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OglethorpePower

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March 5, 2010

Mr. Eric Cornwell
Georgia Environmental Protection Division
Air Protection Branch
4244 International Parkway, Suite 120
Atlanta, GA 30354

Subject: Oglethorpe Power Corporation – Warren County PSD Permit Application Class I Protocol 24-hr Particulate Matter Increment at Shining Rock Wilderness (NC)

Dear Mr. Cornwell:

Oglethorpe Power Corporation (Oglethorpe) attended a meeting with the Georgia Environmental Protection Division (EPD) on December 10, 2009 to discuss the Prevention of Significant Deterioration (PSD) permit application for the proposed nominal 100 megawatt (MW) biomass-fueled electric generating facility in Warren County, Georgia (Warren facility). One of the action items resulting from this meeting was that Oglethorpe would submit a CALPUFF Class I Increment protocol and a subsequent modeling demonstration to EPD for one Class I area for one pollutant.

In the modeling report submitted in October 2009, Oglethorpe followed the previously submitted modeling protocol for both nearfield and farfield modeling. The farfield modeling analyses were performed in a screening mode via usage of the AERMOD model with 10 receptors at 50 km distance on an arc in the direction of the area of interest. A plot showing the receptors is provided in Figure A-5 of the October 2009 modeling report.

Eight Class I areas were analyzed via this screening procedure.

1. Cohutta Wilderness (GA)
2. Joyce Kilmer – Slick Rock Wilderness (NC/TN)
3. Great Smoky Mountains National Park (NC/TN)
4. Shining Rock Wilderness (NC)
5. Linville Gorge Wilderness (NC)
6. Cape Romain National Wildlife Refuge [NWR] (SC)
7. Wolf Island NWR (GA)
8. Okefenokee NWR (GA)

For all eight Class I areas, the maximum impact for sulfur dioxide (SO_2) or oxides of nitrogen (NO_X) was below the Significant Impact Level (SIL), and for seven areas the particulate matter less than ten microns aerodynamic diameter (PM_{10}) was also below the SIL. However, there was one receptor representing one Class I area (Shining Rock) that had a maximum 24-hr PM_{10} impact (0.325 $\mu g/m^3$) of slightly above the SIL (0.3 $\mu g/m^3$) while the annual impact was at less than half of the SIL. Since these screening receptors were placed at a distance of 50 km, and Shining Rock is actually approximately 215 km distance, Oglethorpe performed an additional analysis using AERMOD at 215 km to conclusively demonstrate that the 24-hr PM_{10} impacts at Shining Rock would be far below the SIL. That additional analysis showed a projected impact of 0.005 $\mu g/m^3$, which is approximately 1.5% of the SIL.

However, since the AERMOD model used for the more realistic analysis is not an approved model beyond 50 km, Georgia EPD requested that Oglethorpe complete an additional modeling analysis using the CALPUFF model to address this one pollutant and Class I area.

In addition to being a different dispersion model with different settings, CALPUFF also requires additional source input data. As such, Oglethorpe has prepared this modeling protocol for CALPUFF to ensure agreement with Georgia EPD on the CALPUFF analysis.

The Class I area modeling methodologies described in this protocol reference the following key documents:

- Interagency Workgroup on Air Quality Modeling (IWAQM) *Phase 2 Summary Report* (referenced herein as *IWAQM Phase 2*),[1]
- Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report (referenced herein as *FLAG 2000*),[2]
- Federal Land Manager AQRV Workgroup Guidelines (referenced herein as *FLAG 2008*),[3]
- EPA's Guideline on Air Quality Models (referenced herein as *Guideline*), [4]
- EPA's Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (referenced herein as *BART RHR and Guidelines*),[5] and
- Visibility Improvement State and Tribal Association of the Southeast's (VISTAS) Protocol for the Application of CALPUFF Model for Analyses of Best Available Retrofit Technology (referenced herein as *BART Modeling Protocol*).[6]

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[1] Irwin, J.S., (1998): *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts*. EPA-454/R-98-019, Office of Air Quality Planning and Standards, Research Triangle Park, NC, 151 pp. (NTIS Accession Number PB 99-121089). Available at: http://www.epa.gov/scram001/guidance_sip.htm

[2] U.S. Forest Service – Air Quality Program, National Park Service – Air Resources Division, U.S. Fish and Wildlife Service – Air Quality Branch, *Phase I Report of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG), Phase I Report*, December 2000. Available at: http://www.nature.nps.gov/air/Pubs/pdf/flag/FlagFinal.pdf

[3] U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. *Federal Land Managers' Air Quality Related Values Workgroup (FLAG)*. June 27, 2008, *DRAFT*. Available at: http://www.nature.nps.gov/air/permits/flag/docs/FLAG_RevisedFinalDraft20080624.pdf

[4] EPA, Office of Air Quality Planning and Standards, *Federal Register* Vol. 70 / No. 216, pp. 68,218-68,261, 40 CFR 51, Appendix W, *Revision to Guideline on Air Quality Models*, November 9, 2005. Available at: http://edocket.access.gpo.gov/2005/pdf/05-21627.pdf

[5] EPA, Office of Air Quality Planning and Standards, *Federal Register* Vol. 70 / No. 128, pp. 39,104-39,172, *Regional Haze Regulations and Guidelines for Best Available Retrofit Technology*, July 6, 2005. Available at: http://edocket.access.gpo.gov/2005/pdf/05-12526.pdf

MODELED FACILITY SOURCES

The proposed facility's air emissions units will be:

- Bubbling Fluidized Bed Boiler
- Emergency Fire Water Pumps (2)
- Raw Material Handling and Storage
- Sorbent Silo
- Sand Silo and Day Hopper
- Fly Ash Silo and Bottom Ash Storage Area
- Storage Tanks
- Cooling Tower
- Paved Roads

Since the fugitive PM_{10} emission sources associated with material handling and transport activities at the proposed facility will not have a significant impact on the Class I areas of concern due to their relatively low emissions, low release height, and distance away from the Shining Rock (215 km), Oglethorpe proposes that only non-fugitive, point source emissions will be considered in the Class I Increment modeling analysis.

Given the relatively long transport distances to the Class I area and to limit the model run time, Oglethorpe proposes that similar sources be combined as is common for BART modeling. For example, all four cells of the cooling tower will be modeled as one representative cell with the total emissions from the cooling tower exiting the modeled cell (Model ID# CT01). While all baghouses controlling various process activities at the Warren facility will not have identical dispersion characteristics, their total PM_{10} emissions will be exhausted from one representative stack (Model ID# BMG04). This stack, BMG04, is one of four larger material handling baghouses at the Warren facility and is the one with the most potential for long range transport.

Exhaust parameters from the Biomass Boiler vary by load, ambient temperature, and fuel type. Note that in the October 2009 submittal, all modeling was performed using the 40% load stack parameters for all emission rates to simplify the various permutations to be modeled. At the request of Georgia EPD, Oglethorpe further refined the nearfield PM_{10} modeling analyses to be less conservative, and has performed all subsequent nearfield analyses using Scenario 1 from Table 3-2 of the October 2009 submittal; the refinement paired stack parameters with emission rates to provide a less conservative maximum-impact scenario. The basis for this refinement of the scenario selection is documented in a supplemental analysis to be submitted to Georgia EPD on March 5, 2010.

Boiler Scenario 1 corresponds to a heat input rate of 1,329 MMBtu/hr using the design blend fuel at the maximum steaming rate and represents a higher heat input rate than the most likely operating case, Scenario 4 at 1,282 MMBtu/hr. The highest heat input case is Scenario 8, which assumes both maximum

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[6] VISTAS, *Protocol for the Application of the CALPUFF Model for Analyses of Best Available Retrofit Technology (BART), Revision 3.2*, August 31, 2006. Available at http://www.vistas-sesarm.org/documents/BARTModelingProtocol_rev3.2_31Aug06.pdf

steaming rate and the lowest heating value fuel, resulting in a heat input of 1,399 MMBtu/hr. Oglethorpe proposes to complete the 24-hr PM_{10} Shining Rock CALPUFF analysis using Boiler Scenario 1 to be consistent with the refined nearfield analysis. Oglethorpe seeks concurrence from Georgia EPD on the modeled scenario.

Emission rates (lb/MMBtu) based on proposed BACT limits (with one exception) will be used in the analysis along with the heat input rate and stack parameters from the selected scenario (proposed as Scenario 1).[7]

PARTICULATE SPECIATION AND SIZE FRACTIONS

Given the differences in the CALPUFF model compared to AERMOD, additional emissions data are often provided. In visibility modeling, additional speciation is needed given the varying light absorbing and scattering properties of different sizes and types of particles. However, less speciation is needed for PM_{10} increment modeling as discussed in this section. Additionally, CALPUFF includes a chemistry module to simulate transformation of gaseous species into particulate.

As shown in Figure 1, the organic fraction of condensable particulate matter (CPM) is represented as primary organic condensable (POC) emissions (sometimes called secondary organic aerosol [SOA]). Primary emissions of inorganic CPM may contain hygroscopic ammonium sulfate ($(NH_4)_2SO_4$, labeled as "SO4" within CALPUFF) and ammonium nitrate (NH_4NO_3, labeled as "NO3" within CALPUFF), as well as other salts (e.g., carbonates) that may be hygroscopic to a lesser degree. The distinction between primary sulfate and nitrate inorganic emissions is important since primary nitrate emissions will be affected by the partitioning of nitrate and nitric acid in the presence of ambient ammonia, which is modeled explicitly in CALPUFF and is corrected when the ammonia limiting (ALM) method is applied to reconcile the partitioning.

FIGURE 1. PARTICULATE MATTER SPECIATION FOR CALPUFF

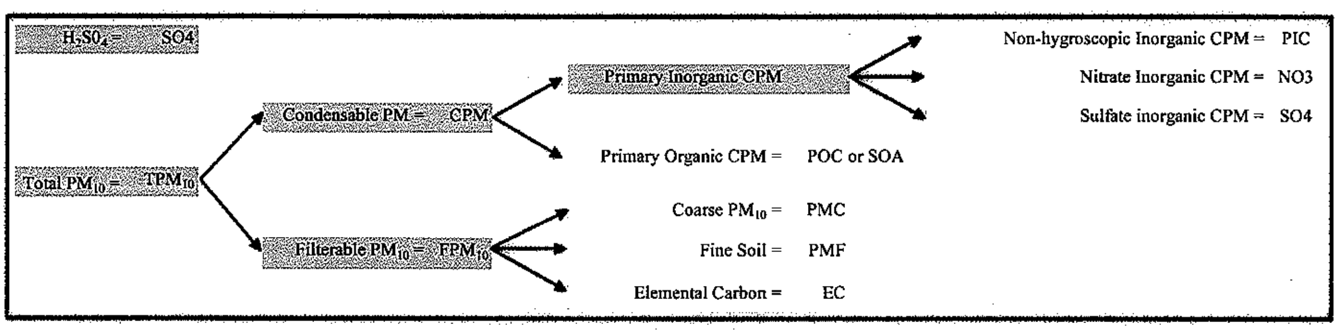

Table 1 provides a list and description of the particulate species and categories as shown in Figure 1 and provides additional subcategories of particulate species based on size fractions. The nomenclature for the particulate species and categories included in Table 1 are used in the remaining discussion about particulate speciation. Individual particulate species can be modeled in CALPUFF and are grouped into categories according to their size using POSTUTIL, as shown in Table 2.

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[7] The emission limit for sulfuric acid mist is not a BACT limit as PSD permitting is not triggered for this pollutant.

TABLE 1. NOMENCLATURE FOR SPECIATION

Nomenclature	Description
PM_{10}	Filterable particulate matter with an aerodynamic diameter < 10 μm
PM_{6-10}	Filterable particulate matter with an aerodynamic diameter > 6 and < 10 μm
$PM_{2.5-6}$	Filterable particulate matter with an aerodynamic diameter > 2.5 and < 6 μm
$PM_{2.5}$	Filterable particulate matter with an aerodynamic diameter < 2.5 μm
$PM_{1.25-2.5}$	Filterable particulate matter with an aerodynamic diameter > 1.25 and < 2.5 μm
$PM_{1-1.25}$	Filterable particulate matter with an aerodynamic diameter > 1.0 and < 1.25 μm
$PM_{0.625-1}$	Filterable particulate matter with an aerodynamic diameter > 0.625 and < 1.0 μm
$PM_{0.5-0.625}$	Filterable particulate matter with an aerodynamic diameter > 0.5 and < 0.625 μm
PMC	Filterable Coarse particulate matter = $PM_{6-10} + PM_{2.5-6}$
PMF	Filterable Fine particulate matter = $PM_{0.5-0.625} + PM_{0.625-1.0} + PM_{1.0-1.25} + PM_{1.25-2.5}$
CPM	Condensable particulate matter (organic and inorganic)
POC	Primary organic condensable emissions
PIC	Primary non-hygroscopic inorganic condensable emissions
TPM_{10}	Filterable PM_{10} + CPM (total PM_{10})
$TPM_{2.5}$	Filterable $PM_{2.5}$ + CPM (total $PM_{2.5}$)
SO4	Sulfate Inorganic CPM
NO3	Nitrate Inorganic CPM
EC	Elemental Carbon

TABLE 2. ASSIGNMENT OF EMITTED PM_{10} TO MODELED PM_{10} CATEGORIES

Description of Modeled Particulate Matter Categories	Modeled Category[†]		Size Fraction	Emitted Species[‡]
Sulfate Inorganic CPM =	SO4	→	0.48 μm	SO4
Nitrate Inorganic CPM* =	NO3	→	0.48 μm	NO3
		↗	0.5 - 0.625 μm	POC056
Organic CPM =	POC	→	0.625 - 1.0 μm	POC081
		↘	6 - 10.0 μm	POC800
		↗	6 - 10 μm	PMC800
Coarse PM_{10} =	PMC			
		↘	2.5 - 6 μm	PMC425
		↗	0.5 - 0.625 μm	PMF056
		↗	0.625 - 1.0 μm	PMF112
Fine Soil =	PMF			
		→	1.0 - 1.25 μm	PMF081
		↘	1.25 - 2.5 μm	PMF187
		↗	0.5 - 0.625 μm	EC056
Elemental Carbon =	EC			
		↘	6 - 10.0 μm	EC800
Total PM_{10} =	TPM_{10}			TPM_{10}

† *Modeled Category* denotes the PM_{10} species produced by POSTUTIL for which PM_{10} increment is assessed in CALPOST.

‡ *Emitted Species* denotes the assignment of the speciated PM_{10} emissions to different species modeled in CALPUFF and subsequently grouped in POSTUIL.

Since the current analysis is solely for PM_{10}, it is only important to size fractionate the emitted PM_{10} rather than to speciate the chemical composition of the components. As such, speciation data (as would be used for visibility modeling) is not used for this analysis. The PM_{10} size fractionation of each grouping is discussed in the following sections.

Boiler

The main boiler has proposed BACT PM_{10} emission limits of 0.010 lb/MMBtu filterable and 0.018 lb/MMBtu total. Given the filter media required to achieve a 0.010 lb/MMBtu filterable emission limit, the permit application has assumed that all filterable PM_{10} from the boiler is $PM_{2.5}$ (represented as PMF in CALPUFF). For modeling in CALPUFF, the boiler filterable $PM_{2.5}$ (PMF) is split evenly across the four PMF size categories shown in Table 2.

Total PM_{10} includes filterable PM_{10} and condensable PM_{10}. By subtraction, condensable PM_{10} is estimated as 0.008 lb/MMBtu/hr. Condensable PM_{10} includes both H_2SO_4 (SO4 in CALPUFF) which has a specific limit, potentially other inorganic species (NO3 and PIC in CALPUFF), and organic CPM. The 6.9 tpy H_2SO_4 limit translates into approximately 0.0012 lb/MMBtu, and the remainder of the condensable fraction is assigned to CPM and split evenly between the two $PM_{2.5}$ size fractions (POC056 and POC081). The modeled boiler emissions are shown in
Table 3.

TABLE 3. BOILER MODELED PM_{10}

Description of Modeled Particulate Matter Categories	Modeled Category[†]	Size Fraction	Emitted Species[‡]	lb/MMBtu	Heat Input (MMBtu/hr)	lb/hr
Sulfate Inorganic CPM =	SO4	0.48 μm	SO4	0.00123	1,329	1.63
Nitrate Inorganic CPM* =	NO3	0.48 μm	NO3			
Organic CPM =	POC	0.5 - 0.625 μm	POC056	0.00339		4.50
		0.625 - 1.0 μm	POC081	0.00339		4.50
		6 - 10.0 μm	POC800			
Coarse PM_{10} =	PMC	6 - 10 μm	PMC800			
		2.5 - 6 μm	PMC425			
Fine Soil =	PMF	0.5 - 0.625 μm	PMF056	0.00250		3.32
		0.625 - 1.0 μm	PMF112	0.00250		3.32
		1.0 - 1.25 μm	PMF081	0.00250		3.32
		1.25 - 2.5 μm	PMF187	0.00250		3.32
Elemental Carbon =	EC	0.5 - 0.625 μm	EC056			
		6 - 10.0 μm	EC800			
Total PM_{10} =	TPM_{10}		TPM_{10}	0.018		23.92

† *Modeled Category* denotes the PM_{10} species produced by POSTUTIL for which PM_{10} increment is assessed in CALPOST.

‡ *Emitted Species* denotes the assignment of the speciated PM_{10} emissions to different species modeled in CALPUFF and subsequently grouped in POSTUIL.

Additionally, the boiler model input also includes emissions of sulfur dioxide (SO_2) and oxides of nitrogen (NO_X), which can transform into particulate via chemical reactions in the atmosphere. The modeled SO_2 and NO_X emissions are based on the proposed BACT emission rates of 0.010 lb/MMBtu (SO_2) and 0.011 lb/MMBtu (NO_X) together with the 1,329 MMBtu/hr boiler operating rate from Scenario 1.

Material Transfer (BMG04) and Cooling Tower (CT01)

BMG04 represents total emissions from the ten baghouses or bin vent filters in the material handling system, which collectively equal 6.38 lb/hr. Similar to the boiler, given the required filtration to achieve the very low grain loading determined BACT for these units, the permit application assumes that all PM_{10} is $PM_{2.5}$. Additionally, for these units, all PM_{10} is filterable, and thus, all $PM_{2.5}$ is filterable. Since the full emissions are assumed as $PM_{2.5}$, the total mass is split evenly across the four $PM_{2.5}$ filterable (PMF) source categories as seen in Table 4.

CT01 represents all four cooling tower cells. The total PM_{10} speciation profile associated with the cooling tower was 40 percent allocated to coarse particulate (PMC) and 60 percent to $PM_{2.5}$ (PMF) based on the California Emissions Inventory Development and Reporting System (CEIDARS), all as filterable particulate.[8] These PMC and PMF fractions were evenly split within each category as shown in Table 4.

TABLE 4. MATERIAL HANDLING AND COOLING TOWER MODELED PM_{10}

Description of Modeled Particulate Matter Categories	Modeled Category†	Size Fraction	Emitted Species‡	Material Handling (lb/hr)	Cooling Tower (lb/hr)
Coarse PM_{10} =	PMC	6 - 10 μm	PMC800		0.0478
		2.5 - 6 μm	PMC425		0.0478
Fine Soil =	PMF	0.5 - 0.625 μm	PMF056	1.595	0.0359
		0.625 - 1.0 μm	PMF112	1.595	0.0359
		1.0 - 1.25 μm	PMF081	1.595	0.0359
		1.25 - 2.5 μm	PMF187	1.595	0.0359
Total PM_{10} =	TPM_{10}		TPM_{10}	6.38	0.239

† *Modeled Category* denotes the PM_{10} species produced by POSTUTIL for which PM_{10} increment is assessed in CALPOST.

‡ *Emitted Species* denotes the assignment of the speciated PM_{10} emissions to different species modeled in CALPUFF and subsequently grouped in POSTUIL.

Tables A-1 and A-2 in Attachment A show the emission rates and source parameters proposed for use in this modeling analysis.

[8] South Coast Air Quality Management District, *Final-Methodology to Calculate Particulate Matter (PM) 2.5 and $PM_{2.5}$ Significance Thresholds,* October 2006, Appendix A. Available at: www.aqmd.gov/ceqa/handbook/PM2_5/finalAppA.doc

CLASS I PSD INCREMENT MODELING METHODOLOGIES

The Class I PSD Increment modeling will be performed using the EPA-approved version (Version 5.8 of CALPUFF) of the CALPUFF model to determine the impacts of the proposed Warren facility on 24-hr PM_{10} Class I PSD Increment at Shining Rock Wilderness Area. The Class I area air quality modeling will be performed using CALPUFF default options unless otherwise noted, as specified in the federal *Guideline, IWAQM Phase 2,* and *BART Modeling Protocol.* See Attachment B, which shows all flag settings proposed for use in the Class I area modeling analysis.

The following sections describe the modeling domain, meteorological data, and model implementation that will be used to assess the Warren facility.

MODELING DOMAIN

The horizontal CALPUFF computational domain chosen for the Warren facility will be a subset of the CALMET domain (VISTAS Domain 4), which is at a grid spacing of 4-km and describe below in the CALMET section. Rather than use the entire CALMET domain, which is 992 km by 1028 km, the CALPUFF computational domain will be 330 km by 330 km, which encompasses the Warren facility and all receptors within Shining Rock with ample area beyond all receptors (50 km or more) to allow for the possible recirculation of puffs. The southwest corner of the computational domain will be at 1,130.0 km Easting and -680.0 km Northing in Lambert Conformal Conic (LLC) and consist of 83 east-west grid cells and 83 north-south grid cells. Both the meteorological CALMET and computational CALPUFF domains are illustrated in Figures 2 through 4, as well as the site location, terrain, and land use.

Vertical grid structure is defined by the cell face height. The cell face height of each cell indicates its vertical extent. The vertical domain will be composed of terrain-following grid cells, the number and size of which are chosen so as to constrain the boundary layer in which dispersion and chemical transformations take place. The highest cell face is 4,000 meters to constrain the default maximum mixing height of 3,000 meters. CALMET and CALPUFF use the same cell face heights. Table 5 summarizes the vertical grid structure selected for both analyses.

FIGURE 2. LOCATION OF WARREN FACILITY RELATIVE TO CLASS I AREAS WITHIN 300 KM AND REPRESENTATION OF MODELING DOMAINS

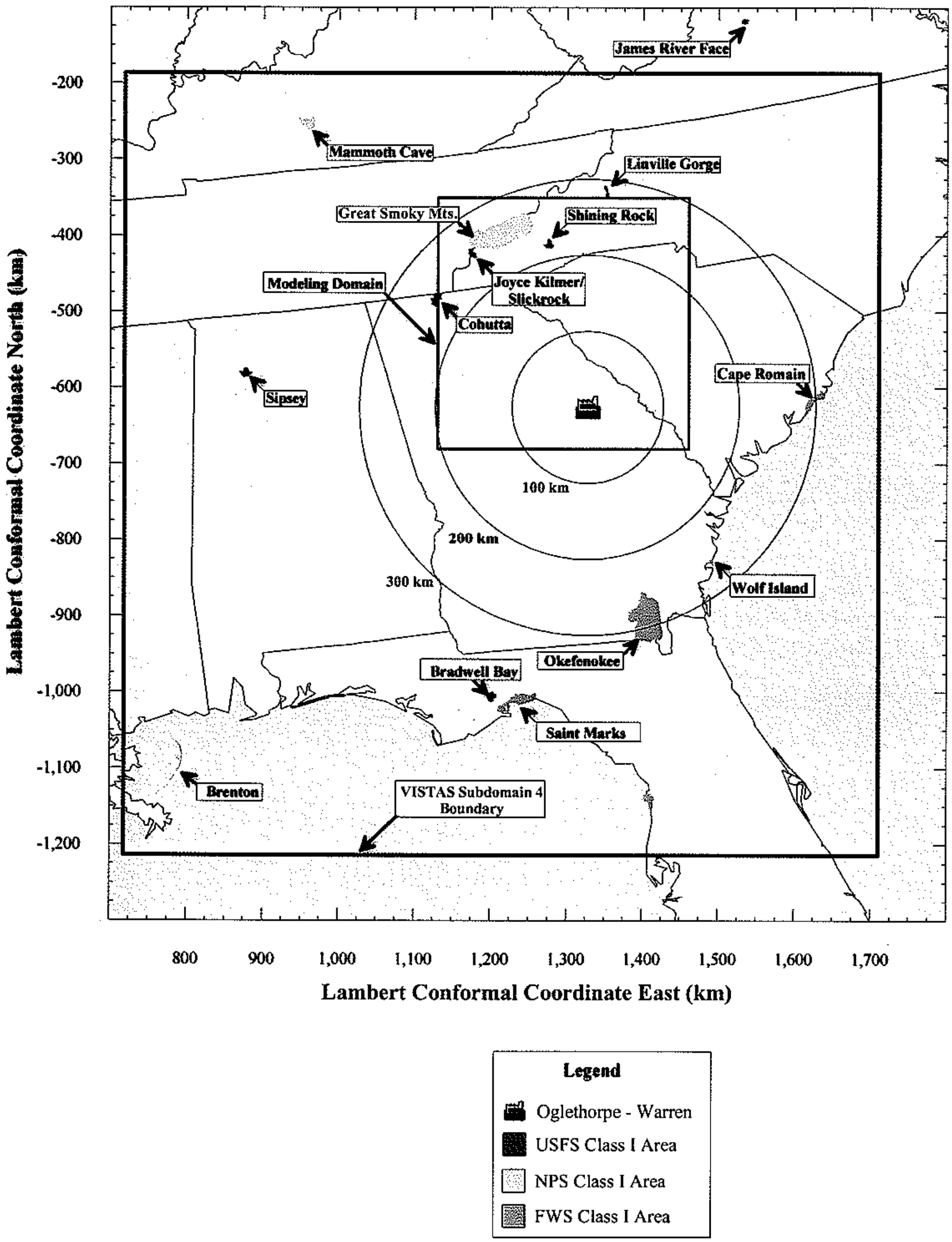

FIGURE 3. TERRAIN ELEVATIONS WITHIN THE MODELING DOMAIN

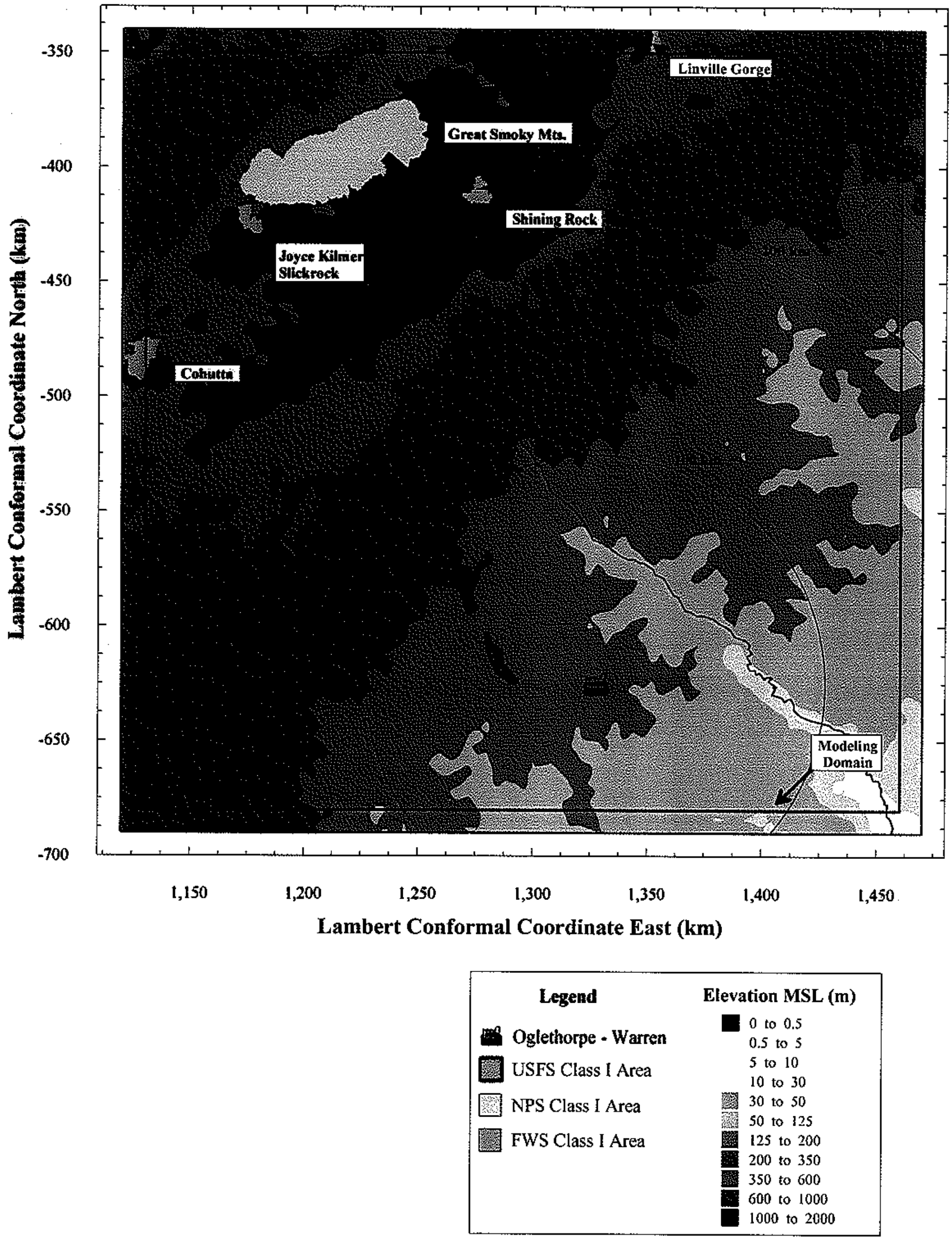

FIGURE 4. LAND USE AND LAND COVER WITHIN MODELING DOMAIN

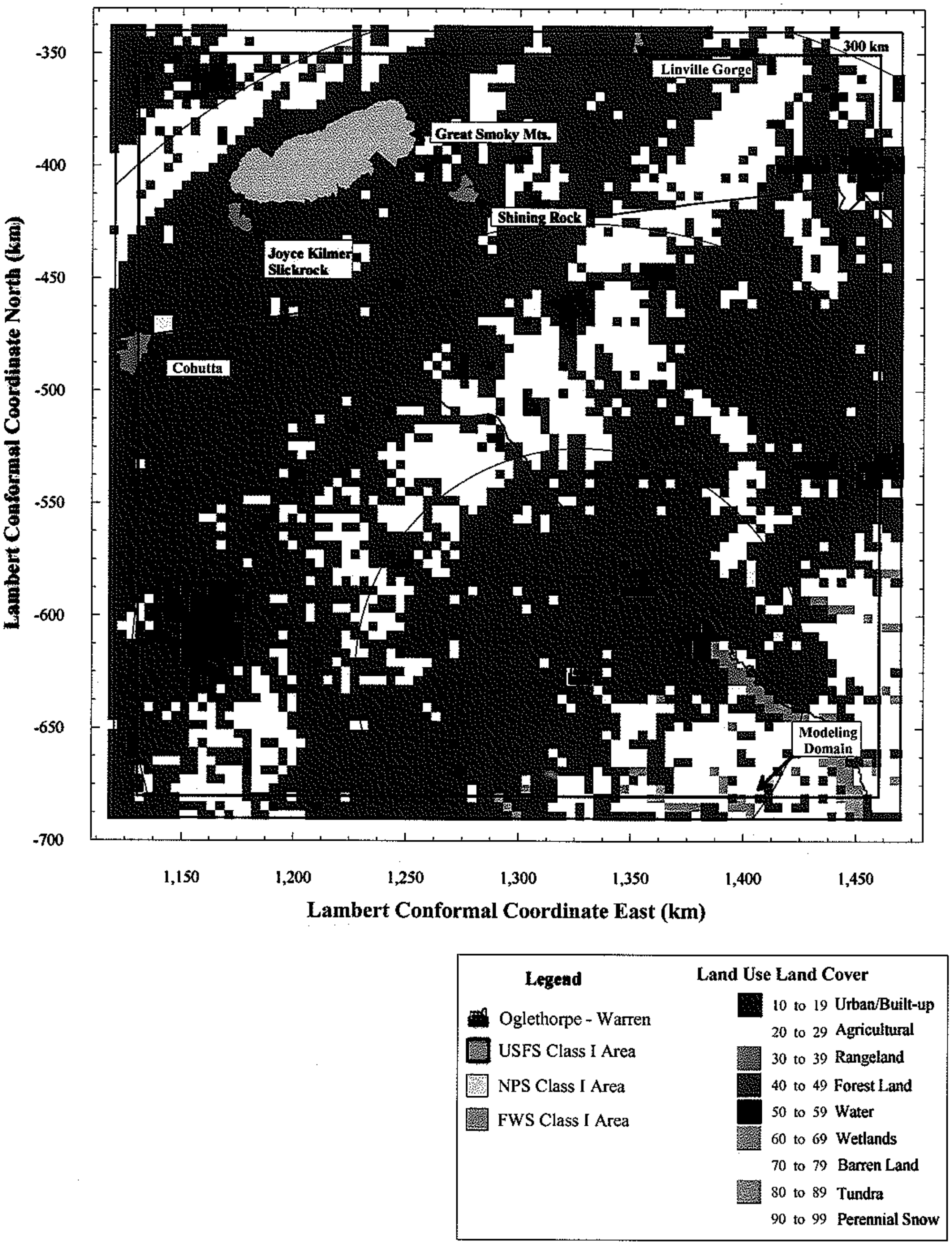

TABLE 5. VERTICAL GRID STRUCTURE

Vertical Grid Cell	Cell Face Height (meters)
1	20
2	40
3	80
4	160
5	320
6	640
7	1,200
8	2,000
9	3,000
10	4,000

Ambient impacts will be predicted at receptors specified by the FLMs to represent Shining Rock.[9] Note that the coordinates and datum used in this modeling simulation are LCC and NWS-84 datum based on the design of the *BART Modeling Protocol.* These coordinates have an origin of 40°N and 97°W with standard parallels of 33°N and 45°N. Receptor locations for Shining Rock were converted from Geodetic (i.e., latitude, longitude) to LCC using the CALPUFF PROfessional Coordinate Convertor (Version 1.99) program included with the CALPUFF modeling system.[10]

CALMET METEOROLOGICAL PROCESSING

CALMET is the meteorological preprocessor that compiles meteorological data from raw observations of surface and upper air conditions, precipitation measurements, mesoscale model output, and geophysical parameters into a single hourly, gridded data set for input to CALPUFF. Consistent with recent guidance from the FLMs, three years of mesoscale meteorological (MM) data were used to create the CALMET dataset used in this analysis. CALPUFF-ready meteorological files for the period 2001-2003 are available and cover the area referred to as VISTAS sub-regional Domain 4. These files were processed by VISTAS and Mr. Tim Allen of the Fish and Wildlife Service using CALMET version 5.8 and obtained by Trinity Consultants from Mr. George Bridgers of the North Carolina Division of Air Quality in November 2007. Based on recent correspondence with Tim Allen at the FWS, the VISTAS Domain 4 CALMET dataset is an acceptable dataset until future updates to the meteorological processing are approved by the FLMs and will be used in this analysis.[11]

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[9] http://www2.nature.nps.gov/air/maps/Receptors/index.htm

[10] EPA-Approved Version of CALPUFF system available at: http://www.src.com/calpuff/download/download.htm

[11] Phone conversation between Mr. Michael Zimmer (Trinity Consultants) and Mr. Tim Allen (WS) on September 1, 2009.

CALPUFF MODEL PROCESSING

Using the data provided by CALMET, CALPUFF simulates the dispersion, deposition, and chemical transformation of discrete puffs of mass from emission sources. Each puff contains emissions of NO_X, SO_2, and PM_{10} and is advected throughout the domain while deposition and chemical transformation processes take place. CALPUFF is a Lagrangian puff model, the principle advantages of which are that pollutant plumes can evolve dynamically and chemically over time and can respond to complex winds caused by terrain effects, stagnation, or recirculation.

Emissions data for on-site emissions sources will be entered into CALPUFF as previously described in this protocol. Due to the large distance from the source to Shining Rock, building downwash will have an insignificant impact on the model transport and dispersion and thus, will not be used in the modeling.

This analysis will be performed with the deposition and chemical transformation algorithms enabled. A full resistance model is provided in CALPUFF for the computation of dry deposition rates of gases and particulate matter as a function of geophysical parameters, meteorological conditions, and pollutant species. An empirical scavenging coefficient approach using default options will be used in CALPUFF to compute the depletion and wet deposition fluxes due to precipitation scavenging.

The CALPUFF model is capable of simulating linear chemical transformation effects by using pseudo-first-order chemical reaction mechanisms for the conversions of SO_2 to sulfate and NO_X, which consists of nitric oxide (NO) and nitrogen dioxide (NO_2), to nitrate and nitric acid (HNO_3). In this analysis, chemical transformations involving five species (SO_2, SO_4, NO_X, HNO_3, and NO_3) will be modeled using the MESOPUFF II chemical transformation scheme, per *IWAQM Phase 2* and the *BART Modeling Protocol*. There are two user-selected input parameters that affect the MESOPUFF II chemical transformation, ammonia concentrations and ozone concentrations. The selection of each parameter is discussed separately.

Ozone

Ambient ozone concentrations can be input to the model as a background level or using hourly, spatially varying observations. For this analysis, hourly ozone data for 2001-2003 from non-urban ozone monitors within and near the domain will be included. Operational monitors on the CASTNET and AIRS reporting networks were included as part of the *VISTAS RHR* modeling, and a subset of these monitors will be utilized in this analysis. In rare cases when all hourly ozone data in the sub-domain are missing from each station, the hourly ozone concentration is substituted with the monthly-average ozone data within CALPUFF; otherwise the computed monthly-average ozone data will not be used.

Ammonia

IWAQM Phase 2 recommends the use of spatially constant background ammonia concentrations to participate in the MESOPUFF-II chemical transformation mechanism. In the absence of an extensive monitoring network for ammonia and due to the limitation of CALPUFF to simulate only a single, domain-average background ammonia level for each month of analysis, a single value will be used. The *IWAQM Phase 2* recommends the ammonia value be set between 0.5 ppb for forested areas and 10 ppb for grasslands. Most areas of the modeling domain are predominantly forested, as shown in Figure 4; therefore the ammonia background level will be set at 0.5 ppb for this analysis.

CALPUFF Processing Control

CALPUFF modeling will be conducted primarily using the recommended regulatory default options specified in Appendix B of *IWAQM Phase 2*. All deviations from *IWAQM Phase 2* and the *BART Modeling Protocol* are noted in Attachment B of this protocol.

POSTUTIL Processing

The first post-processing step involves running POSTUTIL to calculate the combined concentrations of PM_{10} subspecies prior to running CALPOST. Specifically, POSTUTIL (Version 1.56, Level 070627) will be used to combine the modeled species into pollutant groups with the similar sizes, as shown previously in Table 2. For example, all emitted species (size fractions) of:

- PMF will be combined as one group called "SOIL"
- POC will be combined as one group called "SOA"
- PMC will be combined as one group called "PMC"

CALPOST Post-Processing Analysis

The CALPOST postprocessor (Version 6.221) will be used to compute the ambient concentrations of PM_{10} at Shining Rock at appropriate averaging periods for assessment against the PSD Class I Increment SILs.

Summary and Approval of Modeling Protocol

Oglethorpe is supplying this written protocol so that the EPD can formally comment on and approve the methodologies to be used for this analysis. Please provide a response to this protocol with comments for our project record at your earliest convenience. If you have any questions about the material presented in this letter, require additional information, or would like to talk about any of the proposed methods, please do not hesitate to call me 770-270-7166 or Mr. Mike Bilello at 770-270-7196.

Sincerely,

OGLETHORPE POWER CORPORATION

Doug Fulle
Vice President, Environmental Affairs

Attachments

cc: Ms. Wende Martin (Oglethorpe)
Mr. Pete Courtney (Georgia EPD)
Mr. Russell Bailey (Trinity Consultants)
File Copy: Biomass 400.11

Attachment A

Warren Emission Source Inventory

Table A-1. Modeled Emission Rates (lb/hr) for Class I Area 24-hr PM_{10} Increment Analysis

		SO2	SO4	NOX	NO3	POC800	POC081	POC056	PMC800	PMC425	PMF187	PMF112	PMF081	PMF056	EC800	EC056
Biomass Boiler Stack	B001	13.29	1.63	146.19	-	-	4.50	4.50	-	-	3.32	3.32	3.32	3.32	-	-
Cooling Tower Cell 01	CT01	-	-	-	-	-	-	-	0.048	0.048	0.036	0.036	0.036	0.036	-	-
Representative Transfer Operation	BMG04	-	-	-	-	-	-	-	-	-	1.595	1.595	1.595	1.595	-	-

Table A-2. Modeled Stack Parameters for Class I Area 24-hr PM_{10} Increment Analysis

Emission Unit	Stack ID	LCC East (km)	LCC North (km)	Elevation (m)	Stack Height (m)	Stack Diameter (m)	Exhaust Velocity (m/sec)	Exhaust Temperature (°K)
Biomass Boiler Stack	B001	1327.488	-625.378	158.50	67.06	3.66	23.93	441.5
Cooling Tower Cell 01	CT01	1327.518	-625.619	158.50	14.00	8.50	11.66	307.8
Representative Transfer Operation	BMG04	1327.511	-625.480	158.50	57.91	0.66	27.40	293.2

Attachment B

QA/QC for CALPUFF AND CALPOST

TABLE B-1. SUMMARY OF CALPUFF INPUTS

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
Version		5.8	5.8 (070623)	
CALPUFF Model Input Group 1: General Run Control Parameters				
METRUN	All model periods in met files were run	0	0	
IBYR	Starting year	User Defined	2001, 2002, 2003	
IBMO	Starting month	User Defined	1	
IBDY	Starting day	User Defined	1	
IBHR	Starting hour	User Defined	1	
XBTZ	Base time zone (5 = EST)	User Defined	5	
IRLG	Length of run	8760	8760	
NSPEC	Number of chemical species	5	16	User specified
NSE	Number of chemical species to be emitted	3	16	User specified
ITEST	Program is executed after SETUP phase	2	2	
MRESTART	Do not read or write a restart file during run	0	0	
NRESPD	File written only at last period	0	0	
METFM	CALMET binary file CALMET.MET	1	**1**	**See MREG=1**
MPRFFM	Met Format	1	1	
AVET	Averaging time in minutes	60	**60**	**See MREG=1**
PGTIME	PG Averaging time in minutes	60	**60**	**See MREG=1**
CALPUFF Model Input Group 2: Technical Options				
MGAUSS	Gaussian distribution used in near field	1	**1**	**See MREG=1**
MCTADJ	Partial plume path terrain adjustment	3	**3**	**See MREG=1**
MCTSG	Sub-grid-scale complex terrain modeled?	0	0	No grid modeled
MSLUG	Near-field puffs modeled as elongated slugs?	0	0	Slug-approach not modeled
MTRANS	Transitional plume rise modeled?	1	**1**	**See MREG=1**
MTIP	Stack tip downwash used?	1	**1**	**See MREG=1**
MBDW	Downwash Method 1 ISC or 2 Prime	1	1	No downwash modeled since > 50 km from Class I area

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
MSHEAR	Vertical wind shear modeled?	0	0	Not modeled
MSPLIT	Puff splitting enabled?	0	0	No puff splitting
MCHEM	Chemical parameterization scheme	1	**1**	**See MREG=1** MESOPUFF II
MAQCHEM	Aqueous phase transformation flag?	NA	0	Not modeled
MWET	Wet removal modeled?	1	**1**	**See MREG=1**
MDRY	Dry deposition modeled?	1	**1**	**See MREG=1**
MTILT	Plume Tilting?	NA	0	Not modeled
MDISP	Dispersion coefficients	3	**3**	**See MREG=1** PG dispersion coef. for Rural areas
MTURBVW	Sigma-v/sigma-theta, sigma-w measurements used?	3	3	Use both sigma-(v/theta) and sigma-w from PROFILE.DAT to compute sigma-y and sigma-z
MDISP2	Back-up dispersion coefficients for missing data	3	3	PG dispersion coefficients for RURAL areas
MTAULY	Method used for Lagrangian timescale for σ_y	NA	0	Draxler default timescale
MTAUADV	Method used for Advective-Decay timescale for Turbulence	NA	0	No turbulence advection
MCTURB	Method used to compute turbulence sigma-v & sigma-w using micromet. Variables	NA	1	Standard CALPUFF subroutines
MROUGH	PG σ_y and σ_z adjusted for roughness?	0	**0**	**See MREG=1** No adjustments
MPARTL	Partial plume penetration of elevated inversion?	1	**1**	**See MREG=1** Use partial plume penetration
MTINV	Strength of temperature inversion computed from default gradients or measured data?	0	0	Computed from default gradients
MPDF	PDF used for dispersion under convective conditions?	0	**0**	**See MREG=1** Not used

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
MSGTIBL	Sub-grid TIBL module used for shoreline?	0	0	TIBL module not used
MBCON	Boundary conc. conditions modeled?	NA	0	Not modeled
MSOURCE	Individual source contributions saved?	0	0	Not saved
MFOG	Configure for FOG model output?	NA	0	Not configured
MREG	Test options for USEPA Long Range Transport (LRT) guidance	1	1	METFM=**1** or **2** AVET=**60.** (min) PGTIME=**60.** (min) MGAUSS=**1** MCTADJ=**3** MTRANS=**1** MTIP=**1** MCHEM=**1** MWET=**1** MDRY=**1** MDISP=**3** MPDF=**0** MROUGH=**0** MPARTL=**1** SYTDEP=**550.** (m) MHFTSZ=**0** SVMIN=**0.5** (m/s)

CALPUFF Model Input Group 3: Species List-Chemistry Options

	IWAQM				*Oglethorpe*			
	Input Group Species	***Modeled***	***Emitted***	***Dry Deposition***	***Input Group Species***	***Modeled***	***Emitted***	***Dry Deposition***
CSPEC	SO_2	1	1	1	SO_2	1	1	1
	SO4	1	1	2	SO4	1	1	2
	NOX	1	1	1	NOX	1	1	1
	HNO3	1	0	1	HNO3	1	0	1
	NO3	1	0	2	NO3	1	1	2
					POC800	1	1	2
					POC081	1	1	2
					POC081	1	1	2
					PMC800	1	1	2
					PMC425	1	1	2
					PMF187	1	1	2
					PMF112	1	1	2
					PMF081	1	1	2
					PMF056	1	1	2
					EC800	1	1	2
					EC056	1	1	2

Model Input Group 4: Map Projection and Grid Control Parameters

PMAP	Map Projection	User Defined	LCC	
FFEAST	False East	0	0	

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
FNORTH	False North	0	0	
IUTMZN	UTM zone	User Defined	0	NA
UTMHEM	Hemi for UTM	N	N	
RLAT0	Projection Origin	User Defined	40N	Vistas Domain 4
RLON0	Projection Origin	User Defined	97W	Vistas Domain 4
XLAT1	Matching Parallel	User Defined	33N	Vistas Domain 4
XLAT2	Matching Parallel	User Defined	45N	Vistas Domain 4
DATUM	Datum for output coordinates	User Defined	NWS-84	Vistas Domain 4
NX	Number of X grid cells in meteorological grid	User Defined	248	Vistas Domain 4
NY	Number of Y grid cells in meteorological grid	User Defined	257	Vistas Domain 4
NZ	Number of vertical layers in meteorological grid	User Defined	10	Vistas Domain 4
DGRIDKM	Grid spacing (km)	User Defined	4.0	Vistas Domain 4
ZFACE	Cell face heights in meteorological grid (m)	User Defined	0, 20, 40, 80, 160 320,640,1200,2000, 3000, 4000	Vistas Domain 4
XORIGKM	Reference X coordinate for SW corner of grid cell of met. grid (km)	User Defined	718.005	Vistas Domain 4
YORIGKM	Reference Y coord. for SW corner of grid cell of met. grid (km)	User Defined	-1214.003	Vistas Domain 4
IBCOMP	X index of lower left corner of the computational grid	User Defined	102	Used subdomain around both Shining Rock & OPC + 50km
JBCOMP	Y index of lower left corner of the computational grids	User Defined	133	Used subdomain around both Shining Rock & OPC + 50km
IECOMP	X index of upper right corner of the computational grid	User Defined	186	Used subdomain around both Shining Rock & OPC + 50km
JECOMP	Y index of upper right corner of the computational grid	User Defined	217	Used subdomain around both Shining Rock & OPC + 50km
LSAMP	Sampling grid	F	F	Sampling grid not used (*Related CALPUFF variables are not shown here.*)
CALPUFF Model Input Group 5: Output Options				
ICON	Output file CONC.DAT containing concentrations?	1	1	Created for estimating concentrations of PM_{10}

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
IDRY	Output file DFLX.DAT containing dry fluxes?	1	1	Created for N and S deposition calculations, but not used
IWET	Output file WFLX.DAT containing wet fluxes?	1	1	Created for N and S deposition calculations, but not used
IT2D	Output file containing 2D temperature?	0	0	Not created
IRHO	Output file containing 2d density?	0	0	Not created
IVIS	Output file containing relative humidity data?	1	1	Created for Method 2 calculations, but not used
LCOMPRS	Perform data compression in output file?	T	T	Yes
IQAPLOT	Create standard series of output?	1	1	Yes
IMFLX	Calculate mass fluxes across specific boundaries	0	0	Not calculated
IMBAL	Mass balances for each species reported hourly?	0	0	Not calculated
ICPRT	Print concentration fields to output list file?	0	0	Not printed
IDPRT	Print dry flux fields to output list file?	0	0	Not printed
IWPRT	Print wet flux fields to output list file?	0	0	Not printed
ICFRQ	Concentration fields printed to output list file every hour?	1	1	Printed
IDFRQ	Dry flux fields printed to output list file every 1 hour?	1	1	Printed, but not used
IWFRQ	Wet flux fields printed to output list file every 1 hour?	1	1	Printed, but not used
IPTRU	Units for line printer output?	3	3	Units are in $\mu g/m^3$ for concentration and $\mu g/m^2/s$ for deposition
IMESG	Messages tracking the progress of run written to screen?	2	2	Yes

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
LDEBUG	Logical value for debug output	F	F	Debug option not used (*Related CALPUFF variables are not shown here.*)
CALPUFF Model Input Group 6: Sub-Grid Scale Complex Terrain Inputs				
NHILL	Number of terrain features	0	0	Not used
CALPUFF Model Input Group 7: Dry Deposition Parameters for Gases				
SO2	Diffusivity	0.1509	0.1509	
	Alpha star	1000	1000	
	Reactivity	8	8	
	Mesophyll resistance	0	0	
	Henry's Law coef.	0.04	0.04	
NOX	Diffusivity	0.1656	0.1656	
	Alpha star	1	1	
	Reactivity	8	8	
	Mesophyll resistance	5	5	
	Henry's Law coef.	3.5	3.5	
HNO3	Diffusivity	0.1628	0.1628	
	Alpha star	1	1	
	Reactivity	18	18	
	Mesophyll resistance	0	0	
	Henry's Law coef.	8.e-8	8.e-8	

CALPUFF Model Input Group 8: Dry Deposition Parameters for Particles

	Species Name	*Geometric Mass Mean Diameter (μm)*	*Geometric Standard Deviation (μm)*
Dry Deposition	SO4	0.48	2
	NO3	0.48	2
	POC800	8.0	0
	POC081	0.8125	0
	POC056	0.5625	0
	PMC800	8.0	0
	PMC425	4.25	0
	PMF187	1.875	0
	PMF112	1.125	0
	PMF081	0.8125	0
	PMF056	0.5625	0
	EC800	8.0	0
	EC056	0.5625	0

CALPUFF Model Input Group 9: Miscellaneous Dry Deposition Parameters				
RCUTR	Reference cuticle resistance (s/cm)	30	30	
RGR	Reference ground resistance (s/cm)	10	10	
REACTR	Reference pollutant reactivity	8	8	

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
NINT	Number of particle size intervals for effective particle deposition velocity	9	9	
IVEG	Vegetation in non-irrigated areas is active and unstressed	1	1	

CALPUFF Model Input Group 10: Wet Deposition Parameters

	Species Name	*Liquid Precipitation Scavenging Coeff. (s^{-1})*	*Frozen Precipitation Scavenging Coeff. (s^{-1})*
Wet Deposition	SO_2	3.0E-05	0
	SO4	1.0E-04	3.0E-05
	NOX	0	0
	HN03	6.0E-05	0
	NO3	1.0E-04	3.0E-05
	POC800	1.0E-04	3.0E-05
	POC081	1.0E-04	3.0E-05
	POC056	1.0E-04	3.0E-05
	PMC800	1.0E-04	3.0E-05
	PMC425	1.0E-04	3.0E-05
	PMF187	1.0E-04	3.0E-05
	PMF112	1.0E-04	3.0E-05
	PMF081	1.0E-04	3.0E-05
	PMF056	1.0E-04	3.0E-05
	EC800	1.0E-04	3.0E-05
	EC056	1.0E-04	3.0E-05

CALPUFF Model Input Group 11: Chemistry Parameters

MOZ	Read ozone background concentrations from ozone.dat file?	1	1	Provided ozone data files
BCKO3	Background ozone concentration (ppb) by month	Area Dependent	**2001** 28.16, 31.96, 39.58, 49.46, 53.17, 47.62, 45.49, 46.41, 39.81, 38.73, 38.00, 26.71 **2002** 29.11, 33.76, 37.71, 45.68, 46.94, 52.20, 49.56, 51.37, 42.60, 27.00, 26.29, 25.74 **2003** 28.20, 27.43, 37.87, 45.78, 40.66, 45.06, 39.38, 42.89, 40.12, 35.94, 31.93, 25.74	Calculated using ozone data from subdomain for 2001-2003 per *BART Modeling Protocol*

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
BCKNH3	Background NH_3 concentration (ppb) by month	Area Dependent	12*0.5	*BART Modeling Protocol* and *IWAQM Phase 2*
RNITE1	Nighttime SO_2 loss rate is %/hour	0.2	0.2	
RNITE2	Nighttime NO_X loss rate is %/hour	2.0	2.0	
RNITE3	Nighttime HNO_3 loss rate is %/hour	2.0	2.0	
MH2O2	Background H_2O_2 concentrations	1	1	
BCKH2O2	Background monthly H_2O_2 concentrations	12*1.0	12*1.0	
BCKPMF	Fine particulate concentration for SOA option ($\mu g/m^3$)	12*1.0	12*1.0	Not used, since MCHEM ≠4
OFRAC	Organic fraction of fine particulate for SOA option	0.2	0.2	Not used, since MCHEM ≠4
VCNX	VOC/NO_X ratio for SOA option	12*50.0	12*50.0	Not used, since MCHEM ≠4
CALPUFF Model Input Group 12: Miscellaneous Dispersion and Computation Parameters				
SYTDEP	Horizontal size of a puff in m beyond which the Heffter dispersion equation is used	550	**550**	**See MREG=1**
MHFTSZ	Use Heffter formulas for σ_z?	0	**0**	**See MREG=1** Not used
JSUP	Stability class used to determine dispersion rates for puffs above boundary layer	5	5	
CONK1	Vertical dispersion constant for stable conditions	0.01	0.01	
CONK2	Vertical dispersion constant for neutral/stable conditions	0.1	0.1	
TBD	Use ISC transition point for determining the transition point between the Schulman-Scire to Huber-Snyder Building Downwash scheme	0.5	0.5	

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
IURB1	Lower range of LU categories for which urban dispersion is assumed	10	10	
IURB2	Upper range of LU categories for which urban dispersion is assumed	19	19	
ILANDUIN	Land use category for MD	20	20	Not used since METFM=1
ZOIN	Roughness length in meters for MD	0.25	0.25	Not used since METFM=1
XLAIIN	Leaf area index for MD	3.0	3.0	Not used since METFM=1
ELEVIN	Elevation above MSL	0	0	Not used since METFM=1
XLATIN	North latitude of station in °	User Defined	-999	Not used since METFM=1
XLONIN	South latitude of station in °	User Defined	-999	Not used since METFM=1
ANEMHT	Anemometer height in meters	10	10	Not used since METFM=1
ISIGMAV	Is σ_V read for lateral turbulence data?	1	1	Yes
IMIXCTDM	Predicted mixing heights are used	0	0	Not used since METFM=1
XMXLEN	Max length of emitted slug in met. grid units	1	1	
XSAMLEN	Max travel distance of slug or puff in met. grid units during 1 samp. unit	1	1	
MXNEW	Max number of puffs or slugs released from 1 source during 1 time step	99	99	
MXSAM	Max number of sampling steps during 1 time step for a puff or slug	99	99	
NCOUNT	Number of iterations used when computing the transport wind for a sampling step that includes transitional plume rise	2	2	
SYMIN	Minimum sigma y in meters for a new puff or slug	1.0	1.0	

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
SZMIN	Minimum sigma z in meters for a new puff or slug	1.0	1.0	
SVMIN	Minimum lateral turbulence velocities (m/s)	12*0.5	**0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5**	**See MREG=1**
SWMIN	Minimum vertical turbulence velocities (m/s)	0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016	0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016	
CDIV	Divergence criterion for dw/dz (1/s)	0.0, 0.0	0.0, 0.0	
WSCALM	Minimum non-calm wind speeds (m/s)	0.5	0.5	
XMAXZI	Maximum mixing height (m)	3000	3000	
XMINZI	Minimum mixing height (m)	50	50	
WSCAT	Upper bounds of 1st 5 wind speed classes	1.54, 3.09, 5.14, 8.23, 10.80	1.54, 3.09, 5.14, 8.23, 10.80	
PLXO	Wind speed power-law exponents	0.07, 0.07, 0.10, 0.15, 0.35, 0.55	0.07, 0.07, 0.10, 0.15, 0.35, 0.55	ISC Rural
PTGO	Potential temp gradients PG E & F (deg/km)	0.020, 0.035	0.020, 0.035	
PPC	Plume path coefficients (only if MCTADJ = 3)	0.5, 0.5, 0.5, 0.5, 0.35, 0.35	0.5, 0.5, 0.5, 0.5, 0.35, 0.35	
SL2PF	Slug-to-puff transition factor	10	10	Not used
NSPLIT	Number of puffs when split	3	3	
IRESPLIT	Hours when puff is eligible to split	Hour 17	Hour 17	
ZISPLIT	Previous hours minimum mixing height, meters	100	100	
ROLDMAX	Previous max mixing ht/current ht ratio, must be less than this value to allow puff to split	0.25	0.25	
NSPLITH	Number of puffs resulting from a split	5	5	
SYSPLITH	Minimum sigma-y of puff before it may split	1.0	1.0	

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
SHSPLITH	Minimum puff elongation rate from wind shear before puff may split	2.0	2.0	
CNSPLITH	Minimum species concentration before a puff may split	1.0E-07	1.0E-07	
EPSSLUG	Criterion for SLUG sampling	1.0E-04	1.0E-04	
EPSAREA	Criterion for area source integration	1.0E-06	1.0E-06	
DSRISE	Trajectory step length for numerical site algorithm	1.0	1.0	
HTMINBC	Minimum ht (m) to which Boundary Condition (BC) puffs are mixed as they are emitted	500.0	500.0	Not used, since no BC
RSAMPBC	Search radius (km) about a receptor for sampling nearest BC puff.	10.0	10.0	Not used, since no BC
MDEPBC	Near-Surface depletion adjustment to concentration profile used when sampling BC puffs	1	1	Not used, since no BC
CALPUFF Model Input Group 13: Point Source Parameters				
NPT1	Number of point sources with constant stack parameters or variable emission rate scale factors	Varies by scenario	3	Modeled 3 sources
IPTU	Units	1	1	Units for point source emission rates are g/s
NSPT1	Number of source-species combinations with variable emissions scaling factors	0	0	None modeled
NPT2	Number of point sources with variable emission parameters provided in external file	No Default	0	None modeled
MISC	Other point source inputs include stack height, diameter, temp., exit velocity, downwash flag and emissions by species	User Defined	Study Defined	All data in metric units entered for each source as specified by CALPUFF input formats

CALPUFF Variable	Description	Value Included in *IWAQM Phase 2*	Value for OPC Class I Analysis	Notes
CALPUFF Model Input Group 14: Area Source Parameters				
NAR1	Number of polygon area sources	User Defined	0	Area sources not modeled (*Related CALPUFF variables are not shown here.*)
CALPUFF Model Input Group 15: Line Source Parameters				
NLN2	Number of buoyant line sources with variable location and emission parameters	-	0	Line sources not modeled (*Related CALPUFF variables are not shown here.*)
CALPUFF Model Input Group 16: Volume Source Parameters				
NVL1	Number of volume sources	-	0	Volume sources not modeled (*Related CALPUFF variables are not shown here.*)
CALPUFF Model Input Group 17: Discrete Receptor Information				
NREC	Number of non-gridded receptors	-	110	Includes 110 receptors for Shining Rock

TABLE B-2. SUMMARY OF CALPOST INPUTS FOR SHINING ROCK

CALPOST Variable	Description	Value Included in *IWAQM Phase 2* or CALPOST	Value for OPC Class I Analysis	Notes
CALPOST Model Input Group 1: General Run Control Parameters				
METRUN	Option to run limited met period	0	1	All periods
ISYR	Starting year	No Default	2001, 2002, 2003	
ISMO	Starting month	No Default	0	Not used
ISDY	Starting day	No Default	0	Not used
ISHR	Starting hour	No Default	0	Not used
ISMIN	Starting minute	No Default	0	Not used
ISSEC	Starting second	No Default	0	Not used
IEYR	Ending year	No Default	0	Not used
IEMO	Ending month	No Default	0	Not used
IEDY	Ending day	No Default	0	Not used
IEHR	Ending hour	No Default	0	Not used
IEMIN	Ending minute	No Default	0	Not used
IESEC	Ending second	No Default	0	Not used
BTZONE	Base time zone	No Default	5.0	
NREP	Process every hour of data?	1	1	Yes
ASPEC	Species to process	No Default	**PM10** for Increment Analysis	
ILAYER	Layer/deposition code; 1 for CALPUFF concentrations	1	1	CALPUFF concentrations
A	Scaling factor, slope	0	0	
B	Scaling factor, intercept	0	0	
LBACK	Add hourly background concentrations of fluxes?	F	F	Not used
NO2CALC	Fraction of NO_X treated as $_{NO2}$	1	1	Not used
RNO2NOX	Single NO_2/NO_X ratio for treating NO_X as NO_2	1.0	1.0	Not used
CNOX	NO_X concentration. Used if NO2CALC=2	No Default	1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0	Not used
TNO2NOX	NO_2/NO_X ratio for each NO_X concentration. Used if NO2CALC=2	No Default	1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0	Not used
MSOURCE	Process source contributions?	0	0	Process total contributions
MCALMPRO	Apply CALM processing procedures to multiple-hour avg?	0	0	Not used
MET1FMT	Format of Single-point Met File	1	1	Not used

CALPOST Variable	Description	Value Included in *IWAQM Phase 2* or CALPOST	Value for OPC Class I Analysis	Notes
LG	Process gridded receptors?	F	F	Not used
LD	Process discrete receptors?	T	T	Only used discrete receptors
LCT	Process complex terrain receptors?	F	F	Not used
LDRING	Report receptor ring results?	F	F	Not used
NDRECP	Select all discrete receptors (-1)	-1	Shining Rock 110*1	Only process Shining Rock based on EPD Request
IBGRID	X index of LL corner of receptor grid	-1	-1	Not used
JBGRID	Y index of LL corner of receptor grid	-1	-1	Not used
IEGRID	X index of UR corner of receptor grid	-1	-1	Not used
JEGRID	Y index of UR corner of receptor grid	-1	-1	Not used
NGONOFF	Number of gridded receptor rows	0	0	Not used
CALPOST Model Input Group 1a: Specific Gridded Receptors				
NGXRECP	Exclude specific gridded receptors	1	Not used	
CALPOST Model Input Group 2: Visibility Parameters (if ASPEC=VISIB)				
MVISBK	Method for calculating background light extinction	2	2	Visibility not modeled (*Related CALPUFF variables are not shown here.*)
CALPOST Model Input Group 3: Output Options				
LDOC	Print documentation image?	F	F	
IPRTU	Print output units for concentrations and for deposition	1	3 for PM_{10}	Units preference
L1PD	Report 1-period averaging times?	T	F	
L1HR	Report 1 hr averaging times?	F	F	
L3HR	Report 3 hr averaging times	F	F	
L24HR	Report 24 hr averaging times	T	T for PM_{10}	
LRUNL	Report run-length averaging times	F	T for PM_{10}	

CALPOST Variable	Description	Value Included in *IWAQM Phase 2* or CALPOST	Value for OPC Class I Analysis	Notes
NAVGH	User-specified averaging time (hours)	0	0	Not used
NAVGM	User-specified averaging time (minutes)	0	0	Not used
NAVGS	User-specified averaging time (seconds)	0	0	Not used
LT50	Top 50 table	F	F	
LTOPN	Top N table	F	T	Reports high values specified by ITOP below at each receptor
NTOP	Number of Top-N values at each receptor	4	1	
ITOP	Ranks of Top-N values at each receptor	1,2,3,4	1	
LEXCD	Threshold exceedances counts	F	F	
THRESH1	Averaging time threshold for 1 hr averages	-1	-1	
THRESH3	Averaging time threshold for 3 hr averages	-1	-1	
THRESH24	Averaging time threshold for 24 hr averages	-1	-1	
THRESHN	Averaging time threshold for NAVG-hr averages	-1	-1	
NDAY	Accumulation period, days	0	0	
NCOUNT	Number of exceedances allowed	1	1	
LECHO	Echo option	F	F	
LTIME	Time series option	F	F	
LPEAK	Peak value option	F	F	
IECHO	Days selected for output	366*0	366*0	
LPLT	Generates Top-N plot file as described by NTOP and ITOP	F	T for PM_{10}	
LGRD	Use grid format instead of DATA format	F	F	
MDVIS	Output file with visibility change	0	0	
LDEBUG	Output information for debugging?	F	F	
LVEXTHR	Output hourly extinction information (report.hrv) file	F	F	