BART Modeling Protocol:

PRAYON INC.

Augusta, Georgia

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1.0 Introduction

1.1 Objectives

The Regional Haze Rule requires Best Available Retrofit Technology (BART) for any BART-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. Pursuant to federal regulations, states have the option of exempting a BART-eligible source from the BART requirements based on dispersion modeling demonstrating that the source cannot reasonably be anticipated to cause or contribute to visibility impairment in a Class I area. Therefore, this modeling protocol focuses on performing the BART modeling analysis for particulate matter (PM), SO_2 and NOx.

Several emission points at the Prayon Inc. manufacturing facility, located near Augusta, Georgia, have been identified as BART-eligible sources. The purpose of this document is to summarize the procedures by which a modeling analysis will be conducted for this source. The modeling procedures outlined will be used to determine whether the source is subject to BART requirements (exemption modeling). If it is determined that the source is subject to BART, then the procedures will be used to evaluate the visibility improvement factor in the BART determination step (determination modeling). The modeling procedures are consistent with those outlined in the updated final VISTAS common BART modeling protocol (dated December 22, 2005, revision 2 – 3/9/06), available at *http://www.vistas-sesarm.org/BART/BARTModelingProtocol_rev2_9Mar2006.pdf*. This source-specific BART modeling protocol references relevant portions of the common VISTAS modeling protocol.

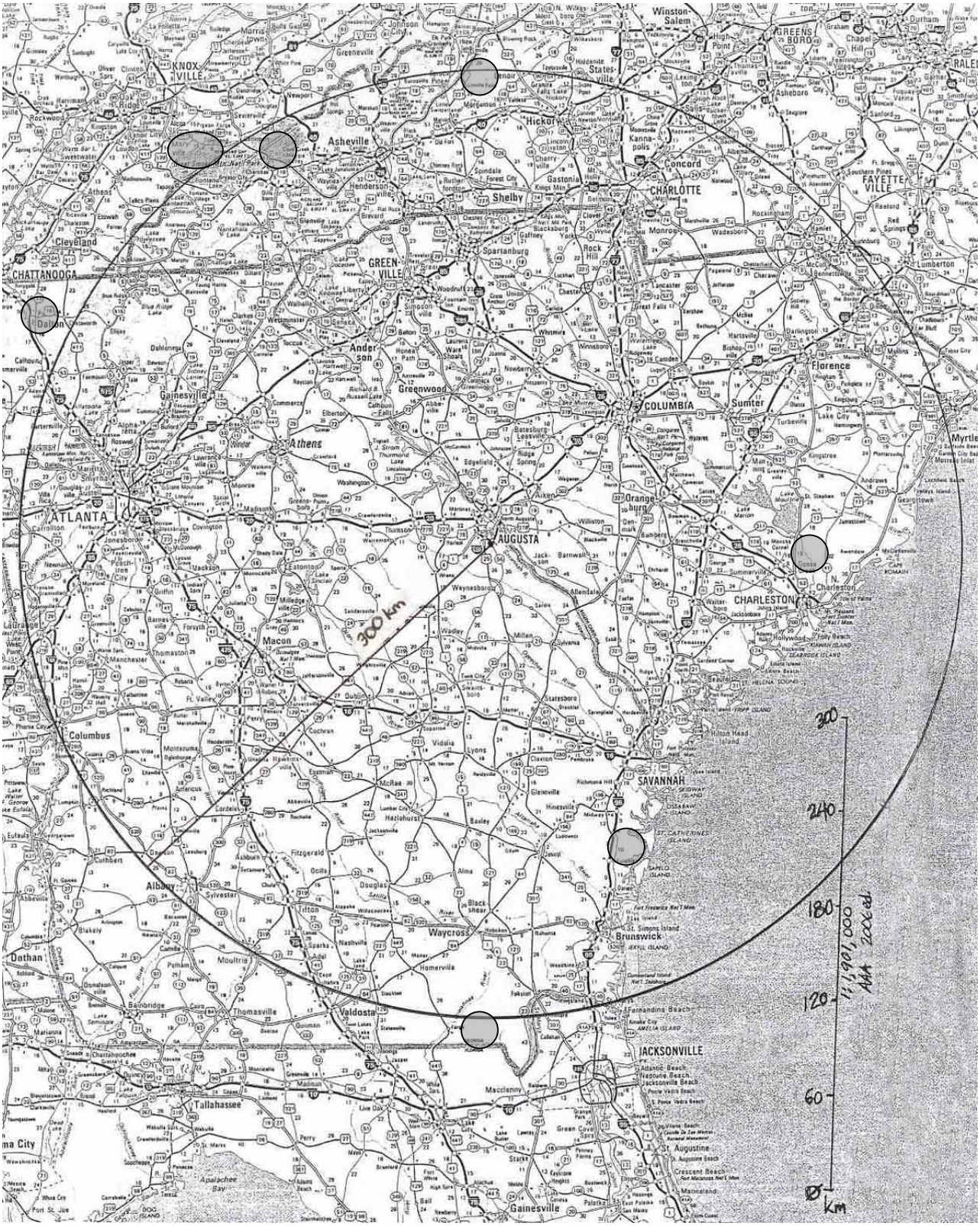
1.2 Location of source vs. relevant Class I Areas

The Georgia Environmental Protection Division’s Air Protection Branch, which is in charge of the state’s BART program, has determined that several sources at Prayon Inc.’s Augusta, Georgia facility are BART-eligible for PM, SO_2 and NOx. Figure 1-1 shows a plot of the Augusta, Georgia facility relative to nearby Class I Areas. There are at least 3 Class I areas (possibly 6) within 300 km of the plant: Wolf Island Wilderness Area, Shining Rock Wilderness Area, and Cape Romain Wilderness Area (possibly Linville Gorge Wilderness Area, Great Smoky Mountains NP, and Okefenokee Wilderness Area). The BART 12-km exemption modeling will be conducted for each of these Class I areas in accordance with the referenced VISTAS common BART modeling protocol and the procedures described in this source-specific BART modeling protocol. If necessary, visibility improvement modeling for the BART determination step will be performed for those Class I areas where the exemption modeling shows a greater than 0.5 deciview impact.

1.3 Organization of protocol document

Section 2 of this protocol describes the source emissions that will be used as input to the BART exemption modeling and, if necessary, the BART determination modeling. Section 3 describes the input data to be used for the modeling including the modeling domain, terrain and land use, and meteorological data. Section 4 describes the air quality modeling procedures and Section 5 discusses the presentation of modeling results. Since all of the references cited are also included in the VISTAS common BART modeling protocol (Section 7.), no additional references section is included in this document. Appendix A provides additional information on the baseline source emissions.

Figure 1-1 Location of Class I Areas in Relation to The Augusta Plant



2.0 Source description and emissions data

2.1 Unit-specific source data

The emissions data used to assess the visibility impacts at the Class I areas within 300 km of the Augusta Plant is discussed in this section. Since various components of PM_{10} emissions have different visibility extinction efficiencies, the PM_{10} emissions are divided, or "speciated," into several components (VISTAS common protocol Sections 4.3.3 and 4.4.2). The VISTAS protocol (Section 5.) allows for the use of source-specific emissions and speciation factors or default values from AP-42. The PM_{10} emissions and speciation approach to be used for the modeling described in this protocol is indicated in the bullets below. Where default speciation values are used, the data represents a unit where current (baseline) emission controls include fabric filter dust collection systems, but no post-combustion NO_x or SO_2 control equipment exists.

- *Total PM_{10} is comprised of emission calculations from last stack testing conducted.*
- *Total PM_{10} filterable and condensable emissions.*

In practice, CALPUFF allows for the user to input certain components of PM_{10} as separate species and separate sizes, which will result in more accurate wet and dry deposition velocity results and also more accurate effects on light scattering.

Table 2-1 provides a summary of the modeling emission parameters to be used in the BART CALPUFF modeling, consistent with the source emissions data.

If the BART exemption modeling indicates that a BART determination is required, then one or more particulate matter control options will be considered for the modeling to determine visibility improvement from the baseline case. The BART engineering analysis will provide the justifications for the selected, technically feasible options and the species-specific control efficiencies. Table 2-1 will be updated to provide the modeling parameters for these feasible options and resubmitted to Georgia EPD for review. Any site-specific deviations from the default particulate matter speciation guidance would be outlined at that time.

Table 2-1 The Augusta Plant modeling emission parameters

Case	Source / Unit	Location UTM (Zone 44 NAD-83)		Stack Ht	Base Elev. Above MSL	Dia-meter	Gas Exit Vel.	Stack Gas Exit Temp.	Actual 24-hr. Max. Emissions		
		UTM East	UTM North						SO_2	NO_X	PM_{10}
		km	km	Ft	Ft	Ft	ft/s	deg F	lbs/hr	lbs/hr	lbs/hr
The Augusta Plant current											
Mist Elim	S101	408284.594	3694680.919	97	240	8.0	13.8	178	0	0	0
Mist Elim	S102	408284.594	3694680.919	97	240	8.0	13.8	178	0	0	0
Reactor	S201	408284.594	3694680.919	8	203	2.67	15.0	176	0	0	10
SMill DC	S304	408284.594	3694680.919	18	233	0.83	52.5	200	0	0	0.29
1 Mill Heater	5221	408284.594	3694680.919	0	0	0	0	N/a	0.00	0.20	0.01
1 Mill	5219	408284.594	3694680.919						0	0	0
DC Heater	5227	408284.594	3694680.919						0.0	0.05	0.00
Vent DC	S306	408284.594	3694680.919	22.5	233	0.83	52.5	100	0.0	0.0	0.29
Calc DC	S305	408284.594	3694680.919	21.75	233	1.17	62	270	0.0	0.0	0.50
Calc heater	5406	408284.594	3694680.919						0.0	0.26	0.01
Bulk Ld DC	S307	408284.594	3694680.919	22.5	233	0.83	52.5	77	0.0	0.0	0.29

3.0 Input data to the CALPUFF model

3.1 General modeling procedures:

VISTAS has developed five sub-regional 4-km CALMET meteorological databases for three years (2001-2003) (VISTAS common protocol Section 4.4.2). The sub-regional modeling domains are strategically designed to cover all potential BART eligible sources within VISTAS states and all PSD Class I areas within 300 km of those sources (to the nearest edge). The extents of the 4-km sub-regional domains are shown in Figure 4-4 of the VISTAS common BART modeling protocol. The BART modeling for The Augusta Plant will be done using the 4-km subdomain 4.

USGS 90-meter Digital Elevation Model (DEM) files were used by VISTAS to generate the terrain data at 4-km resolution for input to the 4-km sub-regional CALMET run. Likewise, USGS 90-meter Composite Theme Grid (CTG) files were used by VISTAS to generate the land use data at 4-km resolution for input to the 4-km sub-regional CALMET run.

Three years of MM5 data (2001-2003) were used by VISTAS to generate the 4-km sub-regional meteorological datasets. See Sections 4.3.2 and 4.4.2 in the VISTAS common BART modeling protocol for more detail on these issues.

It is intended that all of the modeling for The Augusta Plant will use the 4-km subdomain 4. However, if the results indicate that the modeling could be improved with a CALPUFF run using a finer grid, then refinements in the modeling procedures will be considered and Georgia EPD will be asked to approve these refinements.

In the event that a finer grid resolution is used, CALMET must be rerun. Other modifications to inputs of CALMET would include the extent of the modeling domain, the resolution of the terrain and land use data, and other relevant settings. The same MM5 data and observations as used for the 4-km sub-regional CALMET simulations would be used. The extent of the modeling domain may need to be changed because of disk space restrictions. The size of the CALMET output is directly proportional to the grid resolution of the run. The domain would be limited to the source and the exclusive Class I area(s) being assessed with a higher grid resolution, including a 50-km buffer in all directions.

If CALMET needs to be run at even a finer grid resolution, then the appropriate model setting/files (specifically the GEO.DAT file) will be modified. A summary of these modifications would be provided to Georgia EPD for review and approval.

3.2 Air quality database (background ozone and ammonia)

Hourly measurements of ozone from all non-urban monitors, as generated by VISTAS and available on the VISTAS CALPUFF page on the Earth Tech web site (http://www.src.com/verio/download/sample_files.htm), will be used as input to CALPUFF. For ammonia, the approach recommended by VISTAS will be followed. However, since only PM emissions are being modeled, ozone and ammonia data is not really needed given that this data has no affect on PM results in CALPUFF.

3.3 Natural conditions and monthly f(RH) at Class I Areas

For each of the applicable Class I areas, natural background conditions must be established in order to determine a change in natural conditions related to a source's emissions. The modeling described by this protocol document intends to use annual average natural background light extinction (EPA 2003 values).

To determine the input to CALPUFF, it is first necessary to convert the deciviews to extinction using the equation:

Extinction (Mm-1) = 10 exp(deciviews/10).

For example, the EPA guidance document indicates for Great Smoky Mountains National Park that the deciview value for the average of the days is 7.60. This is equivalent to an extinction of 21.38 inverse megameters (Mm-1).

This extinction includes the default 10 Mm-1 for Rayleigh scattering. The remaining extinction is due to naturally occurring particles, and should be held constant for the entire year's simulation. Therefore, the data provided to CALPOST for Great Smoky Mountains would be the total natural background extinction minus 10 (expressed in Mm-1), or 11.38. This is most easily input as fine soil concentrations (11.38 µg/m3) in CALPOST, since the extinction efficiency of soil (PM-fine) is 1.0 and there is no f(RH) component. The concentration entries for all other particle constituents would be set to zero, and the fine soil concentration would be kept the same for each month of the year. The monthly values for f(RH) that CALPOST needs will be taken from "Guidance for Tracking Progress Under the Regional Haze Rule" (EPA, 2003) Appendix A, Table A-3.

4.0 Air quality modeling procedures

This section provides a summary of the modeling procedures outlined in the VISTAS protocol that will be used for the refined CALPUFF analysis to be conducted for The Augusta Plant.

4.1 Model selection and features

As noted in the VISTAS protocol (Summary, Recommendations Section II.), VISTAS will use CALPUFF Version 5.754 and CALMET Version 5.7, which can be obtained at *http://www.src.com/verio/download/download.htm#VISTAS_VERSION*. These versions contain enhancements funded by the Minerals Management Service (MMS) and VISTAS. They were developed by Earth Tech, Inc. and they are maintained on Earth Tech's Atmospheric Studies Group CALPUFF website for public access. This release includes CALMET, CALPUFF, CALPOST, CALSUM, and POSTUTIL as well as CALVIEW.

The major features of the CALPUFF modeling system, including those of CALMET and the post processors (CALPOST and POSTUTIL), are referenced in Section 3 of the VISTAS protocol.

4.2 Modeling domain and receptors

The initial The Augusta Plant BART runs will use the sub-domain 4, 4-km CALMET data to be supplied by VISTAS, as discussed above. This domain includes all Class I areas within 300 km of the source, plus a 50-km buffer. If there is the need for a refined analysis with a finer grid, a supplement to this modeling protocol will be provided describing the proposed procedures.

The receptors used for each of the Class I areas are based on the NPS database of Class I receptors, as recommended by the VISTAS common protocol (Section 4.3.3).

4.3 Technical options used in the modeling

CALMET modeling for the VISTAS-provided 4-km subdomains will be performed per the procedures specified in the VISTAS common BART modeling protocol. If it is decided to conduct additional modeling with a finer grid than 4 km, this modeling protocol will be updated to specify the technical options to be used in the CALMET run, in order to allow for state agency review and approval.

For CALPUFF model options, The Augusta Plant will follow the VISTAS common BART modeling protocol (Section 4.4.1), which states that we should use IWAQM (EPA, 1998) guidance. The VISTAS protocol (Section 4.3.3) also notes that building downwash effects are not required to be included unless the state directs the source to include these effects. Since The Augusta Plant is several tens of kilometers from the nearest Class I area, building downwash effects will not be included in the CALPUFF modeling.

The POSTUTIL utility program (VISTAS common protocol Section 4.4.2) will be used to repartition HNO3 and NO3 using VISTAS-provided ammonia concentrations derived from previous 2002 CMAQ modeling conducted by EPA or the alternate ammonia concentrations approach recommended by VISTAS, if the CMAQ data is unavailable. As indicated earlier, since only PM emissions are being modeled, the treatment of ammonia should not have an affect on PM results from CALPUFF.

4.4 Light extinction and haze impact calculations

The CALPOST postprocessor will be used as prescribed in the VISTAS protocol for the calculation of the impact from the modeled source's primary and secondary particulate matter concentrations on light extinction.

The formula that is used is the existing (not the November 2005 revised) IMPROVE/EPA formula, which is applied to determine a change in light extinction due to increases in the particulate matter component concentrations. Using the notation of CALPOST, the formula is the following:

b_{ext} = 3 f(RH) [(NH4)2SO4] + 3 f(RH) [NH4NO3] + 4[OC] + 1[Soil] + 0.6[Coarse Mass] + 10[EC] + b_{Ray}

The concentrations, in square brackets, are in ug/m3 and b_{ext} is in units of Mm-1. The Rayleigh scattering term (b_{Ray}) has a default value of 10 Mm-1, as recommended in EPA guidance for tracking reasonable progress (EPA, 2003a). However, as recommended in the VISTAS protocol (Section 6.2.4), for refined 4-km grid (or smaller) CALPUFF runs, the Rayleigh scattering term will be modified for the specific elevation of the Class I area receptors. The Rayleigh term for estimating natural background will also, be adjusted to be consistent with this approach.

The assessment of visibility impacts at the Class I areas will use CALPOST Method 6 (VISTAS common protocol Section 4.3.2). Each hour's source-caused extinction is calculated by first using the hygroscopic components of the source-caused concentrations, due to ammonium sulfate and nitrate, and monthly Class I area-specific f(RH) values. The contribution to the total source-caused extinction from ammonium sulfate and nitrate is then added to the other, non-hygroscopic components of the particulate concentration (from coarse and fine soil, secondary organic aerosols, and from elemental carbon) to yield the total hourly source-caused extinction.

The BART rule significance threshold for the contribution to visibility impairment is 0.5 deciviews. The VISTAS protocol (Section 4.3.2) indicates that with the use of the 4-km sub-regional CALMET database, a source does not cause or contribute to visibility impairment if the 98th percentile (or 8th highest) day's change in extinction from natural conditions does not exceed 0.5 deciviews for any of the modeled years (an added check is: the 22nd highest prediction over the three years modeled should also not exceed 0.5 deciviews for a source to be exempted from a BART determination).

Figure 4-1 of the VISTAS common BART modeling protocol presents a flow chart showing the components of that modeling protocol for the analysis to determine whether a source is subject to BART. Again, it should be noted that the modeling for The Augusta Plant will focus on Subregional Fine-Scale modeling as depicted in the lower half of the figure.

If the exemption modeling demonstrates that The Augusta Plant does not cause or contribute to visibility impairment, then the source will not be subject to BART requirements, and no further analysis is needed. Otherwise, the source will proceed to perform BART determination modeling for the baseline and each control option in a similar manner as has been described in this document. This protocol will be supplemented with a revised Table 2-1 if the source is determined to be subject-to-BART.

5.0 Presentation of modeling results

The BART exemption and, if necessary, the BART determination modeling results for the Augusta Plant will be provided to the state agency in a manner as described in the VISTAS protocol (Section 4.5). A report will be produced that includes the following elements (as suggested in the VISTAS protocol):

1. A map of the source location and Class I areas within 300 km of the source.

2. For the CALPUFF modeling domain, a table listing all Class I areas in the VISTAS domain and those in neighboring states and impacts from the BART 4-km grid exemption modeling at those Class I areas within 300 km of the source, as illustrated in Table 4-3 of the VISTAS protocol.

3. A discussion of the number of Class I areas with visibility impairment due to source emissions for the 98th percentile days in each year (and the 98th percentile over all three years modeled) greater than 0.5 dv.

4. For the Class I area with the maximum impact, a discussion of the number of days beyond those excluded (e.g., the 98th percentile for refined analyses) that the impact of the source exceeds 0.5 dv, the number of receptors in the Class I area where the impact exceeds 0.5 dv, and the maximum impact.

5. For any finer grid CALPUFF exemption modeling, results for those Class I areas for which impacts of the source exceeded 0.5 dv in the 4-km initial modeling. We would report the same type of results as provided for 4-km exemption modeling.

The BART determination modeling will be performed for those Class I areas shown in the exemption modeling to exceed 0.5 dv impact. The extent of the BART determination modeling results will depend on the number of technically viable controls identified in the engineering analysis phase of the BART assessment. The results presented will be a comparison of the 98th percentile value for the baseline and each control strategy derived as is outlined above for the exemption modeling. The same statistics as those mentioned above in Steps 3 and 4 would be provided, and a summary of the relative results among all emission scenarios run would be produced.

Additionally, the appropriate electronic files used to conduct the CALPUFF modeling will be submitted on CD-ROM or DVD media.