Attachment C. Demonstration that the SO_2 Milestones Provide Greater Reasonable Progress than BART

A. Background

On July 1, 1999 the Environmental Protection Agency (EPA) published regulations to address regional haze visibility impairment. The new regulations require States to address Best Available Retrofit Technology (BART) requirements for regional haze visibility impairment. The nine Grand Canyon Visibility Transport Region States have the option to address this requirement as part of an overall strategy of emission reductions developed by the Grand Canyon Commission, including the establishment of regional sulfur dioxide (SO2) milestones.

§309(f)(1)(I) of the regional haze rule establishes the requirements for regional milestones to meet the stationary source obligations for the first long-term planning period. The rule states, "The emission reduction milestones must be shown to provide for greater reasonable progress than would be achieved by application of best available retrofit technology (BART) pursuant to section 51.308(e)(2) and would be approvable in lieu of BART." The requirements for BART are described in greater detail in section 51.308(e)(2) as follows:

> "A State may opt to implement an emissions trading program or other alternative measure rather than to require sources subject to BART to install, operate, and maintain BART. To do so, the State must demonstrate that this emissions trading program or other alternative measure will achieve greater reasonable progress than would be achieved through the installation and operation of BART. To make this demonstration, the State must submit an implementation plan containing the following plan elements and include documentation for all required analyses:
>
> > (I) A demonstration that the emissions trading program or other alternative measure will achieve greater reasonable progress than would have resulted from the installation and operation of BART at all sources subject to BART in the State. This demonstration must be based on the following:
> >
> > > (A) A list of all BART-eligible sources within the State.
> > >
> > > (B) An analysis of the best system of continuous emission control technology available and associated emission reductions achievable for each source within the State subject to BART. In this analysis, the State must take into consideration the technology available, the costs of compliance, the energy and nonair quality environmental impacts of compliance, any pollution control equipment in use at the source, and the remaining useful life of the source. The best system of continuous emission control technology and the above factors may be determined on

a source category basis. The State may elect to consider both source-specific and category-wide information, as appropriate, in conducting its analysis.

(C) An analysis of the degree of visibility improvement that would be achieved in each mandatory Class I Federal area as a result of the emission reductions achievable from all such sources subject to BART located within the region that contributes to visibility impairment in the Class I area, based on the analysis conducted under section 51.308(e)(2)(I)(B)."

In order to address these BART requirements, the WRAP used the following process:

- ❑ Develop a list of BART-eligible sources for the region.
- ❑ Estimate emission reductions that could be made by BART-eligible sources through "appropriate retrofit technology".
- ❑ Estimate baseline emissions in the year 2018.
- ❑ Evaluate the visibility improvement that could occur in the region if the "appropriate retrofit technology" emission reductions were implemented.
- ❑ Evaluate additional factors that would contribute to "greater reasonable progress" than regional haze BART
- ❑ Establish 2018 SO_2 emissions milestone

Each of these steps is addressed in greater detail in the following sections of this report. This process was developed through the best efforts of the WRAP through a stakeholder based process and is based on the WRAP's reading of the regional haze rule language and preamble. It is important to note that EPA guidance for determining regional haze BART is under development and so the WRAP had to make a number of assumptions about the analysis.

B. List of BART-eligible sources.

Each of the nine Transport Region States developed a preliminary list of BART-eligible sources for SO_2. EPA identified BART-eligible sources on tribal lands. EPA guidance for regional haze BART is still under development which leaves many unanswered applicability questions. The WRAP developed a draft methodology that was used to identify all of the BART-eligible sources in the region. When final guidance is issued, the Transport Region States and Tribes recognize that changes to their initial lists of BART-eligible sources may be necessary, however the WRAP believes that all sources that emit significant levels of SO_2 have been identified. The preliminary list compiled by the states is included as **Attachment D** to the Annex. The draft methodology used the following assumptions:

- ❑ Where appropriate, BART-eligible sources were identified on a unit-by-unit basis. Only individual units that met the BART criteria were included on the list. For some sources, such as copper smelters, this approach did not work because

the units were so inter-related. In those cases the entire source was examined to determine if it was BART-eligible.

- ❑ Pollutants were treated independently. Therefore, only units that qualified as BART-eligible for SO_2 were included on the list.
- ❑ Modifications during the 15-year BART window were not considered, unless the modification qualified as reconstruction for that unit.
- ❑ Units were not considered BART-eligible if the only modification that was made during the 15-year window was the installation of pollution control equipment.
- ❑ BART-eligible sources that had, were in the process of, or were slated to have new emissions controls installed (Navajo Generating Station, Page, Arizona; Hayden Generating Station, Hayden, Colorado; Mojave Generating Station, Laughlin, Nevada) were not included in the spreadsheet that was used to calculate the BART level emission reductions. In addition, BART-eligible sources that will be controlled as part of the voluntary reductions for the Front Range power plants in Colorado were not included in the spreadsheet (Cherokee Generating Station in Denver and Valmont Generating Station in Boulder). Emission reductions from these sources were treated as downward adjustments to the baseline.

C. Appropriate Retrofit Technology Estimates

The next step in the process was the identification of appropriate retrofit technologies for the BART-eligible sources. BART has traditionally been developed through a case-by-case analysis that considers the unique situation of the source, including costs and the impacts that the source has on a particular mandatory Class I area. As provided in the following passage, the regional haze rule provides flexibility to states in developing, for comparative purposes, a method for calculating the emission reductions that would result from the installation of source-specific BART:

> To compare the emissions reductions and visibility improvement that would result from the application of source specific BART to that resulting from implementation of alternative measures, such as a regional emissions trading program, the state must estimate the emissions reductions that would result from the use of BART-level controls. To do this, the states could undertake a source specific review of the sources in the state subject to BART or it could use a modified approach that simplifies analysis...the states accordingly have flexibility in developing a method to determine the emissions reductions that could be achieved through the application of BART.[1]

The WRAP recognized that a case-by-case analysis of potential controls for each of the BART-eligible sources in the region would be very resource intensive and require more time than allotted for the development of the Annex. Because the goal was to use these estimates to

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[1] 40 CFR part 51, page 35742 (July 1, 1999).

establish a regional emission cap, the individual BART reductions were less important than the overall regional number. The WRAP therefore approached the analysis at the regional level, using a more simplified analysis, as provided for in the regional haze rule.

The WRAP used the following assumptions to estimate the regional emission reductions due to appropriate retrofit controls on the BART-eligible sources in the region. It should be noted that the WRAP methodology was only used to obtain a regional estimate for BART-level emission reductions to calculate the 2018 milestone. It was not intended to be a source-by-source BART analysis.

- ❑ Appropriate retrofit technologies were estimated for source categories rather than individual sources.
- ❑ Emission reductions were estimated at the regional level.
- ❑ All estimates of the level of control constitute an assumed average for that industry sector in the WRAP region.
- ❑ The BART factors, including cost, energy and non-air environmental impact, existing pollution controls, and remaining useful life were addressed in a broad way through the identification of technologies that were currently being used as retrofits in the region. Some consideration of the technical feasibility of installing control equipment at particular sources (site constraints, special conditions, etc.) was considered. However, a comprehensive analysis was not completed for individual sources. Instead, the MTF looked at ranges of potential retrofit controls and established a level that was expected to be valid as a regional average.

Table 1 outlines the estimated appropriate retrofit technology for specific source categories in the region.

TABLE 1

Source Category	Retrofit Technologies or Percentage Reduction
Copper Smelters	Due to the uniqueness of the existing smelters, retrofit technology analysis must be performed on a smelter-by-smelter basis. Currently, the Hidalgo smelter is the only BART-eligible source on the list in this category. A double-contact acid plant will be considered the appropriate retrofit control equipment (all smelters in the region are currently equipped with double-contact acid plants). On August 21, 2000 New Mexico completed an engineering analysis that verified earlier determinations by the MTF that the fugitive SO_2 capture system at Hidalgo satisfies BART at **96% overall capture**.
Refineries	There are three sources of SO_2 emissions at the refinery level: Description — Assumed Average Control Level SRU (pollution control for fuel gas combustion units) — **98% control** or the equivalent of 3-stage Claus units (most already have this in place). Catalytic crackers — 90% control. States will query these sources as to whether or not they have had to comply with subpart J with low sulfur catalyst or hydro-treating, which would amount to 90% control. If not already subject to part J, then 90% control will be required. Flares — no additional controls (Approximately 70% of refinery emissions come from Claus unit, 25% from cat crackers if uncontrolled, and remaining 5% from all other sources)
Lime Plants and Cement Kilns	**No additional reduction**. Approximately 50% control inherent in the process. Additional SO_2 controls are not typically applied to these kinds of sources.
Utility Boilers	Technology determination dependent upon current level of control. Description — Assumed Average Level of Control Uncontrolled units — 85% Units controlled at less than 70% — Treat as uncontrolled (see above). Units controlled between 70-80% — Increase reductions by 5% (i.e., if a unit is at 72%, would be assumed to control to 77%). Units controlled greater than 80% — No additional reductions.
Industrial Boilers	Same as utility boilers.
Pulp and Paper	Sulfur sources are recovery furnaces and boilers. Boiler discussions covered with industrial boilers. **Recovery furnaces: No additional reduction.** Low emissions coupled with lack of more than one example of scrubbing.

The technology assumptions listed above were incorporated into a spreadsheet (Allstat7.xls) to estimate the regional emission reductions due to appropriate retrofit technologies. The spreadsheet used the following assumptions:

- ❑ Existing utility generating units operating at an average capacity factor of less than 85% of nameplate capacity during 1999 were assumed to increase their capacity factor to a maximum level of 85% of nameplate capacity by 2018. Utility units operating at a capacity factor higher than 85% during 1999 were assumed to continue operating at that level.
- ❑ All other source categories were assumed to continue operating at their current level of actual emissions, based on an average of 1996-1998 emissions.
- ❑ The BART-eligible units were assumed to reduce actual emissions by the applying the control efficiency listed in Table 1 for each specific source category.
- ❑ The total emission reductions were then added to obtain a regional estimate. The individual source estimates were only calculated as part of the regional estimate, and are not intended to be used as a BART estimate for those individual sources.

The analysis described above led to an estimated emission reduction of 168,176 tons SO_2 due to the application of appropriate control technologies. For the purposes of this discussion, this number will be rounded to 168,000 tons.

D. Baseline Inventory for 2018

As part of the process of developing the end-point for this program, an inventory of expected actual emissions in 2018 was estimated. The baseline inventory was calculated separately for utilities and non-utilities using the following methods and assumptions:

1. Utilities. 1999 emissions data that were submitted to EPA for the acid rain program were used as the base inventory for the utility projections to 2018. In addition, data for several small power plants that were not in the acid rain data base were added to the inventory list. The 1999 inventory was then grown to account for increased capacity utilization as described below. Known emission reductions that have already been agreed to by the Public Service Company of Colorado (a number of power plants along the Front Range that will be controlled in 2003) and by the Mojave Generating Station in Nevada (controls will be installed by 2006) were subtracted from the emission projections.

a. Capacity Factor. Western utilities are increasing their utilization to meet increasing electricity demand. In addition, deregulation of the power industry is expected to further increase utilization of existing plants because it will be more cost-effective to achieve peak performance from existing plants than to expend the capital to build new plants. Even though utilization is increasing, it is not

realistic to estimate that plants will consistently operate at 100% capacity because units will require maintenance throughout the year. In addition, power demand fluctuates throughout the year, and full utilization may not be needed every day of the year.

The WRAP has assumed that all coal fired power plants in the west will be operating at an average of 85% of nameplate capacity in the year 2018. Any new growth in demand, beyond this capacity factor assumption, is assumed to be met by new power generation at an approximate control efficiency of 98% for SO_2.

b. Retirement Adjustment for Colorado Front Range Power Plants. Public Service Company of Colorado (PSCO) has made a voluntary agreement with the State of Colorado to control a number of Front Range power plants by the year 2003. Several of the plants that will install controls are assumed to retire before the year 2018 according to the assumptions of the model. It is no longer realistic to assume that these plants will retire, because the capital investment in the plants will extend their lifetime. Therefore, a 4,000 ton adjustment was made to the inventory to account for the continued operation of these plants.

2. Co-generation Facilities. 1998 inventory data provided by the nine transport region states were used as the base inventory for future year projections. It was assumed that emissions from these sources would remain constant through the year 2018 (no growth or retirements would occur).

3. Smelters. 1998 inventory data provided by the nine transport region states were used as the base inventory for future year projections. There are two smelters that were operating in 1998 that have temporarily suspended operations due to economic conditions. For this reason, the inventory was projected both with these smelters in operation, and without. The milestones developed by the WRAP contain provisions for an automatic adjustment if one or both of the smelters come back on line. The 2018 inventory for smelters in the region if neither smelter resumes operation is assumed to be 48,000 tons. This inventory number assumes that emissions from smelters would remain constant (no growth or retirements would occur). The 2018 inventory if both smelters resume operation is assumed to be 78,000 tons. This estimate assumes that there will be additional retirement of emissions from the smelter sector, equivalent to the estimates made by the Integrated Assessment System (IAS) used by the Grand Canyon Visibility Transport Commission for the year 2020.

4. Other sources. 1998 inventory data provided by the nine transport region states were used as the base inventory for future year projections. The growth and retirement assumptions developed for the IAS were used to project these emissions to the year 2018. The IAS did not assume any increase in capacity for existing sources, instead, their emissions were retired at a set percentage per year. Any increase in demand for the sector's product, as predicted by the REMI economic model, was assumed to be met by

new sources, operating at a controlled emission rate. The growth and retirement rates, as well as the control efficiency for new sources, vary between sectors.

5. 2018 Baseline Inventory of Projected Actual Emissions (rounded to nearest 1,000)

Utility Emissions	421,000
Front Range Retirement Adjustment	4,000
Co-Gen Units	8,000
Smelter Emissions	48,000
Other Source Emissions	141,000
TOTAL 2018 Baseline	**622,000**

D. 2018 Inventory with Estimated Emission Reductions. The emission reductions estimated for appropriate control technologies applied to BART-eligible sources were then subtracted from the 2018 baseline.

1. CEMs Bias. The federal acid rain program requires coal-fired utilities to monitor SO_2 emissions using continuous emission monitors (CEMs). These monitors measure SO_2 concentration at a point in the stack, and also measure the volume of the gas stream passing through the stack. The combination of the two measurements provides total mass emissions from the stack in tons/year. Prior to the use of CEMs, utilities calculated their emissions using a mass-balance methodology. The sulfur content of the coal was measured, and then total SO_2 emissions were determined by tracking the amount of coal burned.

Two sources of bias result in an over-estimation of emissions as compared to a mass-balance estimation.

- ❑ If two-dimensional probes are used to measure the volume of gas passing through the stack, gas volume will, on average, be over-estimated.

- ❑ If a CEMS malfunctions, the rules require the use of a high-bias estimate in the place of missing data.

The bias varies from plant to plant depending on the specific configuration of the stack, and other variables.

In mid-1999, EPA published a new flow measurement technique that could be used for CEMs under the acid rain program. This new technique is voluntary, and it is not known how many sources will install the equipment (it is significantly more expensive than the existing equipment). The new flow measurement technique is expected to reduce the CEM bias, but bias will never be completely eliminated because of the way emissions are required to be counted when data are missing.

The WRAP recognized that current CEM measurements are biased high, and that compliance measurements to future milestones will be made with CEMs that have less bias than those that were in use in the 1999 base inventory that was used for projecting future utility emissions. However, it is difficult to estimate how many sources will install the new measurement devices, and how much CEM bias will still remain after these changes. Utility emissions in the year 2018 are predicted to be approximately 269,000 tons (after the emission reductions due to appropriate control technology applied to BART-eligible sources). Therefore the WRAP assumed an adjustment of 10,000 tons to account for the CEMs bias.

The WRAP also acknowledges that CEMs are the "gold standard" for determining compliance with the federal Acid Rain Program requirements. A protocol will be developed to make appropriate adjustments to the operation of this component of the regional haze program for participating states and Tribes as improvements in CEMs technology and procedures are implemented. This protocol is necessary to prevent a system of dual book-keeping and to maintain the integrity of compliance with both the federal Acid Rain Program and this proposed backstop cap-and-trade program. The CEMs adjustment protocol is discussed in more detail in the Annex.

2. Operational headroom and uncertainty. The GCVTC agreements and recommendations contain two tenets that have uniquely informed the establishment of operational headroom and uncertainty under the market trading program. First, the Commission recommended that the market trading program "contain specific provisions to encourage and reward early emission reductions, including reductions achieved before 2000."[2] The GCVTC committed to achieve a 13% reduction in SO2 emissions from stationary sources by the year 2000. The GCVTC also recognized that there was a good possibility that actual emission reductions would be greater than this 13% goal. A general plan was derived to give some early reductions credit to the region and some to the environment. The emission reductions that were greater than 13% were to be split, with ½ going to the environment (through the establishment of milestones) and the other ½ providing headroom.[3]

The WRAP currently expects that emissions in the region will show greater reductions than the 13% commitment of the GCVTC. The WRAP has sought to preserve the Commission's approach to early reductions by setting aside as headroom some intermediate portion of the expected reductions in excess of 13%.

Second, the Commission recommended allocations to tribes that are of practical benefit.[4]

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[2] Recommendations for Improving Western Vistas at 33 (June 1996) (emphasis added).

[3] *Id.* at 34.

[4] *Id.* at 35.

This recognized the concern that "tribes, by and large, have not contributed to the visibility problem in the region" and that "[t]ribal economies are much less developed than those of states, and tribes must have the opportunity to progress to reach some degree of parity with states in this regard."[5] The tribes specifically recommended that if an emission trading strategy is adopted to achieve SO2 reductions from stationary sources that allocations be based on considerations of equity rather than historical emissions:

> Credits should not be based on historical emissions, but should be based on equitable factors, including the need to preserve opportunities for economic development on tribal lands. In general, these lands are currently lacking in economic bases and have not contributed to the visibility problems.[6]

Accordingly, the market trading program proposed by the WRAP contains a 20,000 allocation to tribes.

These two considerations – to reward emission reductions occurring between 1990 and 2000, and to provide an equitable allocation to the tribes – originate from the GCVTC recommendations. They reflect distinct policy concerns of the Commission that are unique to the program under section 309 of the regional haze rule incorporating the Commission's recommendations.

In addition, because the baseline emissions inventory is a projection of actual emissions, uncertainty exists in the projection method including, for example, fluctuations in weather and changing economic conditions.

There are inherent uncertainties in the inventory calculation that need to be recognized.

> Inherent measurement uncertainties. CEMs are calibrated daily to a relative accuracy of 20% using calibration gases. Fluctuations in measurements can occur due to the measurement techniques that are not indicative of actual changes in emissions. Pluses and minuses will cancel out to a certain degree, but some consideration of these fluctuations is needed.
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> Projections. Projections of future “actual” emissions are based on the best information available, but are inherently uncertain. This uncertainty increases further out in time. Growth rates may be underestimated, impacts of new technologies or regulatory requirements may have unexpected effects, etc.

The WRAP recognizes that there are some competing uncertainties that the future

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[5] *Id.* at 66-67.

[6] *Id.* at 71.

"actual" emissions may be over-predicted. However, in light of the Commission's specific recommendation to reward early reductions occurring between 1990 and 2000, the WRAP specifically set aside 15,000 tons in 2018 for uncertainty/headroom in addition to the allocation described above for tribes. The 15,000 tons represents 2% of the current SO2 emissions inventory (652,000 tons) encompassed within the trading program.

The WRAP also believes the likelihood exists that the full complement of emissions set aside for uncertainty and headroom will not be utilized. All sources in the region operate below their allowable emissions to ensure that they are in compliance with emission limits. The regional milestones are comparable to allowable emissions because an exceedance of the milestone will trigger regulatory consequences. Individual sources will be tracking their emissions, as well as the overall regional emissions, and the possibility of avoiding a regulatory program will provide a powerful incentive for sources to keep emissions below the cap. This will also provide a disincentive for keeping regional emissions close to the cap, because that will increase the risk that an unexpected event (such as increased production from one sector) will trigger the regulatory program. The incentive to operate below the cap should be especially powerful in 2018 when individual sources will face penalties if the cap is exceeded and a source has emitted SO2 in excess of its allowances.

3. 2018 SO_2 Milestone Calculation

2018 Baseline	622,000
Appropriate Technology Emission Reductions	-168,000
CEM Bias adjustment	-10,000
Uncertainty/Headroom	35,000
Total	**479,000 ≈ 480,000**

In the event the suspended smelters commence operation or the production from those facilities is shifted to other smelters, as much as 30,000 tons may be added to this milestone.

E. Visibility Improvement

Section 169A of the Clean Air Act lists a number of factors that must be considered as part of the BART determination. These factors are addressed in the regional haze rule in a two-step process. First, an analysis of the best system of continuous emission control technology available is performed, considering the statutory factors of cost of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use at the source, and the remaining useful life of the source. Second, an analysis of the degree of visibility improvement that would be achieved in each mandatory Class I federal area as a result

of the emission reductions achievable from all sources subject to BART located within the region. The preamble to the regional haze rule indicates that the visibility analysis should be conducted using the cumulative emission reductions from all BART-eligible sources in the transport region, not the impact of individual sources. The preamble also indicates that the States and Tribes should use this estimated degree of visibility improvement in determining the appropriate BART emission limitations for specific sources.[7]

When defining the visibility impact, the regional haze rule identifies the deciview metric as the appropriate measure of visibility impairment, and improvement. The regional haze rule preamble discusses the value of measuring visibility using a metric that takes into account both measurement of physical changes (i.e., changes in air quality) and human perception.[8] A one deciview change in haziness is a small but noticeable change in haziness under most circumstances when viewing scenes in Mandatory Class I areas.[9] The preamble also recognizes that in some cases a visibility change of less than one deciview is perceptible, while under other conditions a change of more than one deciview might be required in order for the change to be perceptible.[10]

The Regional Haze Rule requires the assessment of reasonable progress in terms of average annual visibility improvement overall, and for each of the 20% of the days in a year with the best and the worst visibility (the first and last quintiles). Regional haze is the product of a wide variety of sources, generally associated with area sources and long-range transport of emissions. Regional haze is, therefore, best assessed using averages, and addressed by strategies that reduce emissions on a region-wide scale.

In keeping with this requirement, the WRAP conducted modeling of the degree of visibility improvement that would occur on average and for the 20% best and worst visibility days. The WRAP used the transfer coefficients developed as part of the Integrated Assessment System (IAS) and used by the Grand Canyon Visibility Transport Commission. This modeling has limitations which must be considered when interpreting the results.

The IAS models were designed to assess regional transport of emissions, and therefore only offers limited insight into the impact of local emission sources. The models are best at demonstrating the relative effects of changes in regional emissions on visibility. One other important limitation involves the number of receptors where pollution data were available. The GCVTC collected data from only six receptors, and ultimately scaled its modeling for only four of these: Hopi Point, Mesa Verde, Canyonlands, and Bryce Canyon. The most detailed

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[7] 64 FR 35741

[8] 64 FR 35726

[9] 64 FR 35725

[10] 64 FR 35726-35727

information came from one receptor, Hopi Point in Grand Canyon National Park.

Although the IAS has limitations, it was the only tool that could realistically be used in the short time frame that was provided to develop an Annex to the Grand Canyon Visibility Transport Commission report. Prior to the development of the IAS, little was understood about the contribution of various emission sources to regional haze. The GCVTC expended considerable time and energy developing the tools that are used today to evaluate the sources of regional haze. The WRAP intends to keep refining and improving the technical tools that are available to better inform policy decisions.

The visibility modeling measured the degree of visibility improvement that would occur at each of the 16 Class I areas due to four different emission reduction scenarios and in comparison to the absence of any regional haze program (i.e., as compared to the baseline emissions inventory). The four scenarios were developed to show the changes in visibility that would occur due to increasingly stringent emission reductions. Table 2 presents the visibility improvements for the scenario that best matches the original WRAP estimate of SO_2 reductions associated with the application of controls on BART-eligible sources, at 155,000 tons, as modeled by ICF in their economic impacts study.

When comparing the results of the visibility analysis for the "Command and Control" scenario to the "MTF" scenario, it is important to recognize the following facts:

- ❑ The emission inventory for the "Command and Control" scenario was developed as part of the economic impacts study by ICF to compare the cost of achieving various levels of emission reduction using a market approach with the cost of achieving similar reductions using a source-specific command and control program.

- ❑ Both the Command and Control and MTF scenarios started with the same baseline emissions inventory for 2018 (648,000 tons)[11].

- ❑ For the Command and Control scenario, ICF applied the MTF BART assumptions to this inventory and calculated 139,000 tons of emissions reductions in 2018. These reductions were subtracted from the baseline, yielding an inventory of 509,000 tons.

- ❑ For the MTF scenario, ICF subtracted the MTF's best estimate of BART reductions at the time (155,000 tons) and added back 35,000 tons for headroom/uncertainty, consistent with the GCVTC recommendations discussed in section D.2., above. This yielded an

[11]Note that the baseline inventory used by ICF is different from that used by the MTF. This is an artifact of the way the economic model was implemented. The important consideration is that the same baseline is used to assess the differences among the options. For details, refer to the ICF final report, Economic Impacts of Implementing a Regional SO_2 Emissions Cap for Stationary Sources in the Western United States (September 2000).

inventory of 528,000 tons.

- ❑ Rounding to the nearest tenth of a deciview -- a level of accuracy beyond which the results cannot be compared with any confidence -- the average visibility benefit of the MTF scenario equals that of the Command and Control scenario -- 0.1 dv.

The use of the "Command and Control" scenario as a surrogate for comparing the visibility benefits of the Annex to a true "BART" scenario is limited because it does not recognize the overall air quality benefits of the emissions caps. Some of the air quality benefits of the emissions caps as compared to a source-by-source BART approach are described in Section F, beginning on page D-17. These benefits include setting caps that limit increased utilization and emission rates at BART and non-BART sources, setting caps based on the assumption that 47,000 tons of emissions from existing non-utility/non-smelter sources will be retired between 1998 and 2018, and setting caps based on the assumption that new source growth will be limited to 27,000 tons between 2003 and 2018. While the "Command and Control" scenario used for the visibility modeling has these same assumptions included, in actuality these benefits would not accrue to a BART program under Section 308 of the Regional Haze Rule. For these reasons , the use of the "Command and Control" scenario as a surrogate for comparing the benefits of the Annex to a true BART scenario is of limited value.

As can be seen, the maximum visibility improvement expected from installation of appropriate control technology for SO_2 on BART-eligible sources in the Western United States, amounts to about one third of a deciview, which is not perceptible to the average person.

Table 3 provides the results of the visibility modeling for an approximation of the four 2018 milestones offered for public comment in May 2000. The modeling distinguishes among the milestones based on the estimated BART level emissions reductions.

These visibility results show that, even under the most aggressive emissions reduction scenario, no perceptible change in visibility will accrue. Further, the visibility improvements of all of the different approaches would be indistinguishable for regional haze purposes. ***This is not intended to imply that the lack of perceptible visibility improvement is a justification for taking no action to reduce SO_2 emissions from stationary sources.*** To the contrary, it emphasizes the need to develop a comprehensive plan that reduces visibility impairing emissions from all types of sources if the goals of Subpart C of Title I of the Clean Air Act are to be achieved in the West.

Table 2

Modeled Visibility Improvement in 2018: Command and Control Scenario

Class I Area	Deciview Improvement		
	20% Best Days	20% Worst Days	Annual Average
Arches National Park	0.17	0.28	0.22
Bryce Canyon	0.02	0.16	0.08
Black Canyon of the Gunnison	0.08	0.08	0.10
Canyonlands	0.16	0.26	0.21
Capitol Reef	0.06	0.21	0.13
Flat Tops	0.09	0.23	0.16
Hopi Point	0.03	0.15	0.09
Maroon Bells	0.10	0.07	0.10
Mesa Verde National Park	0.09	0.35	0.19
Mt. Baldy	0.04	0.20	0.12
Petrified Forest	0.07	0.14	0.11
San Pedro Parks	0.08	0.32	0.21
Sycamore Canyon	0.05	0.08	0.07
Weminuche Wilderness	0.06	0.34	0.18
West Elk	0.10	0.07	0.10
Zion National Park	0.02	0.10	0.06
Average	0.08	0.19	0.13
Min	0.02	0.07	0.06
Max	0.17	0.35	0.22

Table 3

Modeled Visibility Improvement in Deciviews, for 2018: Trading Programs for Four Proposed 2018 Milestones

	Minority Report 95,000 ton reduction			Market Trading Forum 155,000 ton reduction			EPA 177,000 ton reduction			Environmental Groups 220,0000 ton reduction		
Class I Area	20% Best Days	20% Worst Days	Annual Average	20% Best Days	20% Worst Days	Annual Average	20% Best Days	20% Worst Days	Annual Average	20% Best Days	20% Worst Days	Annual Average
Arches National Park	0.03	0.05	0.04	0.13	0.20	0.17	0.14	0.24	0.19	0.19	0.37	0.28
Bryce Canyon	0.01	0.03	0.02	0.02	0.11	0.06	0.02	0.13	0.08	0.04	0.22	0.12
Black Canyon of the Gunnison	0.03	0.03	0.03	0.07	0.07	0.08	0.09	0.08	0.10	0.16	0.15	0.18
Canyonlands	0.03	0.04	0.04	0.13	0.18	0.15	0.13	0.22	0.17	0.19	0.35	0.25
Capitol Reef	0.02	0.04	0.03	0.05	0.15	0.10	0.06	0.18	0.11	0.08	0.27	0.17
Flat Tops	0.04	0.08	0.06	0.07	0.17	0.12	0.08	0.22	0.15	0.12	0.33	0.23
Hopi Point	0.01	0.03	0.02	0.02	0.10	0.06	0.03	0.13	0.08	0.05	0.21	0.13
Maroon Bells	0.03	0.03	0.04	0.08	0.06	0.08	0.10	0.08	0.10	0.15	0.12	0.16
Mesa Verde National Park	0.02	0.05	0.03	0.07	0.25	0.14	0.08	0.31	0.17	0.13	0.47	0.26
Mt. Baldy	0.01	0.04	0.03	0.03	0.13	0.08	0.04	0.17	0.11	0.05	0.28	0.17
Petrified Forest	0.02	0.02	0.02	0.06	0.11	0.08	0.07	0.13	0.10	0.11	0.19	0.15
San Pedro Parks	0.02	0.05	0.04	0.06	0.23	0.15	0.08	0.29	0.19	0.11	0.43	0.29
Sycamore Canyon	0.01	0.01	0.01	0.03	0.04	0.04	0.05	0.07	0.06	0.08	0.12	0.10
Weminuche Wilderness	0.02	0.06	0.04	0.05	0.24	0.13	0.06	0.30	0.16	0.09	0.47	0.26
West Elk	0.03	0.03	0.04	0.08	0.06	0.08	0.10	0.08	0.10	0.15	0.13	0.16
Zion National Park	0.01	0.02	0.02	0.02	0.08	0.05	0.02	0.10	0.06	0.04	0.15	0.10
Average	0.02	0.04	0.03	0.06	0.14	0.10	0.07	0.17	0.12	0.11	0.27	0.19
Minimum	0.01	0.01	0.01	0.02	0.04	0.04	0.02	0.07	0.06	0.04	0.12	0.10
Maximum	0.04	0.08	0.06	0.13	0.25	0.17	0.14	0.31	0.19	0.19	0.47	0.29

F. Other Considerations

There are a number of other considerations that must be taken into account in the overall determination as to whether or not the 2018 milestone developed by the WRAP achieves greater reasonable progress than would be achieved by the application of BART.

1. Remedy and Prevention. When Congress established the visibility program in 1977 it declared as a national goal "the prevention of any future, and the remedying of any existing" anthropogenic visibility impairment in mandatory class I federal areas.[12] BART is an emission limitation established at a specific source and is designed as a remedy to impairment at specific mandatory Class I areas. By contrast, the market trading program proposed by the WRAP serves the dual purpose of remedying existing impairment and preventing future impairment by requiring regional SO2 emissions reductions and capping emissions for stationary sources. Future impairment is prevented by capping emissions growth from sources not eligible under the BART requirements, from BART sources that are expected to significantly increase utilization, and from entirely new sources in the region.

2. Additional Sources Included. The backstop trading program designed by the WRAP will include all stationary sources with emissions higher than 100 tons/year of SO_2. The WRAP designed this program as part of an overall strategy to address all sources of visibility impairing pollutants, rather than focusing on a subset of stationary sources.

	Number of Sources	2018 SO_2 Emissions*
BART-Eligible	47	201,615
Other Stationary Sources	157 +	246,570

**Note: The 2018 Emission estimate does not include 2 shut down smelters, or a CEM's bias adjustment. The estimate includes an emission reduction estimate of 168,000 from BART-eligible sources.*

The inclusion of all major SO_2 sources in the program is necessary to create a viable trading program, and also serves a broader purpose to ensure that growth in emissions from non-BART-eligible sources does not undermine the progress that has been achieved. BART applied on a case-by-case basis would not affect these sources, and there would be no limitation on their future operations under their existing permit conditions. Because the milestones will cap these sources at actual emissions (which are less than current allowable emissions), the overall effect of their inclusion is to provide greater reasonable progress than would have been achieved if only BART-eligible sources were included in the program.

[12] CAA § 169A(a)(1).

3. Cap on New Source Growth. The milestones designed by the WRAP will cap the growth of SO_2 emissions in the west. These milestones include estimates for growth, but then lock these estimates in as an enforceable emission cap. The WRAP strategy is consistent with the statutory goal of preventing any future visibility impairment that results from man-made air pollution. The entire region is experiencing rapid growth which could erode the progress that has been achieved in the last two decades towards improving visibility. BART applied on a case-by-case basis would have no impact on future growth, and in the long run would not achieve the regional emission reductions that are guaranteed by the program.

4. Actual vs. Allowable Emissions. The baseline emission projections, and assumed reductions due to the application of appropriate retrofit controls to BART-eligible sources, are all based on actual emissions, using either 1998 or 1999 as the baseline. The use of actual emissions has an effect in several ways. If the BART process was applied on a case-by-case basis to individual sources, emission limitations would be established based on the maximum level of operation of the unit. The "allowable emissions" are typically higher than actual emissions, because sources do not always run under full load conditions, over the full year's available time. In addition, the allowable emissions would account for variations in the sulfur content of fuel and alternative operating scenarios. The difference between actual emissions and allowable emissions is particularly large when a source is permitted to burn two different fuel types, such as oil and natural gas, or when the source is part of a cyclical industry where production varies from year to year due to the changing demand for their product.

The WRAP's method of emission projections allows for some increase in capacity for the electric utility industry which will partially address this difference between actual and allowable emissions. Even in this case, the utilities are assumed to operate at an average of 85% of nameplate capacity, even though they are permitted to operate at 100% capacity. Non-utility sources, on the other hand, are assumed to retire at a certain percentage rate each year with no provision for emission growth from existing sources. Any growth that is projected for those industries (refineries, pulp and paper, cement, etc.) is assumed to be met by new sources at highly controlled emission rates.

In addition to the cap on growth of actual emissions, the difference between an emission projection for future years, and a regional emission cap must also be considered. The milestones will act as a regulatory trigger that will be converted into an enforceable emission cap if the milestones are not met. This essentially creates a regional "allowable" emission level. When sources are managing their operations they have a large incentive to maintain headroom under any enforceable limit to ensure that they stay in compliance. This process is expected to happen on a voluntary basis prior to the program trigger, and will be strengthened if the milestones become enforceable emission caps. The net effect is that compliance with the milestones should lead to actual emissions that are below the milestone. The difference between actual emissions and allowable emissions is commonly referred to as headroom.

5. Mass-based Cap vs. Rate-Based Emission Limits for BART. Emission limitations for stationary sources (including BART limits) are typically expressed as emission rates (lbs/hour or lbs/MMBtu), while the WRAP milestones are expressed as total mass during a given year (tons/year). One effect of this difference is that rate-based limits can lead to higher emissions when production is increased or when higher sulfur fuel is used, as explained in the discussion of actual vs. allowable emissions above. Another difference is that mass-based limits will include excess emissions that may occur due to malfunctions or during the start-up or shut-down of emission units. A good example of this difference is the requirement in the acid rain program that emissions must be assumed to be the highest value recorded from the past year during the time period that continuous emission monitors are not functioning on a stack. These higher emissions are calculated as part of the overall tons/year, and must be accounted for under the mass-based cap for the acid rain program.

6. 1990 as a baseline for Section 309 Regional Haze Plans. The regional haze rule recognized the significant work that had been completed by the Grand Canyon Commission, and section 309 of the rule was therefore designed to incorporate the Commission recommendations. A key element of this section of the rule is the use of 1990 as a baseline for measuring progress. There have been significant emission reductions in the west since 1990, and this improvement needs to be considered when measuring the overall effects of the Commission's strategies. The Commission established a goal of a 13% reduction from 1990 emissions. It is anticipated that the actual emission reductions in the region will be closer to 20%. Emission reductions due to the application of appropriate retrofit technology on BART-eligible sources between 1990 and 2018 are estimated to be 287,176 tons of SO_2 (See Table 4). This estimate includes a reduction of 119,000 tons of SO_2 from BART-eligible sources that have occurred or have been legally committed to between 1990 and 2000 (assuming that these plants are operating at 85% of nameplate capacity). The 2018 milestone of 510,000 represents a regional emission reduction of around 321,000 tons of SO_2 from the 1990 baseline emissions of 831,000 tons. This overall reduction due to the milestones is approximately 35,000 tons greater than what has been estimated due to the application of appropriate retrofit technology to BART-eligible sources.

Table 4
Calculation of BART-Level Emissions Reductions from the 1990 Baseline

Facility and Unit	1990 Emissions	1990 Capacity	1990 level of control	Emissions at 85% capacity	Level of control	Emissions after Controls	Emissions Reductions
Navajo #1	20,497	62%	0%	27,952	90%	2,050	18,447
Navajo #2	26,101	81%	0%	27,252	90%	2,610	23,491
Navajo #3	29,621	90%	36%	29,621	90%	2,962	26,659
Hayden #1	4,857	77%	0%	5,344	85%	729	4,128
Hayden #2	6,420	78%	0%	7,039	85%	963	5,457
Cherokee #4	4,689	55%	38%	7,298	85%	703	3,986
Valmont #5	3,007	65%	0%	3,924	85%	451	2,556
Mojave #1	21,605	56%	0%	32,834	85%	3,241	18,364
Mojave #2	18,720	68%	0%	23,297	85%	2,808	15,912
Total Effected and Planned Emission Reductions from BART-eligible sources							**119,000**
WRAP Calculated BART-level reductions (rounded to nearest 1,000, from allstat7.xls)							168,000
TOTAL							**287,000**

7. Commission Strategies are a Total Package. The GCVTC recommendations go well beyond stationary sources, and include strategies to address mobile sources, prescribed fire, pollution prevention, and emissions in and near Mandatory Class I areas. The reductions from these additional strategies have not yet been quantified, but are expected to be significant. The stationary source strategies need to be viewed as part of this overall package. Visibility impairment in the west is caused by multiple sources and pollutants, and a narrow focus on stationary sources may not achieve the same results as a broad-based program. The WRAP is in the process of quantifying the effect of the rest of the Commission's strategies, and the entire package will be included in the State and Tribal Implementation Plans in 2003.

G. Comparison of Trading vs Command and Control BART Requirements. One additional issue that must be considered when determining if the 2018 milestone achieves greater reasonable progress than BART is the geographic location where emission reductions will occur. For example, if all of the emission reductions under a trading program scenario are concentrated in one small part of the region, the visibility improvement may be less than what would be achieved if reductions occurred at specific locations under a command and control approach.

To address this question, the WRAP modeled the improvement in visibility impairment that would occur under two different scenarios: a command-and-control scenario where the emission reductions due to the application of appropriate retrofit controls on BART-eligible sources were assumed to occur at locations, and a second scenario where least-cost modeling was used to identify where these same emission reductions would occur under a trading program. The visibility transfer coefficients and control cost assumptions developed as part of the Integrated Assessment System were used for this analysis. Tables 2 and 3 provide the data for the comparison of the visibility improvement associated with these two approaches

The results of this analysis showed that there would be an imperceptible improvement in visibility impairment under the command-and-control scenario. The maximum difference between the two scenarios at any of the 16 Class I areas was only 0.1 deciview.