# Analysis of Visibility Impacts of BART-Eligible Sources on the Regional Scale

# Technical Support Document

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## I. REGULATORY BACKGROUND

The requirement to examine the impact of certain categories of air pollution sources upon atmospheric clarity in downwind national park and wilderness areas originates in Section 169A of the Clean Air Act (CAA), is implemented in the Regional Haze Rule of 1999 (64 FR 35714, July 1, 1999), and is prescribed in further detail in "Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations; Final Rule" (70 FR 39104, July 6, 2005). The categories that fall within the scope of the rule are those stationary sources that:

- have the potential to emit 250 tons per year of a visibility-impairing air pollutant;
- were put in place between August 7, 1962 and August 7, 1977; and
- perform operations falling within one or more of 26 specifically listed source categories.

A source meeting the above criteria (described as a "BART-eligible source") must be equipped with BART emission controls if the State in which it is located determines that it "emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in any [national park or wilderness area]." If the State determines that the source causes or contributes to a sufficient degree, then it is a "source subject to BART," for which the State must make a further determination of the level of emission control that will suffice to satisfy the definition of BART as codified in 40 CFR 51.308(e)(1)(ii). 40 CFR 51.308(e)(1)(iii) states the determination must be based on analysis of the best system of continuous emissions control available and reductions achievable and identifies the factors that the State must consider in making the source-specific BART determination:

- the technology available;
- the costs of compliance;
- the energy and non-air quality environmental impacts of compliance;
- any existing pollution control technology in use 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.

However, 40 CFR 51.308(e)(2) provides that a State may impose a cap-and-trade emissions program in lieu of BART requirements, if it can be shown that the program will provide a greater rate of progress toward visibility improvement goals than would BART. The U.S.EPA has determined that the cap-and-trade provisions of the Clean Air Interstate Rule

(CAIR) under 40 CFR Part 96 AAA-EEE do establish such a program in relation to SO2 and NOx emissions from Electric Generating Units (EGUs), and this determination that CAIR is an acceptable alternative to BART for EGU's has been codified in 40 CFR 51.308(e)(4).

The U.S.EPA is required under 40 CFR 51.308(e)(1)(ii)(B) to issue guidelines for States to follow in establishing BART emission limitations for fossil-fuel fired EGU's of capacity greater than 750 megawatts, and this requirement is fulfilled by Appendix Y to 40 CFR Part 50. For this category the guidelines are mandatory (unless the sources are covered by an acceptable CAIR program), but for other BART-eligible sources, the U.S.EPA states " . . . we do encourage States to follow the guidelines for all source categories but are not requiring States to do so. States should view the guidelines as helpful guidance for these other categories." (preamble, 70 FR 39108)

## II. OVERVIEW OF PROJECT

This BART analysis was developed with extensive technical assistance provided by the Lake Michigan Air Directors Consortium and the Midwest Regional Planning Organization (LADCO/MRPO).

The preliminary stages of the BART analysis included the following activities:

- Review of the Ohio EPA/Division of Air Pollution Control (OEPA/DAPC) emissions inventory files, to identify candidate sources for BART eligibility, based on SIC code and installation date. This review turned up 35 candidate facilities, including 14 EGUs (the preliminary list of eligible EGUs is attached as Appendix H); and

- Sending of questionnaires to the 21 potentially affected non-utility facilities identified in the review of the inventory files. A sample questionnaire is provided as Appendix B.

To determine which sources need not be subject to BART, USEPA identified three approaches in the BART Guidelines:

(1) Individual Source Attribution Approach (Dispersion Modeling)

Under this option, CALPUFF (or other appropriate models) can be used to show that SO2, NOx, and direct PM emissions from an individual source do not cause or contribute to visibility impairment in a Class I area. The first step in this approach is to prepare a modeling protocol. Following release of the final BART rule, LADCO drafted a CALPUFF modeling protocol ("Single Source Modeling to Support Regional Haze BART" contained in Appendix F-m)[1]. For the purposes of this analysis, the threshold value used to determine whether a source causes or contributes to visibility impairment is 0.5 deciviews (dv).

Analysis by LADCO showed there were more than 100 BART-eligible non-EGU sources in the 5-state region. CALPUFF modeling for all these sources was not considered necessary. This is because previous CALPUFF modeling (conducted in response to USEPA's proposed BART rule) indicated that only sources with a Q/d value > 10 – 20 had more than a 0.5 dv visibility impact in a nearby Class I area (LADCO's "Determining Which BART-Eligible Sources are Subject to BART: Summary", December 21, 2004.) Consequently, new CALPUFF runs were performed with those sources with a Q/d value > 5. (The Q/d values were calculated using the minimum distance to a Class I area and potential emissions, if available, or actual emissions, if potential emissions were not available.)

(2) Use of Model Plants

Under this option, analyses of model plants can be used to exempt sources that share specific characteristics. CALPUFF modeling was performed by USEPA of model plants (EGUs and non-EGUs) with representative plume characteristics to assess the visibility impact from emission sources of difference sizes and distances from two hypothetical Class I areas (one in the East and one in the West). Based on these analyses, USEPA

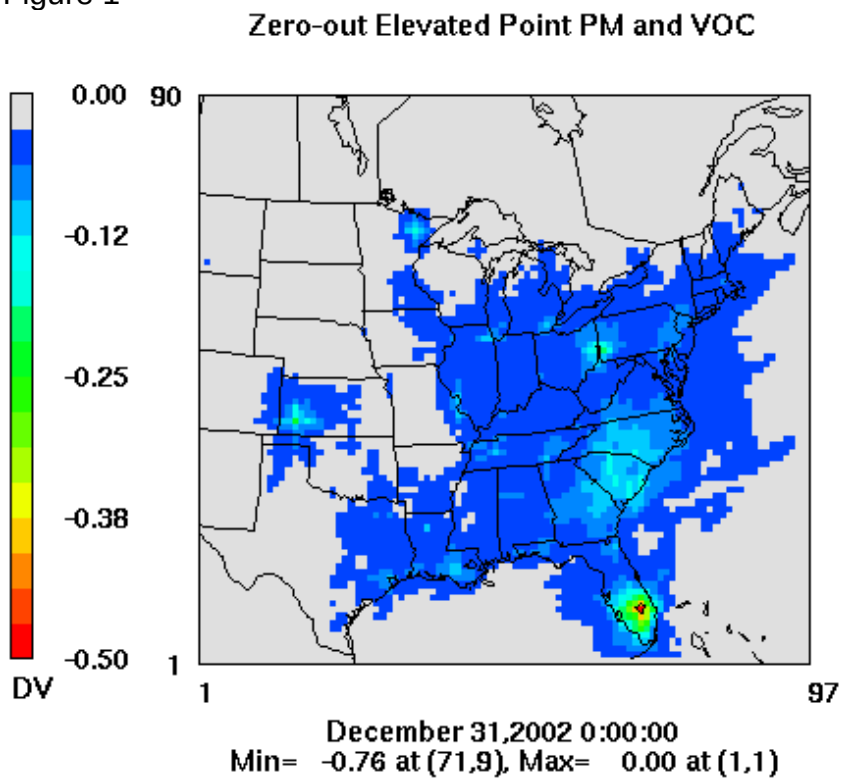
[1] The procedures and assumptions in this CALPUFF modeling are specific to the BART analysis (i.e., to help determine which BART-eligible sources are subject to BART), and may not necessarily be applicable to CALPUFF modeling performed for other purposes, including new source review analyses.

concluded that if a State establishes 0.5 dv as a contribution threshold, then the State could exempt sources with combined SO2 and NOx emissions of less than 500 TPY located more than 50 km from a Class I area, or less than 1000 TPY located more than 100 km from a Class I area. (Note, in "Q&A's for Source by Source BART rule" of July 6, 2005" (Revision 1, October 31, 2005), USEPA approved the use of these emissions-distance criteria by states to exempt sources from BART review.) These emissions-distance criteria are consistent with a Q/d value < 10.

(3) Cumulative Modeling

Under this option, modeling of total visibility impacts from all BART-eligible sources in a given state can be used to show that they collectively do not cause or contribute to visibility impairment in a Class I area. This approach was used to assess the likelihood that VOC and PM emissions will not cause or contribute to visibility impairment. Specifically, CAMx was run with all point source VOC and PM emissions eliminated ("zeroed-out") to assess the contribution of these species to visibility impairment. The model results, which are presented in Figure 1, show that these emissions do not contribute to visibility impairment (i.e., less than a 0.5 dv impact in any Class I area). Because the VOC and PM emissions from just the BART-eligible sources are much less than those from all point sources, the visibility impact of these emissions from the BART-eligible sources will be much less than 0.5 dv in any Class I area. Thus, these emissions can be excluded from BART review. In addition, ammonia emissions can be excluded from BART review, given that these emissions from the BART-eligible sources are relatively small (i.e., ammonia emissions from all point sources make-up only 1% of the total ammonia emissions in the region).

Figure 1




The result of the preliminary review was that twelve facilities were identified as needing a detailed analysis using the CALPUFF computer model. This includes one facility (Degussa) which was overlooked at the outset, and several that were provided a Q/D analysis based on faulty source locations. Ohio EPA determined CALPUFF modeling would be conducted rather than reanalyzing the Q/D calculation for those facilities. Appendix D contains the results of the analysis along with the Q/D values.

LADCO identified a subset of 17 Class I areas that may be impacted by sources in the LADCO states. These areas (which number 16 when Dolly Sods and Otter Creek wilderness areas are considered jointly) are listed and plotted in Appendices E and F-i. The visibility impacts of these twelve facilities upon the 16 Class I areas were modeled with CALPUFF, using three years of meteorological data (2002, 2003, and 2004). The operation of the model was consistent with LADCO's protocol document and employed run scripts and postprocessor routines supplied by LADCO. The basis for the mass rates of emission varied from source to source. Generally, permit allowables were used, but where emissions were not restricted by permit, actual values were found in Ohio EPA's emission inventory or in data supplied by the company. If the data were taken from the annual inventory, the annual release was divided by actual hours of operation (also found in the inventory) to arrive at the pounds per hour to be used for modeling. This approach was judged to be satisfactory for facilities with impacts well below the eight days/year exceedance level, but inadequate for the one source, P. H. Glatfelter Company, with a larger impact. For Glatfelter, three years of

daily emission data were reviewed, to identify the single day of highest combined emission of all BART-eligible sources. This gave rise to a modeled emission rate higher than would have been used if permit allowables had served as the basis. (This does not indicate a violation by Glatfelter, since the permit allowable is based on a 30-day averaging period.) Notes on the model inputs for each facility appear in Appendix F-l.

The CALPUFF modeling showed one facility (Glatfelter) with visibility impacts well above the eight days per year threshold, and all other facilities well below. Accordingly, this study finds that Glatfelter's two large coal fired boilers are the only non-utility "subject to BART" sources in Ohio. Glatfelter has worked cooperatively with Ohio EPA to identify potential emission controls and analyze all the site-specific factors that are required as part of a BART determination. The proposed BART determination for Glatfelter is presented in Section IV and Appendix G of this TSD.

## III. SUMMARY OF MODELING INPUTS AND RESULTS

| | Modeled quantities (g/s) | | | Number of exceeding days | | |
|---|---|---|---|---|---|---|
| | **SO2** | **NOx** | **PM** | **2** | **3** | **4** |
| Cemex | 105 | 122.3 | 6 | 1 | 1 | 3 |
| Chemtrade Logistics | 45.9 | 0.003 | 0.07 | 0 | 0 | 0 |
| Cinergy Solutions | 113.4 | 32.1 | 7.4 | 1 | 0 | 2 |
| Cognis | 103.3 | 60.2 | 8.6 | 2 | 1 | 3 |
| Degussa | 36.6 | 7.5 | 1.1 | 0 | 0 | 0 |
| P. H. Glatfelter | 1308.9 | 59.3 | 0.9 | 23 | 37 | 38 |
| Martin Marietta | 399.8 | 64.9 | 28.2 | 4 | 3 | 1 |
| Ormet | 163 | 0.0025 | 0.9735 | 0 | 1 | 3 |
| Owens Corning | 101.1 | 44.9 | 47.7 | 0 | 0 | 0 |
| Premcor | 398.7 | 44.01 | 15.79 | 2 | 2 | 3 |
| Sun | 405.39 | 46.69 | 14.74 | 3 | 3 | 3 |
| WCI Steel | 319.8 | 18.2 | 8.1 | 2 | 1 | 1 |

## IV. P. H. GLATFELTER COMPANY COMPLIANCE PLAN

Glatfelter embarked upon a BART analysis predicated upon directions given to them by the Ohio EPA concerning the identity of the pollutant(s) requiring control and the minimum degree of control likely to be acceptable. These directions were based on modeling performed by Ohio EPA for the purpose of assessing relative benefits of $SO_2$ versus NOx versus particulate control. "Zero-out" runs in which emission of each pollutant in turn was totally eliminated show the following:

**Max. days above threshold for any of years 2002, 2003, or 2004**

| | Uncontrolled | NOx zeroed | $SO_2$ zeroed | PM zeroed |
|---|---|---|---|---|
| Shenandoah | 38 | 35 | 0 | 38 |
| Dolly Sods | 31 | 31 | 0 | 31 |
| Mammoth Cave | 22 | 21 | 0 | 22 |

Several 50% runs were also performed, to discover if any significant synergism would result from combined control of $SO_2$ and NOx:

| | 50% SO2 | 50% NOx | 50% SO2 + 50% NOx |
|---|---|---|---|
| Shenandoah | 11 | 36 | 10 |
| Dolly Sods | 11 | 31 | 9 |
| Mammoth Cave | 8 | 22 | 8 |

In view of the fact that 100% control of $SO_2$ brings the number of above-threshold days in the most-impacted area from 38 days down to zero, whereas 100% NOx control only brings it down to 35 days, it was judged that the benefit of NOx control would be a full order of magnitude less than for $SO_2$, and on that basis the current controls on NOx were judged to be acceptable. Likewise, the benefit of control of primary particulate is negligible compared to $SO_2$.

The complete BART analysis prepared for Glatfelter by BE & K Engineering is enclosed as Appendix G. The company and their consultant reviewed a number of possible retrofit technologies and rejected several of them either on the grounds of impracticality, or on the basis of being dominated by another, superior technology offering equal or better pollutant removal at equal or lesser cost. Three technologies passed the initial review and were subjected to a more detailed analysis, namely:

- Wet FGD
- Semi-Dry FGD
- Overfire Air and Sorbent Injection System (OASIS)

The three processes are capable of 90, 90, and 60 percent sulfur dioxide removal, respectively. The processes may be capable of some amount of NOx removal, as well, but the Company did not attempt to quantify the NOx reductions, based on guidance from Ohio EPA to the effect that the potential visibility improvements from NOx reduction were very minimal compared to $SO_2$. Moreover, their combustion equipment is already low-NOx, as described in Appendix G, Section 2.0.

The three technologies have similar costs on a basis of dollars per ton of pollutant removed. Their financial analysis was based on a Monte Carlo analysis, with capital and operating costs being permitted to fluctuate generally within a plus/minus 10 percent range, and the amortization period held constant at 10 years and the discount rate at 15%. Their analysis shows the following (taken from Appendix G, Sections .2.0, 5.3, 5.4, and 7.5) (note: units are millions of dollars, except as noted, with negative quantities in parentheses; extrema of ranges not shown):

| | Wet FGD | Semi-Dry FGD | OASIS |
|---|---|---|---|
| Design & construction | $26.0 | $34.3 | $19.4 |
| Operation & maintenance (per year) | $9.72 | $6.96 | $5.47 |
| SO2 removed (TPY) | 20,515 | 20,515 | 13,677 |
| NPV (Net Present Value) | ($56.29) | ($52.10) | ($35.52) |
| NPV / SO2 (dollars per ton) | ($2744) | ($2540) | ($2597) |

Taking this analysis into consideration in conjunction with the CALPUFF modeling results, Ohio determined that a process capable of 90 percent SO2 removal was appropriate. Upon further discussions with Glatfelter it was decided that Glatfelter would implement an alternative program to BART as allowed under 40 CFR 51.308(e)(2). An alternative BART measure must achieve greater reasonable progress than would be achieved through the installation and operation of BART. If the alternative measure results in greater emission reductions, then the alternative measure is deemed to achieve greater reasonable progress. As part of a broader business strategy to improve energy efficiency, Glatfelter will be implementing an alternative approach that will achieve greater emission reductions than the 90 percent SO2 removal projected under traditional BART. This approach includes installing control technology sufficient to achieve greater than BART SO2 removal on boiler numbers B002 and B003 or permanently shutting down the boiler(s). Ohio EPA will implement the requirement as a modification to Glatfelter's permit-to-install (PTI). Prior to implementing the alternative BART, the Company will be issued a modified PTI, and prior to startup of any new equipment, within the 5-year time frame specified under 40 CFR 51.308 (e)(1)(iv), permit restrictions will be in force assuring continuous effective operation of a control process capable of greater than 90 percent sulfur dioxide removal.