May 15, 2006

Peter Courtney
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Environmental Protection Division - Air Protection Branch
4244 International Parkway, Suite 120
Atlanta, Georgia 30354

Re: Protocol for Best Available Retrofit Technology Exemption Modeling: Brunswick Mill

Georgia-Pacific Corporation (GP) is pleased to submit this Protocol for Best Available Retrofit Technology (BART) Exemption air modeling for our pulp and paper facility in Brunswick, Georgia. BART is required for any eligible source that ‘‘emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility” in any mandatory Class I federal area. 40 CFR Part 51 Appendix Y states, “*You can use dispersion modeling to determine that an individual source cannot reasonably be anticipated to cause or contribute to visibility impairment in a Class I area and thus is not subject to BART*.” The enclosed protocol describes our proposal for this dispersion modeling. The VISTAS Regional Planning Organization (RPO) is providing the technical resources for the analysis through their contractor, Earth Tech. While many of the components of a protocol for this analysis are thoroughly documented in the VISTAS common protocol, this document provides source-specific information.

We look forward to addressing any questions or concerns you have with this protocol. Please contact me at (404) 652-4293; FAX (404) 654-4706; mjaguila@gapac.com.

Sincerely,

Mark J. Aguilar P.E.
Senior Environmental Engineer
Georgia-Pacific Corporation

Cc: Jill Holmes, Brunswick Mill

1.0 INTRODUCTION

1.1. Overview of the Regional Haze BART Process

Under regional haze regulations, the Environmental Protection Agency (EPA) has issued final guidelines dated July 6, 2005 for Best Available Retrofit Technology (BART) determinations (70 FR 39104-39172). The regional haze rule includes a requirement for BART for certain large stationary sources, such as our pulp & paper facility in Brunswick, Georgia. Sources are BART-eligible if they meet three criteria on potential emissions of visibility-impairing pollutants, the date when the source was put in place and fall within one of the source categories listed in the guidance. The guidance requires a BART engineering evaluation using five statutory factors for any BART-eligible source that can be reasonably expected to cause or contribute to impairment of visibility in any Class I areas protected under the regional haze rule. (Note that, depending on the five factors, the evaluation may result in no control.) Air quality modeling is an important tool available to the States to determine whether a source can be reasonably expected to contribute to visibility impairment in a Class I area.

The process of establishing BART determination consists of four steps:

1) Identify whether a source is "BART-eligible" based on its source category, when it was put in service, and the magnitude of its emissions of one or more "visibility-impairing" air pollutants. The BART guidelines list 26 source categories of stationary sources that are BART-eligible. Sources must have been put in service between August 7, 1962 and August 7, 1977 in order to be BART-eligible. Finally, a source is eligible for BART if potential emissions of visibility-impairing air pollutants are greater than 250 tons per year. Qualifying pollutants include primary particulate matter (PM_{10}) and gaseous precursors to secondary fine particulate matter, such as SO_2 and NO_x. VISTAS has determined that neither ammonia nor volatile organic compounds (VOCs) should be included as visibility-impairing pollutants for BART eligibility.

2) Determine whether a BART-eligible source can be excluded from BART controls by demonstrating that the source cannot be reasonably expected to cause or contribute to visibility impairment in a Class I area. The preferred approach is an assessment with an air quality model such as CALPUFF or other appropriate model followed by comparison of the estimated 24-hr visibility impacts against a threshold above estimated natural conditions to be determined by the States.[1] The threshold to determine whether a single source "causes" visibility impairment is set at 1.0 deciview (dv) change from natural conditions over a 24-hour averaging period in the final BART rule (70 FR 39118). The guidance also states that the proposed threshold at which a source may "contribute" to visibility impairment should not be higher than 0.5 dv although, depending on factors affecting a specific Class I area, it may be set lower than 0.5 dv. The test against the

[1] Guidance to determine the level of the natural conditions baseline for BART modeling purposes is still under development by VISTAS members states and EPA Region IV.

threshold is "driven" by the contribution level, since if a source "causes", by definition it "contributes".

3) Determine BART controls for the source by considering various control options and selecting the "best" alternative, taking into consideration:

a) Any pollution control equipment in use at the source (which affects the availability of options and their impacts),
b) The costs of compliance with control options,
c) The remaining useful life of the facility,
d) The energy and non air-quality environmental impacts of compliance, and
e) The degree of improvement in visibility that may reasonably be anticipated to result from the use of such technology.

Note that if a source agrees to apply the most stringent controls available to BART-eligible units, the BART analysis is essentially complete and no further analysis is necessary (70 FR 39165).

4) Incorporate the BART determination into the State Implementation Plan for Regional Haze, which is due by December 2007.

Step 2 described above reflects 40 CFR Part 51 Appendix Y which states that, "*You can use dispersion modeling to determine that an individual source cannot reasonably be anticipated to cause or contribute to visibility impairment in a Class I area and thus is not subject to BART.*" (70 FR 39162) This "individual source attribution approach" determines if a BART-eligible source (*i.e.*, collection of eligible emission units at a source) is predicted to cause or contribute to visibility impairment in a Class I area. As mentioned above, a predicted impact of 1.0 dv change or more is considered to "cause" visibility impairment, and a predicted impact of 0.5 dv change or more is considered to "contribute". Any source determined to cause or contribute to visibility impairment in any Class I area is subject to BART.

1.2. Organization of the Protocol

Section 2 presents facility-specific information. Section 3 presents the contribution by VISTAS for the BART exemption analyses. Section 4 summarizes the exemption process, modeling approach, and model configuration. Section 5 presents the criteria and processing of model results to demonstrate what impairment, if any, the facility is predicted to create in the Class I areas. Section 6 presents the Quality Assurance Plan.

The exemption modeling is completed in two phases: screening and refined. The sections below also identify how values in model input, exemption criteria, and model approach are different in these two phases.

2.0 SITE DESCRIPTION

The Brunswick Mill is located along the Turtle River, approximately 15km upchannel from the Atlantic Ocean. The area surrounding the Mill is largely rural or undeveloped to the north and west, open water to the south, and generally flat in all directions. Figure A-1 presents a topographic map of the G-P Brunswick Mill vicinity.

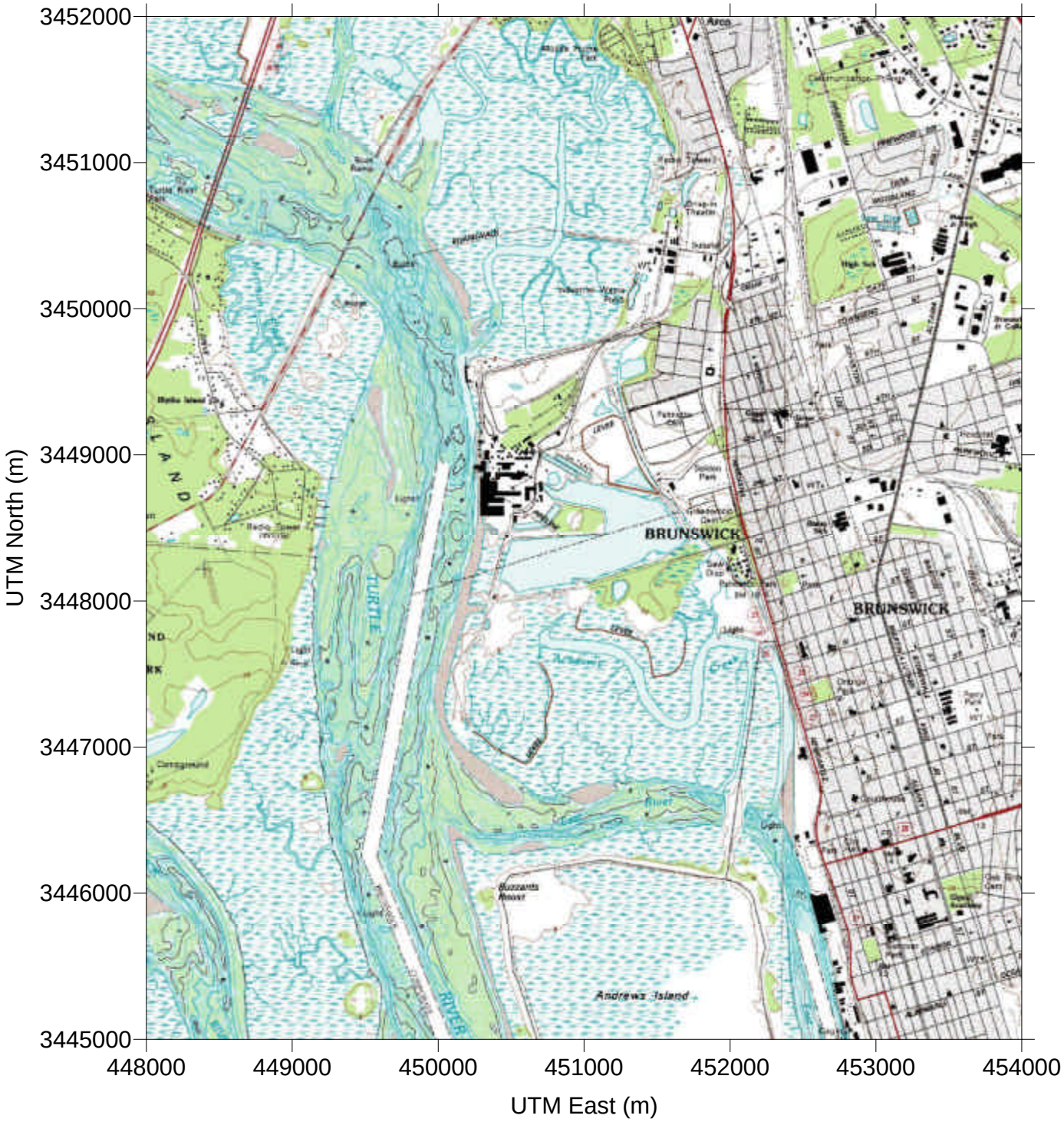
The Brunswick Mill is a major manufacturer of paper products and fluff pulp. Operations at the facility include pulping, steam generation, bleaching, papermaking, and converting. The feedstock used by a paper mill can come from a variety of sources, including virgin wood and recycled paper (post-manufacturing and post-consumer). The Mill recycles all paper trimmings and damaged paper (broke) within the plant. The papermaking operations at the Brunswick Mill consist of three paper machines (Nos. 3, 4, and 5). The steam plant at the Mill consists of one multi-fuel boiler (No. 4 Power Boiler) which primarily combust bark/wood waste, fuel oil, natural gas, and two power boilers (Nos. 6 and 7) capable of firing natural gas and No. 6 fuel oil. The steam generated in these boilers is sent to a common header for distribution in the Mill.

The only BART-eligible emission units are the No. 5 Recovery Furnace (with 2 stacks), No. 4 Paper Machine, and No. 5 Smelt Dissolver Tank.

Table 1. Source Parameters, Brunswick Mill BART Eligible Units

Stack ID #			R401	R402	MG04	R403
Emissions Unit Name			No. 5 Recovery Furnace	No. 5 Recovery Furnace	No. 4 Paper Machine	No. 5 Smelt Dissolver Tank
Location UTM	East	km	450.275	450.276	450.347	450.275
	North	km	3448.723	3448.713	3448.460	3448.732
	Zone		17	17	17	17
	Datum		NAR-C	NAR-C	NAR-C	NAR-C
Stack Height		m	82.9	82.9	19.8	80.5
Base Elevation		m	1.5	1.5	1.5	1.5
Diameter		m	3.95	3.95	3.66	1.04
Gas Exit Velocity		m/s	8.20	8.20	14.33	18.6
Stack Gas Exit Temp.		K	474	474	339	350

Figure 1. Topographic Map of Brunswick Mill Vicinity



(Source: USGS)

Table 2. Maximum 24-hour Actual Emissions, Brunswick Mill BART Eligible Units.

Parameter		No. 5 Recovery Furnace (N Stack)	No. 5 Recovery Furnace (S Stack)	No. 4 Paper Machine	No. 5 Smelt Dissolver Tank
Fuels		Black Liquor	Black Liquor	None	None
Existing Control Equipment		ESP	ESP	None	Scrubber/ Demister
SO_2 Emissions	gram/sec	3.88(a)	3.88(a)	0	0.16
H_2SO_4 Emissions	gram/sec	0.225	0.225	0	0
NOx Emissions	gram/sec	10.4	10.4	0	0.35
PM_{10} Emissions	gram/sec	2.61(b)	2.61(b)	0.111	2.1
$PM_{2.5}$ Emissions	gram/sec	1.6	1.6	0.111	1.9
PM Speciated Emissions %	filterable %	88	88	No data	84
	condensable%	12	12	No data	16

Notes:

(a) Maximum short term emissions reflect 100% Black Liquor firing at a rate of 4 millions lbs BLS/day. The Mill has tested emission for this source to determine that maximum actual emissions are less than 260 tpy of SO_2.

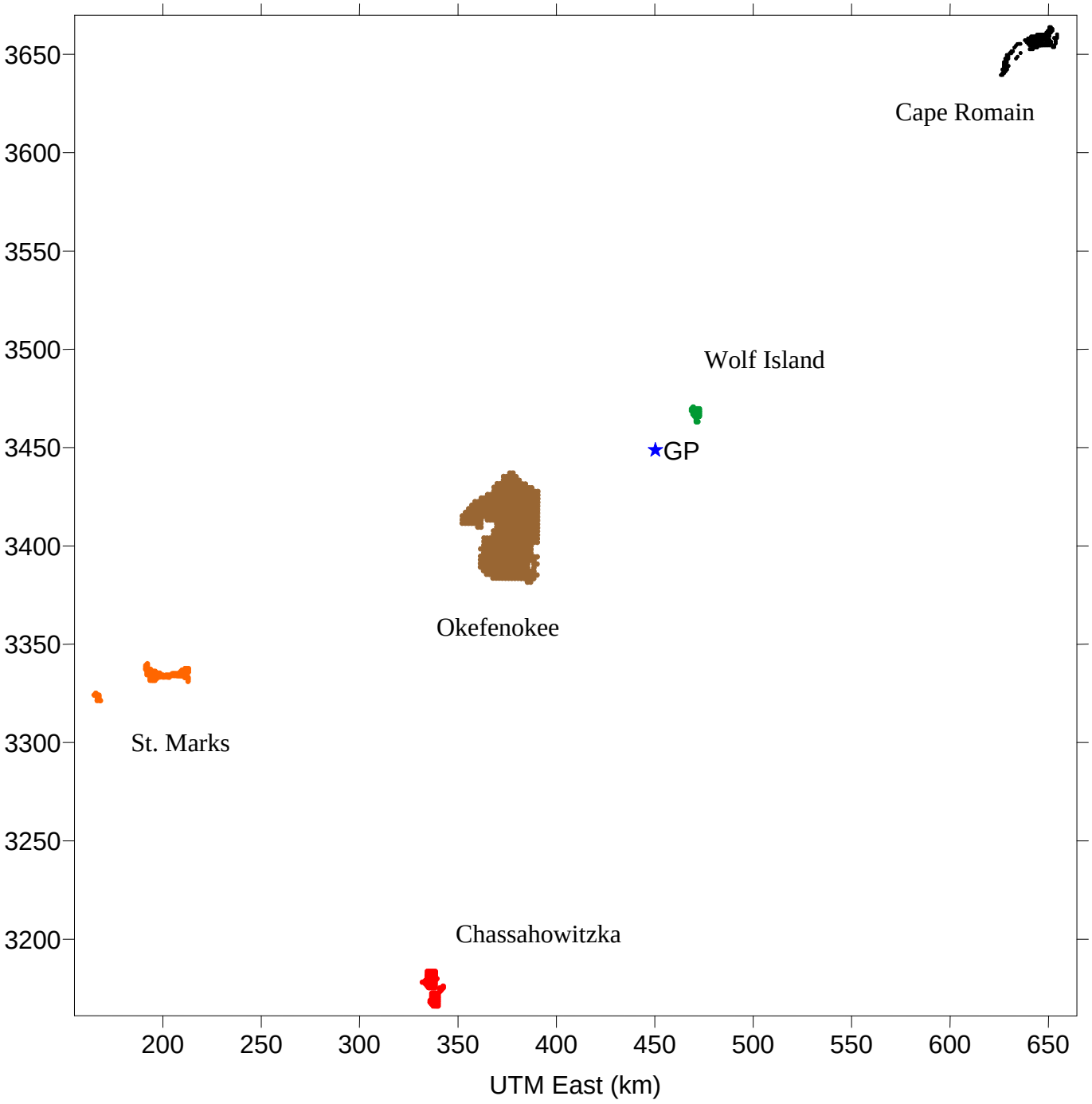
(b) Reflects MACT limit of 0.021 grains/dry standard cfm corrected to 8% oxygen

BUILDING DOWNWASH

As presented below, the Brunswick Mill is within approximately 26 km of the Wolf Island Class I Area. For air permit applications, GP has evaluated the effect of building downwash on predicted air quality concentration levels in the modeling analysis. For this analysis, GP proposes to use the US EPA-developed Building Profile Input Program-PRIME to determine the appropriate direction-specific building dimensions for all modeled sources at the Mill for the Wolf Island receptors only. GP has submitted the model-ready downwash input text in its January 2006 PSD permit application for Mill Optimization (currently under review at GDNR). As all other Class I areas are greater than 100 km from the Mill, GP proposes not to include the downwash information for those receptors.

Figure 2 presents a regional map showing the Brunswick Mill and all PSD Class I Areas within 300 km.

Figure 2. Class I Area Receptors within 300km of GP Brunswick



3.0 VISTAS CONTRIBUTION TO CALPUFF MODELING

For this application of BART Exemption Modeling, VISTAS is providing the technical analysis through its contractor, Earth Tech. Earth Tech will apply its compiled data for the 12-km datasets.

VISTAS will provide updates and supporting information concerning the VISTAS Common Modeling Protocol on the VISTAS website. In addition, VISTAS will make publicly available the following data bases developed by Earth Tech:

- VISTAS version of the CALPUFF modeling system, maintained on the Earth Tech website. And will not be updated further unless errors are found in the code.
- 12-km CALMET output files for 2001, 2002, and 2003 produced as described in previous sections. Further detail on model configuration and settings will be provided with the output files and will be made available on the CALPUFF website.
- CALMET will include a software modification to allow the meteorological data inputs into CALMET to be used to generate finer grid CALMET files without having to go back to the original MM5 output files
- Five 4-km CALMET subdomains for 2001, 2002, and 2003, produced as described in previous sections. Further detail on model configuration and settings will be provided with the output files and will be made available on the website.
- File with CALPUFF model configuration and settings sufficient to replicate CALPUFF modeling done for VISTAS using 12 km CALMET, including
    - Ozone data used to run CALPUFF
    - Ammonia data used to run CALPUFF and to partition NO_3 in POSTUTIL.
    - Background concentrations files for use in POSTUTIL
    - All other set up files used in VISTAS 12-km CALPUFF run

4.0 MODEL DISCUSSION

4.1 Exemption Procedures

For determining if a BART-eligible source is subject to a full BART engineering analysis, GDNR is using a two-tier approach. For the initial exemption modeling use CALPUFF with 12-km grid CALMET. For finer resolution of meteorological fields, use CALPUFF with CALMET of 4-km or smaller grid size. For sources with Q/d less than or equal to 10 (such as the Brunswick Mill), VISTAS is funding Earth Tech to assist States with the initial CALPUFF

exemption modeling. Each State will prioritize which sources will be offered modeling by VISTAS. Modeling of these sources will be conducted in priority order to first accommodate States with nearer term timing constraints in their SIP development process.

For the 12-km initial modeling exemption test, compare the highest single 24-hour average value across all receptors in the Class I area to the threshold value of 0.5 dv. If the highest 24-hr average value is below 0.5 dv at all Class I areas, then the source is not subject to BART. If the highest 24-hr average value is greater than 0.5 dv, then the source may choose to perform finer grid modeling for exemption purposes or may accept determination that the source is subject to BART and proceed to establish visibility impacts prior to and after BART controls. If using the single highest 24-hr average value proves, after initial 12-km grid CALPUFF modeling, to be too conservative a screening level, VISTAS may allow some exceedances of the threshold value for exemption purposes, up to no more than the 98th percentile value.

The 12-km modeling results can be used to focus finer grid modeling for exemption purposes on only those Class I areas where impacts greater than 0.5 dv were projected in the 12-km modeling.

For finer grid (4 km or less) analyses, use the 98th percentile impact value for the 24-hr average. Use either the 8th highest day in each year or the 22nd highest day in the 3-year period, whichever is more conservative, for comparison to the exemption threshold.

The analysis uses the same model assumptions for pre-BART visibility impact and for BART control options modeling: establish baseline visibility from the pre-BART run; change one control at a time; and evaluate the change in visibility impact, i.e. the delta-deciview. Note that "no control" may constitute BART.

The VISTAS Common Modeling Protocol consistently recommends conservative assumptions. Individual States ultimately have responsibility to determine which, if any, BART controls are recommended in their State Implementation Plans (SIPs). The VISTAS protocol presents additional detailed information on the meteorological fields, and specific settings for CALPUFF and CALPOST (see section 4.33 of the VISTAS Common Modeling Protocol).

4.2 CALPUFF Configuration

Source emissions should be defined using the maximum 24-hour actual emission rate during normal operation for the most recent 3 or 5 years. If maximum 24-hr actual emissions are not available, continuous emissions data, permit allowable emissions, potential emissions, and emissions factors from AP-42 source profiles may be used as available. Specific configuration settings presented in the VISTAS Common Modeling Protocol are listed below:

- Use CMAQ modeling data from 2001-2003 to determine background concentrations of SO_4 and total NO_3 (HNO_3 + NO_3). CMAQ data in CALPUFF-ready format will be provided for each Class I area by VISTAS. After running CALPUFF for an individual facility, repartition NO_3 in POSTUTIL using the CMAQ background data, including that for NH_3.

- Use ozone data from non-urban monitors as the background ozone input.

- Use the Pasquill-Gifford dispersion method

- In CALPOST, use Method 6 with monthly average RH for calculating extinction, as recommended by the EPA.

- Use EPA default calculations of light extinction under current and natural background conditions.

The major features and options of the meteorological and dispersion model are summarized and discussed in the VISTAS Common Modeling Protocol.

As also discussed in the VISTAS Common Modeling Protocol, CALPUFF is currently not recommended for addressing visibility impacts from VOC because its capability to simulate secondary organic aerosol formation from VOC emissions is not adequately tested, especially for anthropogenic emissions. (Separately, condensable organic carbon can be calculated from PM10.)

EPA has given states the option to address ammonia (NH3) emissions from BART-eligible sources. VISTAS has also contracted with Georgia Tech to perform emissions sensitivities using CMAQ v 4.4 with a refined SOA module and the Jun-Jul and Nov-Dec periods in 2002. At the time of this protocol, GDNR is not requesting the objective treatment of ammonia emissions from the source.

5.0 RESULTS AND DETERMINATION OF IMPAIRMENT

5.1 Impact Threshold

The final BART guidance recommends that the threshold value to define whether a source "contributes" to visibility impairment is 0.5 dv change from natural conditions (although states may set a lower threshold). The 98^{th} percentile (8^{th} highest annual) 24-hr average predicted impact at the Class I area, as calculated using CALPOST Method 6 (monthly average relative humidity values), is to be compared to this contribution threshold value. For this comparison, the predicted impact at the Class I area on any day is taken to be the highest 24-hr average impact at any receptor in the Class I area on that day. (Note that the receptor where the highest impact occurs can change from day to day.) According to clarification of the BART guidance received

from EPA, for a three-year simulation the modeling values to be compared with the threshold are the greatest of the three annual 8th highest values or the 22nd highest value over all three years combined, whichever is greater.

For the purposes of the initial analysis, however, the *highest value* over the three-year period (not the 98th percentile value) is to be compared to the contribution threshold. This ensures a significant measure of conservatism in the initial approach. VISTAS will evaluate the initial CALPUFF results to determine if using the single highest value provides too conservative a screen for exemption purposes. If so, VISTAS may increase the number of exceedances of the contribution threshold that would be allowed and still qualify to exempt a source.

5.2 Presentation of Modeling Results

The CALPOST processing computes the daily maximum change in deciviews. A sample of the summary table produced by CALPOST is shown in Table 3. For evaluating compliance with the VISTAS screening threshold, the highest change in extinction value, located at the bottom of the CALPOST list file is compared to the threshold value (e.g., 0.5 dv). For example, in the sample shown in Table 3, the summary at the bottom shows that the highest visibility impact is 1.219 dv, with 9 days over the year showing values greater than 0.5 dv. Therefore this source would not pass the initial analysis, and finer grid modeling would be required.

In addition to the highest change in deciview value on each day over all the receptors in a particular Class I area, the CALPOST summary table in Table 3 contains the coordinates of the receptor, receptor type (D indicates discrete receptors), the total haze level (background + source, in dv), the background haze in deciviews, the change in haziness (delta dv), the humidity term applied to hygroscopic aerosols (F(RH)), and the contribution of each species to light extinction (in percent of the total source contribution) for SO4, NO3, organics, elemental carbon, coarse and fine particulate matter.

If the maximum predicted impact is above 0.5 dv, then these results will also be presented:

- Number of receptors within a single Class I area with impact > 0.5 dv
- Number of days at all receptors in the Class I area with impact > 0.5 dv
- Number of Class I areas with impacts > 0.5 dv

Section 4 of the VISTAS Common Modeling Protocol present sample tables for these results.

Table 3. Example of CALPOST Output, Showing Maximum Daily Impacts of Source and Locations of Those Impacts.

YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	DV(Total)	DV(BKG)	DELTA DV	F(RH)	%_SO4	%_NO3	%_OC	%_EC	%_PMC	%_PMF
2001	2	0	3	20.540	79.782	D	5.397	5.358	0.039	4.314	44.33	47.22	3.07	1.07	0.00	4.30
2001	3	0	9	31.680	79.822	D	4.566	4.421	0.145	1.767	40.75	33.89	9.19	3.24	0.00	12.94
2001	4	0	1	24.723	77.951	D	4.540	4.540	0.000	2.076	0.00	0.00	0.00	0.00	0.00	0.00
2001	5	0	77	30.228	94.571	D	4.950	4.939	0.011	3.144	43.13	44.74	4.64	1.45	0.00	6.05
2001	6	0	1	24.723	77.951	D	5.181	5.166	0.015	3.772	38.58	56.05	1.90	0.70	0.00	2.76
2001	7	0	3	20.540	79.782	D	6.366	5.745	0.620	5.439	44.98	44.99	3.69	1.26	0.00	5.08
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2001	363	0	113	27.414	103.782	D	5.725	5.652	0.073	5.164	53.49	35.51	4.03	1.39	0.00	5.58
2001	364	0	113	27.414	103.782	D	6.554	6.521	0.033	7.826	48.12	47.09	1.67	0.64	0.00	2.48
2001	365	0	1	24.723	77.951	D	6.499	6.499	0.000	7.757	0.00	0.00	0.00	0.00	0.00	0.00

--- Number of days with Delta-Deciview => 0.50: 9
--- Number of days with Delta-Deciview => 1.00: 2
--- Largest Delta-Deciview = 1.219

6.0 QUALITY ASSURANCE PLAN

Air quality modeling covered under this protocol is an important tool for use in determining whether a BART-eligible source can be reasonable expected to cause or contribute to visibility impairment in a Class I area, and therefore whether this source should be subject to BART controls, and if so, to determine the relative benefits of various BART controls. The purpose of the quality assurance (QA) program is to establish procedures for ensuring that products produced by the application of the modeling techniques for BART studies satisfy the regulatory objectives of the BART program. Section 6 of the VISTAS Common Modeling Protocol presents additional detailed information on the QA plan.