in which you should evaluate control options for BART. Whatever the order in which you choose to evaluate options, you should always (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; and (5) consider the modeled visibility impacts. You should provide a justification for adopting the technology that you select as the ``best" level of control, including an explanation of the CAA factors that led you to choose that option over other control levels.
- (2.) In the case where you are conducting a BART determination for two regulated pollutants on the same source, if the result is two different BART technologies that do not work well together, you could then substitute a different technology or combination of technologies.

3. In selecting a "best" alternative, should I consider the affordability of controls?

- (1.) 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.
- (2.) 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, the market share, and profitability of the source. Where there are such unusual circumstances that are judged to affect plant operations, you may take into consideration the conditions of the plant and the economic effects of requiring the use of a control technology. Where these effects are judged to have a severe impact on plant operations you may consider them in the selection process, but you may wish to provide an economic analysis that demonstrates, in sufficient detail for public review, the specific economic effects, parameters, and reasoning. (We recognize that this review process must preserve the confidentiality of sensitive business information).

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Any analysis may also consider whether other competing plants in the same industry have been required to install BART controls if this information is available.

4. Sulfur dioxide limits for utility boilers

A 750 MW or larger power plant must meet specific control levels for sulfur dioxide (SO₂) of either 95 percent control or 0.15 lbs/ MMBtu, for each EGU greater than 200 MW that is currently uncontrolled unless you determine that an alternative control level is justified based on a careful consideration of the statutory factors. Thus, for example, if the source demonstrates circumstances affecting its ability to cost-effectively reduce its emissions, you should take that into account in determining whether the presumptive levels of control are appropriate for that facility.

For a currently uncontrolled EGU greater than 200 MW in size, but located at a power plant smaller than 750 MW in size, such controls are generally cost-effective and could be used in your BART determination considering the five factors specified in CAA section 169A(g)(2). While these levels may represent current control capabilities, EPA expects that scrubber technology will continue to improve and control costs continue to decline. You should be sure to consider the level of control that is currently best achievable at the time that you are conducting your BART analysis.

For coal-fired EGUs with existing post-combustion SO₂ controls achieving less than 50 percent removal efficiencies, we recommend that you evaluate constructing a new FGD system to meet the same emission limits as above (95 percent removal or 0.15 lb/mmBtu), in addition to the evaluation of scrubber upgrades discussed below. For oil-fired units, regardless of size, you should evaluate limiting the sulfur content of the fuel oil burned to 1 percent or less by weight.

For those BART-eligible EGUs with pre-existing post-combustion SO₂ controls achieving removal efficiencies of at least 50 percent, your BART determination should consider cost effective scrubber upgrades designed to improve the system's overall SO₂ removal efficiency. There are numerous scrubber enhancements available to upgrade the average removal efficiencies of all types of existing scrubber systems. EPA recommends that as you evaluate the definition of "upgrade," you evaluate options that not only improve the design removal efficiency of the scrubber vessel itself, but also consider upgrades that can improve the overall SO₂ removal efficiency of the scrubber system. 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 SO₂ removal efficiencies.

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EPA recommends that as you evaluate the performance of existing wet scrubber systems, you consider some of the following upgrades, in no particular order, as potential scrubber upgrades that have been proven in the industry as cost effective means to increase overall SO₂ removal of wet systems:

- (a) Elimination of Bypass Reheat;
- b) Installation of Liquid Distribution Rings;
- (c) Installation of Perforated Trays;
- (d) Use of Organic Acid Additives;
- (e) Improve or Upgrade Scrubber Auxiliary System Equipment;
- (f) Redesign Spray Header or Nozzle Configuration.

We recommend that as you evaluate upgrade options for dry scrubber systems, you should consider the following cost effective upgrades, in no particular order:

- (a) Use of Performance Additives;
- (b) Use of more Reactive Sorbent;
- (c) Increase the Pulverization Level of Sorbent;
- (d) Engineering redesign of atomizer or slurry injection system.

You should evaluate scrubber upgrade options based on the 5 step BART analysis process.

5. Nitrogen oxide limits for utility boilers

Ecology must establish specific numerical limits for NOX control for each BART determination. For power plants with a generating capacity in excess of 750 MW currently using selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) for part of the year, you should presume that use of those same controls year-round is BART. For other sources currently using SCR or SNCR to reduce NOX emissions during part of the year, you should carefully consider requiring the use of these controls year-round as the additional costs of operating the equipment throughout the year would be relatively modest.

For coal-fired EGUs greater than 200 MW located at greater than 750 MW power plants and operating without post-combustion controls (i.e. SCR or SNCR), we have provided presumptive NOX limits, differentiated by boiler design and type of coal burned. You may determine that an alternative control level is appropriate based on a careful consideration of the statutory factors. For coal-fired EGUs greater than 200 MW located at power plants 750 MW or less in size and operating without post-combustion controls, you should likewise presume that these same levels are cost-effective. You should require such utility boilers to meet the following NOX emission limits, unless you determine that an alternative control level is justified based on consideration of the statutory factors. The following NOX emission rates were determined based on a number of assumptions, including that the EGU boiler has enough volume to allow for

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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 NOX Emission Limits for BART-Eligible Coal-Fired Units.^{10 11}

Unit type	Coal type	NOx presumptive limit (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	0.32
	Sub-bituminous	0.23
Wet-bottom tangential-fired	Bituminous	0.62

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

Because of the relatively high NOX emission rates of cyclone units, SCR is more cost-effective than the use of current combustion control technology for these units. The use of SCRs at cyclone units burning bituminous coal, sub-bituminous coal, and lignite should enable the units to cost-effectively meet NOX rates of 0.10 lbs/MMBtu. As a result, we are establishing a presumptive NOX limit of 0.10 lbs/MMBtu based on the use of SCR for coal-fired cyclone units greater than 200 MW located at 750 MW power

¹⁰ 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.

¹¹ These limits reflect the design and technological assumptions discussed in the technical support document for NOX limits for these guidelines. See Technical Support Document for BART NOX Limits for Electric Generating Units and Technical Support Document for BART NOX Limits for Electric Generating Units Excel Spreadsheet, Memorandum to Docket OAR 2002- 0076, April 15, 2005.

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plants. As with the other presumptive limits established in this guideline, you may determine that an alternative level of control is appropriate based on your consideration of the relevant statutory factors. For other cyclone units, you should review the use of SCR and consider whether these post-combustion controls should be required as BART.

For oil-fired and gas-fired EGUs larger than 200MW, EPA believes that installation of current combustion control technology to control NOX is generally highly cost-effective and should be considered in your determination of BART for these sources. Many such units can make significant reductions in NOX emissions which are highly cost-effective through the application of current combustion control technology.^{12\}

¹² See Technical Support Document for BART NOX Limits for Electric Generating Units and Technical Support Document for BART NOX Limits for Electric Generating Units Excel Spreadsheet, Memorandum to Docket OAR 2002-0076, April 15, 2005.

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III. Enforceable Limits/Compliance Date

To complete the BART process, Ecology and your permitting authority must establish enforceable emission limits that reflect the BART requirements and require compliance within a given period of time. In particular, Ecology and your permitting authority must establish an enforceable emission limit for each subject emission unit at the source and for each pollutant subject to review that is emitted from the source. In addition, Ecology and your permitting authority must require compliance with the BART emission limitations no later than 5 years after EPA approves the Washington regional haze SIP. If technological or economic limitations in the application of a measurement methodology to a particular emission unit make a conventional emissions limit infeasible, Ecology and your permitting authority may instead prescribe a design, equipment, work practice, operation standard, or combination of these types of standards. Ecology and your permitting authority may consider allowing you to “average” emissions across any set of BART-eligible emission units within a fenceline, so long as 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 BART-eligible source.

Ecology and your permitting authority must ensure that any BART requirements are written in a way that clearly specifies the individual emission unit(s) subject to BART regulation. Because the BART requirements themselves are “applicable” requirements of the CAA, they must be included as title V permit conditions according to the procedures established in 40 CFR part 70 or 40 CFR part 71.

Section 302(k) of the CAA requires emissions limits such as BART to be met on a continuous basis. Although this provision does not necessarily require the use of continuous emissions monitoring (CEMs), it is important that sources 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. See, e.g., 40 CFR part 64 (compliance assurance monitoring); 40 CFR 70.6(a)(3) (periodic monitoring); 40 CFR 70.6(c)(1) (sufficiency monitoring). Note also that while EPA does not believe that CEMs would 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, such as the acid rain program. In addition, emissions limits must be enforceable as a practical matter (contain appropriate averaging times, compliance verification procedures and recordkeeping requirements).

In light of the above, the permit must:

- Be sufficient to show compliance or noncompliance (i.e., through monitoring times of operation, fuel input, or other indices of operating conditions and practices); and

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- Specify a reasonable averaging time consistent with established reference methods, contain reference methods for determining compliance, and provide for adequate reporting and recordkeeping so that air quality agency personnel can determine the compliance status of the source; and
- For EGUS, specify an averaging time of a 30-day rolling average, and contain a definition of "boiler operating day" that is consistent with the definition in the proposed revisions to the NSPS for utility boilers in 40 CFR Part 60, subpart Da.¹³ You should consider a boiler operating day to be any 24-hour period between 12:00 midnight and the following midnight during which any fuel is combusted at any time at the steam generating unit. This would allow 30-day rolling average emission rates to be calculated consistently across sources.

Ecology will make the final BART determination and set the date(s) for your emission units to be in compliance with the BART emission limitations. We encourage you to propose both BART emission limits, and a schedule by which your BART units can come into compliance with the BART limit.

Ecology will coordinate with your permitting authority to issue any necessary Notice of Construction approvals and PSD permits to implement the BART determination. The BART Determination issued by Ecology will include the minimum amount of detail necessary to define the BART limits and associated monitoring, recordkeeping and reporting requirements. The Notice of Construction approvals issued by the local permitting authority would contain more detailed information reflecting the actual emission control equipment installed or work practices employed to comply with the BART determination.

The BART regulations¹⁴ require states to require compliance with the BART limitations as expeditiously as possible, but in no case later than 5 years from the effective date of the SIP approval.

As of the date this document was finalized, we do not know when Ecology will submit our regional haze SIP to EPA or how long it will take them to approve it. We anticipate EPA approval of Washington's regional haze SIP approximately one year after it is submitted. As a result, you want you to propose a schedule that will achieve compliance with your proposed BART limitations as expeditiously as possible, but within 7 years of submitting your BART analysis.

If there are specific circumstances such as oil refinery major unit turnaround scheduling where such a timeframe will not allow compliance with BART for a specific emission unit to be achieved in the required timeframe, present your rationale for a differing schedule for that unit in your BART proposal.

¹³ 70 FR 9705, February 28, 2005.

¹⁴ 40 CFR 51.307(e)(1)(iv)