Chemical Products Corporation BART-Eligible Source

DRAFT

CALPUFF BART-Exclusion Modeling Protocol (4-km Grid)

Cartersville, Georgia (Bartow County)

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VISTAS BART CALPUFF (4-km) Modeling Protocol

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1. Introduction

Chemical Products Corporation ("CPC") operates an inorganic chemical manufacturing plant in Cartersville, Georgia and primarily processes barite ore (barium sulfate) and celestite ore (strontium sulfate) into finished products such as barium carbonate, barium chloride, strontium carbonate and strontium nitrate. These chemicals are produced using a number of different types of heated process equipment such as reduction kilns and various types of dryers. CPC also owns a furnace that has been used in the production of sodium silicate glass. Along with the primary products, CPC produces several secondary products such as barium metaborate, elemental sulfur, sodium hydrosulfide, sodium sulfide, ammonium sulfide and dry calcium carbonates. CPC is a major source with respect to the Part 70 (Title V) operating permit program and operates under Georgia Title V Permit No. 2819-015-0008-V-02-0, as amended May 1, 2007 (V-02-1).

In 1999, the US EPA published a final rule to address a type of visibility impairment known as "regional haze" (64 FR 35714) in 156 Federally-protected national parks and wilderness areas ("mandatory Class I Federal Areas", or just "Class I Areas"). The Regional Haze Rule requires the evaluation of the best available retrofit technology (BART) for certain major stationary sources defined as "BART-eligible" which are those sources which have the potential-to-emit 250 tons per year (tpy) of one or more visibility-impairing air pollutants, were "in existence" before August 7, 1977 but began operation after August 7, 1962, and whose operations fall within one or more of 26 specific source categories; chemical process plants are one of the listed source categories, and include process units and support facilities that are considered to be part of major Standard Industrial Classification 28 – Chemicals and Allied Products. BART is required for "BART-eligible sources" if is it determined that the source emits any air pollutant which may reasonably be anticipated to cause or contribute to any impairment of visibility in a Class I Area.

According to US EPA guidelines for BART determinations under the Regional Haze Rule (70 FR 39104), dispersion modeling can be used to determine if an individual source can reasonably be anticipated to cause or contribute to visibility impairment in a Class I area and is thus not subject to BART. A BART-eligible source that is responsible for a 0.5 deciview (dv) change or more from natural background conditions is considered to "contribute" to visibility impairment in a Class I area while a BART-eligible source that is responsible for a 1.0 dv change or more natural background conditions is considered to "cause" a visibility impairment in a Class I area. The Visibility Improvement State and Tribal Association of the Southeast (VISTAS) requires the application of the CALPUFF modeling system for carrying out air quality modeling in support of BART determinations using the maximum actual 24-hr emissions rates of NOx, SO2, and PM10. The VISTAS application of CALPUFF for BART determinations uses a two-tier approach: (1) initial exemption modeling using 12-km grid CALMET data and (2) finer resolution exclusion modeling using 4-km grid or smaller CALMET data.

Chemical Products Corporation has six emission units that comprise the BART-eligible source because the units operate at a chemical processing facility, were in existence on August 7, 1977, and began operation after August 7, 1962 and have the potential-to emit greater than 250 tpy of at least one visibility-impairing pollutant. To avoid the requirements of BART, CPC has a federally enforceable permit limitation on SO2 emissions of less than 250 tpy during any 12 consecutive month period from the six BART-eligible emissions units unless exemption modeling conducted in accordance with 40 CFR 51.303(a)(2) demonstrates that it cannot be reasonably be anticipated to cause or contribute to visibility impairment in a Class I Area. Periodic monitoring, recordkeeping and reporting requirements required to demonstrate

compliance with the 250 tpy SO2 BART avoidance limitation are allowed to be voided if Chemical Products Corporation can demonstrate that it is exempt from the requirements of BART and is thus the purpose of this protocol.

Initial 12-km grid BART exemption modeling was conducted on behalf of CPC through funding provided by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS). Now, CPC is electing to conduct finer 4-km grid BART exclusion modeling on its own, in conjunction with Smith Aldridge, Inc. The source configuration, pollutant speciation, Class I Area receptors, ozone data sets and CALPUFF model options for finer grid exclusion modeling are essentially the same as the initial exemption modeling. In addition to the better grid resolution and the introduction of MM5 observational data, several other modeling refinements enhance the accuracy of the finer 4-km grid modeling, including the use of the higher resolution terrain data in defining the terrain fields and application of the Ammonia Limiting Method in the POSTUTIL post-processor.

1.1. Objectives. The purpose of this document is to (a) establish a modeling protocol that describes the procedure that will be used for the application of the CALPUFF modeling system for finer grid (4-km) BART exclusion modeling for the Chemical Products Corporation BART-eligible source and (b) to determine if the Chemical Products Corporation BART-eligible source emits any air pollutant(s) in an amount which may reasonably be anticipated to contribute to a visibility impairment in a Class I Area. The following protocol is based on VISTAS BART common modeling protocol, revised August 31, 2006.

1.2. Location of Source vs. Relevant Class I Areas. The VISTAS BART Modeling Protocol specifies that all Class I Areas within 300 km of a BART-eligible source must be initially evaluated to determine whether the source contributes to visibility impairment. Figure 1-1 and Table 1-1 summarize the distances separating the CPC BART-eligible source from mandatory Class I Federal Areas within 300 km.

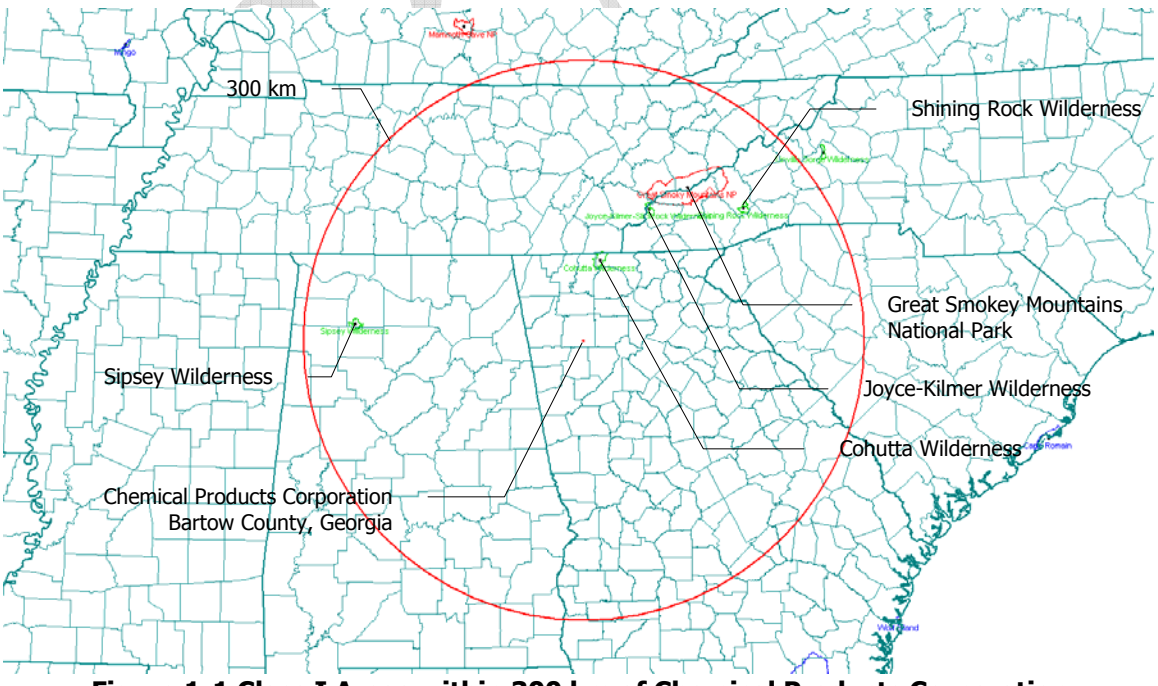

Figure 1-1 Class I Areas within 300 km of Chemical Products Corporation
(Latitude 34° 09′ 03″ N, Longitude 84° 46′ 09″ W)

Table 1-1 Distances Separating CPC and Class I Areas within 300 km

Cohutta Wilderness Area	Great Smokey Mountains National Park	Joyce-Kilmer Wilderness Area	Sipsey Wilderness Area	Shining Rock Wilderness Area
78.9 km	167.0 km	153.4 km	237.3 km	217.4 km

Distances determined from Chemical Products Corporation (Latitude 34° 09′ 03″ N, Longitude 84° 46′ 09″ W) to closest receptor in each Class I Area.

1.3. Source Impact Evaluation Criteria.

1.3.1. *BART Exclusion Modeling (4-km Grid)*. For 4-km grid BART exclusion modeling, a BART-eligible source is considered to cause or contribute to visibility impairment in a Class I Area if the 98th percentile 24-hr average predicted change in the haze index over a three-year period exceeds 0.5 dv from natural background conditions. The 98th percentile 24-hr average predicted impact is the greatest of the three annual highest 8th-high or highest 22nd-high predicted change over the entire three year period, whichever is greater, per EPA BART guidelines and the VISTAS BART common modeling protocol.

Haze is caused when sunlight encounters tiny pollution particles in the air. Some light is absorbed by particles and other light is scattered away before it reaches an observer. More pollutants mean more absorption and scattering of light, which reduce the clarity and color of what we see. Some types of particles such as sulfates, scatter more light, particularly during humid conditions. The predicted change in haze is measured by calculating natural light extinction (b_{ext}) which is used to represent the haze index (HI), expressed in dv. The haze index is calculated using the following equation,

$$HI = 10 \ln\left(\frac{b_{ext}}{10}\right),$$

The change in light extinction is affected by various chemical species and the Rayleigh scattering phenomenon and can be calculated using the IMPROVE methodology as shown in the following equation,

$$b_{ext} = \underbrace{3f(RH)[(NH_4)_2SO_4]}_{\text{Ammonium Sulfates}} + \underbrace{3f(RH)[NH_4NO_3]}_{\text{Ammonium Nitrates}} + \underbrace{4[OC]}_{\text{Condesable Organic PM}} + \underbrace{[Soil]}_{\text{Filterable Fine PM } PM_{2.5}} + \underbrace{0.6[PMC]}_{\text{Filterable Coarse PM } PM_{10-2.5}} + \underbrace{10[EC]}_{\text{Filterable Elemental Carbon}} + \underbrace{b_{ray}}_{\text{Rayleigh Scattering}}$$

The concentrations, in square brackets, are in micrograms per cubic meter (ug/m^3) and b_{ext} is in units of inverse megameters (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.

2. Chemical Products Corporation BART-Eligible Source Description

2.1. CPC BART-Eligible Source Emissions Units. Table 2-1 provided a summary of the applicability criteria for the six emissions units that comprise the BART-eligible source at

Chemical Products Corporation. Potential emissions for NOx, SO2 and PM10 are determined in data provided in Table A-1 of Appendix A to this document, using worst-case fuel for each unit, Georgia Rule (g) for fuel oil sulfur content, and Georgia Rules (d) and (e) for particulate matter.

Table 2-1 CPC BART-Eligible Source Emissions Units BART Applicability Summary

Emissions Unit	Source Code	Construction Date	Latitude Longitude	Potential SO2, (tpy)	Potential NOx, (tpy)	Potential PM10, (tpy)
South Rotary Calciner	BC01	1968	34° 9′ 3.40″N 84° 47′ 10.29 W	278.33	16.08	56.27
Rotary Dryer	BD01	1964	34° 9′ 3.37″N 84° 47′ 9.52 W	102.62	5.96	45.46
South Spray Dryer	BD03	1968	34° 9′ 2.87″N 84° 47′ 10.25 W	68.42	3.92	41.57
Barium Chloride Rotary Dryer	BD04	1976	34° 9′ 3.10″N 84° 47′ 10.61 W	52.87	3.02	37.49
East Rotary Kiln	BK02	1966	34° 9′ 2.32″N 84° 47′ 7.33 W	1444.66	18.31	52.79
B&W Process Steam Boiler	GBX1	1973	34° 9′ 1.78″N 84° 47′ 6.62 W	1391.95	90.95	69.25

2.2. CPC BART-Eligible Source Model Emissions Inventory. An emissions inventory of modeled source parameters is provided in Tables A-2 and A-3 of Appendix A to this document. All modeled source parameters are consistent with those previously modeled by VISTAS, excluding the maximum 24-hr emissions rates modeled. The maximum actual 24-hr emissions used for the 4-km finer grid exclusion modeling for NOx and SO2 were determined based on the combustion of fuel oil with 0.5% sulfur by weight and use of emissions factors published by US EPA in AP-42 (http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf). The maximum actual 24-hr emission rate of SO2 from the East Rotary Kiln includes an emissions factor derived for the processing of petroleum coke at one ton per hour with a maximum 7.50% sulfur content by weight assuming a conversion factor of sulfur to SO2 of two during processing. Particulate matter emissions rates were determined from Georgia Rules (d) and (e), as applicable, and used as a surrogate for PM10. For PM10 speciation, all PM10 was assumed to be condensable organic particulate matter in the submicron particle size categories (PM081 and PM056) consistent with the guidance provided by VISTAS for BART modeling. Table 2-2 summarizes the maximum 24-hr actual emissions rates proposed to be modeled.

Table 2-2 CPC BART-Eligible Source Maximum Actual 24-hr Emissions Rates

Emissions Unit	Source Code	SO2 (lb/hr)	NOx (lb/hr)	PM10 (lb/hr)	PM081 (lb/hr)	PM056 (lb/hr)
South Rotary Calciner	BC01	12.709	3.580	12.848	6.424	6.424

Table 2-2 CPC BART-Eligible Source Maximum Actual 24-hr Emissions Rates

Emissions Unit	Source Code	SO2 (lb/hr)	NOx (lb/hr)	PM10 (lb/hr)	PM081 (lb/hr)	PM056 (lb/hr)
Rotary Dryer	BD01	4.686	1.320	10.379	5.190	5.190
South Spray Dryer	BD03	3.124	0.880	9.491	4.745	4.745
Barium Chloride Rotary Dryer	BD04	2.414	0.680	8.560	4.280	4.280
East Rotary Kiln	BK02	306.97	4.180	12.053	6.026	6.026
B&W Process Steam Boiler	GBX1	52.966	14.92	15.811	7.906	7.906

3. Geophysical and Meteorological Data

3.1. Modeling Domain, Terrain, and Meteorological Data Sets. VISTAS has developed 12-km coarse domain and five sub-regional 4-km CALMET meteorological databases for three years (2001-2003). The sub-regional modeling domains are strategically designed to cover all potential BART eligible sources within VISTAS states and all Class I Areas within 300 km of those sources. The extents of the 4-km sub-regional domains are shown in Figure 3-1.

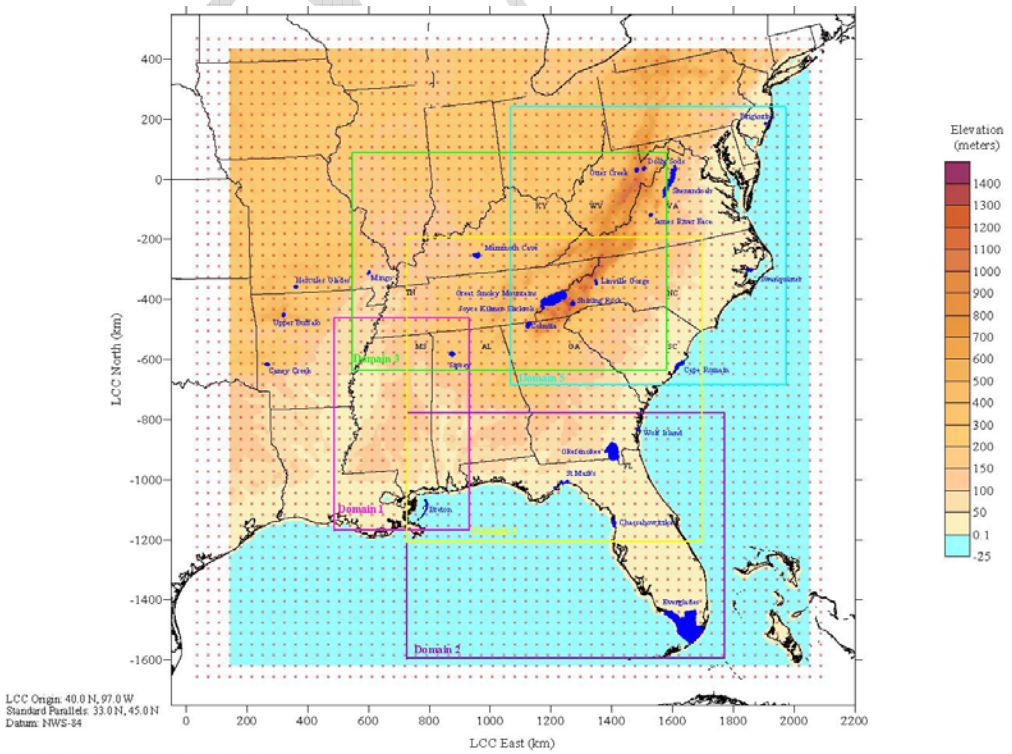

Figure 3-1 VISTAS 4-km Sub-Regional Domains

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.

3.2. Air Quality Database. The CALPUFF model is capable of simulating linear chemical transformation effects by using pseudo-first-order chemical reaction mechanisms for the conversions of SO2 to SO4, and NOx, which consists of nitrogen oxide (NO) and nitrogen dioxide (NO2), to nitrate (NO3) and nitric acid (HNO3). In this application, chemical transformations involving five species (SO2, SO4, NOx, HNO3, and NO3) will be modeled using the MESOPUFF II chemical transformation scheme. Ambient concentrations of ozone and ammonia concentrations as represented in the model affect the MESOPUFF II chemical transformation simulation.

3.2.1. *Ozone Concentrations*. Ambient ozone concentrations are used in the CALPUFF "MESOPUFF II" chemical transformation scheme as a surrogate for OH radicals throughout the daylights hours during SO2 and NOx oxidation. Hourly measurements of ozone from all non-urban monitors within and just outside the computational grid shall be used as input to CALPUFF. The model default of 80 ppb was used for the background ozone concentration in the instance when hourly data was missing for each station. The standard ozone data files for 2001-2003 will be provided by Peter Courtney of the GA EPD Data and Modeling Unit.

3.2.2. *Ammonia Concentrations*. For the background ammonia value, a constant background value of 0.5 ppb shall be used rather than using ammonia data derived from CMAQ model output per recommendation by VISTAS.

3.3. Natural Conditions at Class I Areas. For the Class I Areas within 300 km of the CPC BART-eligible source, Table 3-1 summarizes the default natural background conditions as tabulated in Appendix B of US EPA's Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule. To represent natural background conditions in the absence of anthropogenic sources of sulfates and nitrates, the VISTAS BART Modeling Protocol expresses monthly background extinction coefficients in terms of Rayleigh scattering (default value of 10 Mm^{-1} for Class I Areas) and scattering due to soils (i.e., fine particles) only and is calculated from the tabulated haze index (HI) values from the following equation,

$$b_{back} = 10e^{(HI/10)} = \underbrace{[Soil]}_{\substack{\text{Fiterable}\\ \text{Fine PM}\\ PM_{2.5}}} + \underbrace{b_{ray}}_{\substack{\text{Rayleigh}\\ \text{Scattering}}} = [Soil] + 10\ Mm^{-1}$$

$$[b_{back}]\left(\frac{\mu g}{m^3}\right) = [Soils] = 10e^{(HI/10)} - 10\ Mm^{-1}$$

Table 3-1 Natural Background Conditions for Class I Areas

Class I Area	b_{ext} (Mm^{-1})	Annual Average Haze Index (dv)	20% Best Days Haze Index (dv)	20% Worst Days Haze Index (dv)	Soil b_{back} Annual Avg. ($\mu g/m^3$)	Soil b_{back} 20% Best Days Avg. ($\mu g/m^3$)
Cohutta Wilderness Area	21.39	7.60	3.76	11.44	11.38	4.56
Great Smokey Mountains National Park	21.39	7.60	3.76	11.44	11.38	4.56
Joyce-Kilmer Wilderness Area	21.40	7.61	3.77	11.45	11.40	4.58
Sipsey Wilderness Area	21.28	7.55	3.71	11.39	11.28	4.49
Shining Rock Wilderness Area	21.40	7.61	3.77	11.45	11.40	4.58

The effects of relative humidity to amplify the visibility impairment of hygroscopic sulfates and nitrates were characterized using "Method 6," which computes the change in light extinction using a monthly average relative humidity adjustment particular to each Class I Area applied to background and modeled sulfate and nitrate. Table 3-2 summarizes the monthly average humidity values that were applied for the Class I Areas considered in this analysis, as tabulated in Table A-3 of US EPA's Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule.

Table 3-2 Monthly Site-Specific Average *f*(RH) for Class I Areas

Class I Area	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Cohutta Wilderness Area	3.3	3.1	3.0	2.8	3.4	3.8	4.0	4.2	4.2	3.8	3.4	3.5
Great Smokey Mountains National Park	3.3	3.0	2.9	2.7	3.2	3.9	3.8	4.0	4.2	3.8	3.3	3.4
Joyce-Kilmer Wilderness Area	3.3	3.1	2.9	2.7	3.3	3.8	4.0	4.2	4.2	3.8	3.3	3.5
Sipsey Wilderness Area	3.4	3.1	2.9	2.8	3.3	3.7	3.9	3.9	3.9	3.6	3.3	3.4
Shining Rock Wilderness Area	3.3	3.0	2.9	2.7	3.4	3.9	4.1	4.5	4.4	3.8	3.3	3.4

4. Air Quality Modeling Methodology

4.1. Plume Model Selection. CALPUFF has been adopted by the U.S. EPA as a "Guideline" model for source-receptor distances greater than 50 km (i.e. long range transport), and for use on a case-by-case basis in complex flow situations for shorter distances. CALPUFF is also recommended for Class I impact assessments by FLAG and IWAQM. The final BART guidance recommends CALPUFF as "the best modeling application available for predicting a single source's contribution to visibility impairment." As a

result of these recommendations, the VISTAS BART Modeling Protocol is based on the use of CALPUFF modeling system (Version 5.754) for its BART determinations.

4.2. CALPUFF Computational Domain and Receptors. The CPC BART-eligible source modeling shall use the meteorological dataset representing VISTAS sub-regional domain 4 and shall be provided by GA EPD. The computational domain shall be a subset of the VISTAS regional domain with the size of the domain selected to encompass the CPC BART-eligible source and each Class I Area, plus a minimum 50 km buffer in all directions to allow for the puff recirculation beyond CPC and the Class I Areas being evaluated. The receptor grid for each Class I Area shall be those receptor locations and elevations provided by the National Park Service (NPS) Air Resources Division (ARD) available at http://www.nature.nps.gov/air/maps/receptors/index.cfm. Table 4-1 summarizes the extents of the computational domains that shall be used for each Class I Area.

Table 4-1 Computational Domains used for CALPUFF for each Class I Area

Class I Area	CALPUFF Computation Grid Variables				Approximate Model Buffer
	IBCOMP	JBCOMP	IECOMP	JECOMP	
Cohutta Wilderness Area	76	136	127	208	+ 100 km
Great Smokey Mountains National Park	76	149	136	230	+ 100 km
Joyce-Kilmer Wilderness Area	76	140	136	224	+ 100 km
Sipsey Wilderness Area	15	125	133	186	+ 100 km
Shining Rock Wilderness Area	76	165	136	227	+ 100 km

4.3. CALPUFF Modeling Options Selection. The CALPUFF modeling shall be conducting in accordance with the IWAQM Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts (EPA-454/R-98-019, December 1998), except as modified by the VISTAS BART Modeling Protocol (Section 4.3.3, Revision 3.2, August 2006). An example of the proposed CALPUFF input file is provided in Appendix B describing the CALPUFF model options selection for Cohutta Wilderness Area for meteorological year 2001.

4.3.1. *Building Downwash*. Building downwash shall be ignored since the CPC BART-eligible source is located at a distance greater than 50 km from the nearest Class I Area.

4.3.2. *Ozone Dataset*. Observed hourly ozone data from CASTNet and AIRS stations shall be used. A default of 80 ppb shall be used for the background ozone concentration in the instance when hourly data was missing for each station.

4.3.3. *Background Ammonia Concentration*. A constant value of 0.5 ppb shall be used for background ammonia concentration.

4.4. POSTUTIL and CALPOST Processing for Light Extinction and Haze Impact Calculations. Examples of the proposed POSTUTIL and CALPOST input files are provided in Appendices C and D, respectively, which describe the post-processing procedures

proposed to be used determining the change in light extinction as measured at receptors in the Cohutta Wilderness Area for meteorological year 2001.

4.4.1. *Species Considered*. Species considered shall include sulfur dioxide, oxides of nitrogen and particulate matter with an aerodynamic diameter less than 10 microns (SO2, NOx, and PM10). Speciation of PM10 shall be performed in accordance with "Procedure for Speciation of Emissions for VISTAS BART Modeling", July 18, 2006. In the absence of continuous emissions monitoring data and specific particulate matter AP-42 factors relevant to the source classification code for each emissions units, Georgia Rules (d) and (e) particulate matter permitted emissions limits shall be used as a surrogate for PM10 which are in turn speciated evenly into condensable organic (OC) particulate matter in the submicron size categories PM081 (PM0.625-1) and PM056 (PM0.5-0.625). PM081 and PM056 are modeled explicitly in CALPUFF and then summed in POSTUTIL to represent secondary organic aerosols using the following input file modification;

******
INPUT GROUP: 1 – General run control parameters

"Number of species to compute from those modeled",

! NSPECCMP=1 !,

SUBGROUP (2b)

"The following NSPECOUT species will be written",

~~! ASPECO = PM081 !~~
~~! ASPECO = PM056 !~~
! ASPECO = SOA !

SUBGROUP (2c)

"The following NSPECCMP species will be computed by scaling and summing on or more of the processed input species. Identify the name(s) of the computed species and provide the scaling factors for each of the NSPECINP input species."

! CSPECCMP = SOA !
! PM081 = 1.0 !
! PM056 = 1.0 !
! END !
******

4.4.2. *Nitrate Partitioning*. The Ammonia Limiting Method may be used in POSTUTIL to repartition nitrate using the default background ammonia concentration of 0.5 ppb.

4.4.3. *Background Light Extinction Method*. A monthly average natural background shall be calculated using Visibility Method 6, based on the annual average default

natural conditions specified in Table 3-1 and the monthly average *f*(RH) values specified in Table 3-2 for the centroid of each Class I Area.

4.4.4. *Light Extinction Efficiencies.* The US EPA (2003a) default IMROVE algorithm light extinction efficiencies shall be used.

5. BART Exemption Modeling Results Review

To be determined after GA EPD acceptance of modeling protocol.

Results shall be provided in Table 5-1 using the existing IMPROVE algorithm. Results shall be provided in Appendix E using both the existing and new IMPROVE algorithm. The evaluation of impacts using the new IMPROVE formula shall be performed using the guidance and calculation spreadsheet provided by VISTAS technical consultant, Dr. Ivar Tombach. The new IMPROVE algorithm takes into account site-specific Rayleigh scattering and a Class I-specific sea salt concentration. Where site-specific data were not available, the default EPA Rayleigh scattering value was used with a sea salt concentration of zero.

Table 5-1 Summary of CALPOST IMPROVE Change in Light Extinction Results

Class I Area	Distance (km)	Number of Days > 0.5 dv in Class I Area			Highest 8th-High (Max)	Highest 22nd-High 3 Years
		2001	2002	2003		
Cohutta Wilderness Area	78.9	TBD	TBD	TBD	TBD	TBD
Great Smokey Mountains National Park	167.0	TBD	TBD	TBD	TBD	TBD
Joyce-Kilmer Wilderness Area	153.4	TBD	TBD	TBD	TBD	TBD
Sipsey Wilderness Area	237.3	TBD	TBD	TBD	TBD	TBD
Shining Rock Wilderness Area	217.4	TBD	TBD	TBD	TBD	TBD

Appendix A

Chemical Products Corporation BART-Eligible Source Potential-to-Emit Calculations, Maximum 24-hr Actual Emissions Rates, and Modeled Emissions Inventory

Chemical Products Corporation - Best Available Retrofit Technology Eligible Emissions Units (BART-Eligible Source)

Table A-1. Chemical Products Corporation BART-Eligible Source Potential-to-Emit

Stack ID No. [a]	Emissions Unit ID No. [a]	Emission Unit Description [a]	Construction Date [a]	Maximum Rated Heat Input, (mmBtu/hr) [a]	Fuel Oil Consumption, (gph) [a]	Coke Consumption, (tph) [a]	Design Capacity, (tph) [a]	LCC Easting, (km) [b]	LCC Northing, (km) [b]	Stack Height, (ft) [c]	Exhaust Temp., t (°F) [c]	Exit Velocity, (fps) [c]	Stack Diameter, (ft) [c]	Georgia Rule (d) PM10 Emissions Permit Limit, (lb/hr)	Georgia Rule (e) PM10 Emissions Permit Limit, (lb/hr)	Georgia Rule (g) Fuel Sulfur Permit Limit, (%)	Coke Sulfur Content, (%) [d]	Coke: SO2 Emissions Factor, Mass Balance, (lb/ton) [e]	Natural Gas: NOx Emissions Factor, AP-42 1.4-1/-2, (lb/mmBtu)	Natural Gas: SO2 Emissions Factor, AP-42 1.4-1/-2, (lb/mmBtu)	Propane: NOx Emissions Factor, AP-42 1.5-1, (lb/mmBtu)	Propane: SO2 Emissions Factor, AP-42 1.5-1, (lb/mmBtu)	Fuel Oil: Fuel Oil Type	Fuel Oil: NOx Emissions Factor, AP-42 1.3-1, (lb/10³ gal)	Fuel Oil: SO2 Emissions Factor, AP-42 1.3-1, (lb/10³ gal)	PM10, Potential Emissions Rate, (lb/hr) [f]	NOx, Potential Emissions Rate, (lb/hr) [g]	SO2, Potential Emissions Rate, (lb/hr) [g]
Chemical Products Corporation, Title V Permit No. 2819-015-0008-V-02-0/-1																												
BCZ1	BC01	Carbonate Product South Rotary Calciner	1969	24.00	179	--	5.50	1118.276	-572.125	45	400	50.0	2.26	--	12.85	2.5	--	--	0.098	0.00059	0.153	0.000218	No. 2	20.00	355.00	12.848	3.672	63.545
BDZ1	BD01	Carbonate Product Rotary Dryer	1964	8.89	66	--	4.00	1118.296	-572.124	48	300	13.0	2.00	--	10.38	2.5	--	--	0.098	0.00059	0.153	0.000218	No. 2	20.00	355.00	10.379	1.360	23.430
BDZ3	BD03	Carbonate Product South Spray Dryer	1968	5.85	44	--	3.50	1118.279	-572.141	48	300	35.0	1.35	--	9.49	2.5	--	--	0.098	0.00059	0.153	0.000218	No. 2	20.00	355.00	9.491	0.895	15.620
BDZ4	BD04	Barium Chloride Rotary Dryer	1976	4.50	34	--	3.00	1118.269	-572.136	30	250	12.0	1.67	--	8.56	2.5	--	--	0.098	0.00059	0.153	0.000218	No. 2	20.00	355.00	8.560	0.689	12.070
BKZ1	BK02	Ore Reduction East Rotary Kiln	1966	10.20	76	1.00	5.00	1118.356	-572.148	195	400	54.0	4.00	--	12.05	2.5	7.50	0.1500	0.098	0.00059	0.153	0.000218	No. 6	55.00	392.50	12.053	4.180	329.830
GBZ1	GBX1	B&W Process Steam Boiler	1973	100.00	746	--	--	1118.376	-572.162	55	500	38.0	2.99	15.81	--	3.0	--	--	0.098	0.00059	0.208	0.000262	No. 2	20.00	426.00	15.811	20.765	317.796

Notes:

a. Stack and emissions unit identification, construction date, maximum rated heat input, fuel oil consumption rates, petroleum coke consumption and design capacity determined from Title V Permit No. 2819-015-0008-V-02-0/-1 and Title V Application No. 16069.
b. Lambert Conformal Conic (LCC) coordinates determined from conversion from latitude and longitude coordinates determined from Google Earth and stack locations provided by Chemical Products Corporation.
c. Stack characteristics determined from CALPUFF.INP files provided by GA EPD from 2006 12km BART exemption modeling performed by VISTAS.
d. Highest petroleum coke sulfur content based on historical data for calendar years 2001, 2002, and 2003 provided by Chemical Products Corporation.
e. SO2 emissions factor for processing of petroleum coke determined from twice the highest sulfur content in coke processed based on historical data and 100% conversion to SO2; (2)*(2000 lb/hr coke processed)*(6.48 lb sulfur per 100 lb coke processed)/(2000 lb/ton).
f. PM10 potential-to-emit determined from Georgia Rules (d) and (e).
g. NOx and SO2 potential-to-emit determined from maximum emissions rates resulting from combustion of natural gas, propane, or fuel oil. SO2 emissions rate for the East Rotary Kiln includes estimated SO2 from processing coke.

	PTE (tpy)	PM	NOx	SO2
South Rotary Calciner		56.27	16.08	278.33
Rotary Dryer		45.46	5.96	102.62
South Spray Dryer		41.57	3.92	68.42
Barium Chloride Rotary Dryer		37.49	3.02	52.87
East Rotary Kiln		52.79	18.31	1444.66
B&W Boiler		69.25	90.95	1391.95
BART-Eligible Source Total		302.84	138.24	3338.83

Table A-2. Chemical Products Corporation BART-Eligible Source Maximum 24-hr Actual Emissions Rates (Fuel Oil Combustion, 0.5% Sulfur Content, AP-42)

Stack ID No. [a]	Emissions Unit ID No. [a]	Emission Unit Description [a]	Construction Date [a]	Maximum Rated Heat Input, (mmBtu/hr) [a]	Fuel Oil Consumption, (gph) [a]	Coke Consumption, (tph) [a]	Design Capacity, (tph) [a]	LCC Easting, (km) [b]	LCC Northing, (km) [b]	Stack Height, (ft) [c]	Exhaust Temp., t (°F) [c]	Exit Velocity, (fps) [c]	Stack Diameter, (ft) [c]	Georgia Rule (d) PM10 Emissions Permit Limit, (lb/hr)	Georgia Rule (e) PM10 Emissions Permit Limit, (lb/hr)	Maximum Actual Fuel Sulfur Permit Limit, (%)	Maximum Actual Coke Sulfur Content, (%) [d]	Coke: SO2 Emissions Factor, Mass Balance, (lb/ton) [e]	Natural Gas: NOx Emissions Factor, AP-42 1.4-1/-2, (lb/mmBtu)	Natural Gas: SO2 Emissions Factor, AP-42 1.4-1/-2, (lb/mmBtu)	Propane: NOx Emissions Factor, AP-42 1.5-1, (lb/mmBtu)	Propane: SO2 Emissions Factor, AP-42 1.5-1, (lb/mmBtu)	Fuel Oil: Fuel Oil Type	Fuel Oil: NOx Emissions Factor, AP-42 1.3-1, (lb/10³ gal)	Fuel Oil: SO2 Emissions Factor, AP-42 1.3-1, (lb/10³ gal)	PM10, Potential Emissions Rate, (lb/hr) [f]	NOx, Potential Emissions Rate, (lb/hr) [g]	SO2, Potential Emissions Rate, (lb/hr) [g]
Chemical Products Corporation, Title V Permit No. 2819-015-0008-V-02-0/-1																												
BCZ1	BC01	Carbonate Product South Rotary Calciner	1969	24.00	179	--	5.50	1118.276	-572.125	45	400	50.0	2.26	--	12.85	0.50	--	--					No. 2	20.00	71.00	12.848	3.580	12.709
BDZ1	BD01	Carbonate Product Rotary Dryer	1964	8.89	66	--	4.00	1118.296	-572.124	48	300	13.0	2.00	--	10.38	0.50	--	--					No. 2	20.00	71.00	10.379	1.320	4.686
BDZ3	BD03	Carbonate Product South Spray Dryer	1968	5.85	44	--	3.50	1118.279	-572.141	48	300	35.0	1.35	--	9.49	0.50	--	--					No. 2	20.00	71.00	9.491	0.880	3.124
BDZ4	BD04	Barium Chloride Rotary Dryer	1976	4.50	34	--	3.00	1118.269	-572.136	30	250	12.0	1.67	--	8.56	0.50	--	--					No. 2	20.00	71.00	8.560	0.680	2.414
BKZ1	BK02	Ore Reduction East Rotary Kiln	1966	10.20	76	1.00	5.00	1118.356	-572.148	195	400	54.0	4.00	--	12.05	0.50	7.50	0.1500					No. 6	55.00	78.50	12.053	4.180	305.966
GBZ1	GBX1	B&W Process Steam Boiler	1973	100.00	746	--	--	1118.376	-572.162	55	500	38.0	2.99	15.81	--	0.50	--	--					No. 2	20.00	71.00	15.811	14.920	52.966

Notes:

a. Stack and emissions unit identification, construction date, maximum rated heat input, fuel oil consumption rates, petroleum coke consumption and design capacity determined from Title V Permit No. 2819-015-0008-V-02-0/-1 and Title V Application No. 16069.
b. Lambert Conformal Conic (LCC) coordinates determined from conversion from latitude and longitude coordinates determined from Google Earth and stack locations provided by Chemical Products Corporation.
c. Stack characteristics determined from CALPUFF.INP files provided by GA EPD from 2006 12km BART exemption modeling performed by VISTAS.
d. Highest expected petroleum coke sulfur content based on historical data provided by Chemical Products Corporation.
e. SO2 emissions factor for processing of petroleum coke determined from twice the highest sulfur content in coke processed based on historical data and 100% conversion to SO2; (2)*(2000 lb/hr coke processed)*(6.48 lb sulfur per 100 lb coke processed)/(2000 lb/ton).
f. PM10 potential-to-emit determined from Georgia Rules (d) and (e).
g. NOx and SO2 potential-to-emit determined from maximum emissions rates resulting from combustion of fuel oil with 0.50% sulfur content. SO2 emissions rate for the East Rotary Kiln includes estimated SO2 from processing coke.

	PTE (tpy)	PM	NOx	SO2
BART-Eligible Source Total		302.84	111.95	1672.57

Table A-3. Chemical Products Corporation BART-Eligible Source CALPUFF Modeling Input Parameters and PM10 Specication

Stack ID No.	Emissions Unit ID No.	Emission Unit Description	Location: Latitude	Location: Longitude	Location LCC: Zone	Location LCC: Easting, (km)	Location LCC: Northing, (km)	Stack Height, (ft)	Base Elevation, (ft)	Exhaust Temp., t (°F)	Exit Velocity, (fps)	Stack Diameter, (ft)	SO2, (lb/hr)	H2SO4, (lb/hr)	NOx, (lb/hr)	PM10, (lb/hr)	PM2.5, (lb/hr)	NH3, (lb/hr)	PM10 Particle Speciation (Unknown): Filterable, (%)	PM10 Particle Speciation (Unknown): Condesable, (%)	Organic Condensable (OC) Assumed Fraction of PM10: 0.625 - 1.0 µm, (%)	Organic Condensable (OC) Assumed Fraction of PM10: 0.5 - 0.625 mm, (%)	Organic Condensable (OC): 0.625 - 1.0 µm, (lb/hr)	Organic Condensable (OC): 0.5 - 0.625 mm, (lb/hr)
Chemical Products Corporation, Title V Permit No. 2819-015-0008-V-02-0/-1																							PM08I	PM05
BCZ1	BC01	Carbonate Product South Rotary Calciner	34.1509	84.7862	16	1118.276	-572.125	45	750	400	50.0	2.26	12.709	0.000	3.580	12.848	0.000	0.000	0	100	50	50	6.424	6.424
BDZ1	BD01	Carbonate Product Rotary Dryer	34.1509	84.7860	16	1118.296	-572.124	48	753	300	13.0	2.00	4.686	0.000	1.320	10.379	0.000	0.000	0	100	50	50	5.190	5.190
BDZ3	BD03	Carbonate Product South Spray Dryer	34.1508	84.7862	16	1118.279	-572.141	48	753	300	35.0	1.35	3.124	0.000	0.880	9.491	0.000	0.000	0	100	50	50	4.745	4.745
BDZ4	BD04	Barium Chloride Rotary Dryer	34.1509	84.7863	16	1118.269	-572.136	30	735	250	12.0	1.67	2.414	0.000	0.680	8.560	0.000	0.000	0	100	50	50	4.280	4.280
BKZ1	BK02	Ore Reduction East Rotary Kiln	34.1506	84.7854	16	1118.356	-572.148	195	900	400	54.0	4.00	305.966	0.000	4.180	12.053	0.000	0.000	0	100	50	50	6.026	6.026
GBZ1	GBX1	B&W Process Steam Boiler	34.1505	84.7852	16	1118.376	-572.162	55	760	500	38.0	2.99	52.966	0.000	14.920	15.811	0.000	0.000	0	100	50	50	7.906	7.906

Appendix B

Example of Proposed CALPUFF Input File for Cohutta Wilderness Area (2001)

```
VISTAS BART - Chem Products Corp. - 4km Domain No. 4 - Cohutta - 2001
Computational Grid X (Easterly):   From  76  To  127
Computational Grid Y (Northerly): From  136  To  208
---------------- Run title (3 lines) ------------------------------------

                    CALPUFF MODEL CONTROL FILE
                    --------------------------

------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type           File Name
------------  ----           ---------
CALMET.DAT    input    * METDAT = ..\CALMET.DAT    *
    or
ISCMET.DAT    input    * ISCDAT =                  *
    or
PLMMET.DAT    input    * PLMDAT =                  *
    or
PROFILE.DAT   input    * PRFDAT =                  *
SURFACE.DAT   input    * SFCDAT =                  *
RESTARTB.DAT  input    * RSTARTB=                  *
------------------------------------------------------------------------------
CALPUFF.LST   output   ! PUFLST =CALPUFF.LST   !
CONC.DAT      output   ! CONDAT =CONC.DAT      !
DFLX.DAT      output   ! DFDAT  =DFLX.DAT      !
WFLX.DAT      output   ! WFDAT  =WFLX.DAT      !

VISB.DAT      output   ! VISDAT =VISB.DAT      !
TK2D.DAT      output   * T2DDAT =              *
RHO2D.DAT     output   * RHODAT =              *
RESTARTE.DAT  output   * RSTARTE=              *
------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =              *
VOLEMARB.DAT  input    * VOLDAT =              *
BAEMARB.DAT   input    * ARDAT  =              *
LNEMARB.DAT   input    * LNDAT  =              *
------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    ! OZDAT  = F:\VISTASmet\BART4kmD4\O3data\ozone2001dom4.dat
!
VD.DAT        input    * VDDAT  =              *
CHEM.DAT      input    * CHEMDAT=              *
H2O2.DAT      input    * H2O2DAT=              *
HILL.DAT      input    * HILDAT=               *
HILLRCT.DAT   input    * RCTDAT=               *
COASTLN.DAT   input    * CSTDAT=               *
FLUXBDY.DAT   input    * BDYDAT=               *
BCON.DAT      input    * BCNDAT=               *
DEBUG.DAT     output   ! DEBUG = DEBUG.DAT    !
MASSFLX.DAT   output   * FLXDAT=               *
MASSBAL.DAT   output   * BALDAT=               *
FOG.DAT       output   * FOGDAT=               *
------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = F !
         F = UPPER CASE
```

NOTE: (1) file/path names can be up to 70 characters in length

Provision for multiple input files

Number of CALMET.DAT files for run (NMETDAT)
Default: 1 ! NMETDAT = 36 !

Number of PTEMARB.DAT files for run (NPTDAT)
Default: 0 ! NPTDAT = 0 !

Number of BAEMARB.DAT files for run (NARDAT)
Default: 0 ! NARDAT = 0 !

Number of VOLEMARB.DAT files for run (NVOLDAT)
Default: 0 ! NVOLDAT = 0 !

!END!

Subgroup (0a)

The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name	Type	File Name
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-01a.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-01b.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-01c.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-02a.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-02b.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-02c.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-03a.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-03b.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-03c.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-04a.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-04b.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-04c.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-05a.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-05b.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-05c.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-06a.dat ! !END!
none	input	! METDAT= F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-06b.dat ! !END!
none	input	! METDAT=

```
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-06c.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-07a.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-07b.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-07c.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-08a.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-08b.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-08c.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-09a.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-09b.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-09c.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-10a.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-10b.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-10c.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-11a.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-11b.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-11c.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-12a.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-12b.dat !   !END!
 none          input    ! METDAT=
F:\VISTASmet\BART4kmD4\2001-4KM\met2001-dom4-12c.dat !   !END!

------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =   0   !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:   Year (IBYR) -- No default       ! IBYR =  2001  !
     (used only if   Month (IBMO) -- No default       ! IBMO =  1   !
      METRUN = 0)      Day (IBDY) -- No default       ! IBDY =  1   !
                      Hour (IBHR) -- No default       ! IBHR =  1   !

     Note: IBHR is the time at the END of the first hour of the simulation
           (IBHR=1, the first hour of a day, runs from 00:00 to 01:00)

     Base time zone        (XBTZ) -- No default       ! XBTZ = 5   !
     The zone is the number of hours that must be
     ADDED to the time to obtain UTC (or GMT)
     Examples: PST = 8., MST = 7.
               CST = 6., EST = 5.
```

```
Length of run (hours) (IRLG) -- No default        ! IRLG =  8760  !

Number of chemical species (NSPEC)
                                  Default: 5      ! NSPEC =  11   !

Number of chemical species
to be emitted  (NSE)              Default: 3      ! NSE =  4   !

Flag to stop run after
SETUP phase (ITEST)               Default: 2      ! ITEST =  2   !
(Used to allow checking
of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of program
                  after SETUP

Restart Configuration:

   Control flag (MRESTART)        Default: 0      ! MRESTART =  0   !

      0 = Do not read or write a restart file
      1 = Read a restart file at the beginning of
          the run
      2 = Write a restart file during run
      3 = Read a restart file at beginning of run
          and write a restart file during run

   Number of periods in Restart
   output cycle (NRESPD)          Default: 0      ! NRESPD =  0   !

     0 = File written only at last period
    >0 = File updated every NRESPD periods

Meteorological Data Format (METFM)
                                  Default: 1      ! METFM =  1   !

      METFM = 1 - CALMET binary file (CALMET.MET)
      METFM = 2 - ISC ASCII file (ISCMET.MET)
      METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
      METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                  surface parameters file (SURFACE.DAT)
      METFM = 5 - AERMET tower file (PROFILE.DAT) and
                  surface parameters file (SURFACE.DAT)

Meteorological Profile Data Format (MPRFFM)
       (used only for METFM = 1, 2, 3)
                                  Default: 1      ! MPRFFM =  1   !

      MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
      MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
Averaging Time (minutes) (AVET)
                                  Default: 60.0   ! AVET = 60. !
PG Averaging Time (minutes) (PGTIME)
                                  Default: 60.0   ! PGTIME = 60. !

!END!
```

```
INPUT GROUP: 2 -- Technical options
--------------

     Vertical distribution used in the
     near field (MGAUSS)                    Default: 1     ! MGAUSS =  1   !
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                               Default: 3     ! MCTADJ =  3   !
        0 = no adjustment
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
            adjustment
        3 = partial plume path adjustment

     Subgrid-scale complex terrain
     flag (MCTSG)                           Default: 0     ! MCTSG =  0    !
        0 = not modeled
        1 = modeled

     Near-field puffs modeled as
     elongated slugs? (MSLUG)               Default: 0     ! MSLUG =  0    !
        0 = no
        1 = yes (slug model used)

     Transitional plume rise modeled ?
     (MTRANS)                               Default: 1     ! MTRANS =  1   !
        0 = no  (i.e., final rise only)
        1 = yes (i.e., transitional rise computed)

     Stack tip downwash? (MTIP)             Default: 1     ! MTIP =  1  !
        0 = no  (i.e., no stack tip downwash)
        1 = yes (i.e., use stack tip downwash)

     Method used to simulate building
     downwash? (MBDW)                       Default: 1     ! MBDW =   1  !
        1 = ISC method
        2 = PRIME method

     Vertical wind shear modeled above
     stack top? (MSHEAR)                    Default: 0     ! MSHEAR =  0  !
        0 = no  (i.e., vertical wind shear not modeled)
        1 = yes (i.e., vertical wind shear modeled)

     Puff splitting allowed? (MSPLIT)       Default: 0     ! MSPLIT =  0  !
        0 = no (i.e., puffs not split)
        1 = yes (i.e., puffs are split)

     Chemical mechanism flag (MCHEM)        Default: 1     ! MCHEM =  1   !
        0 = chemical transformation not
            modeled
        1 = transformation rates computed
            internally (MESOPUFF II scheme)
        2 = user-specified transformation
            rates used
        3 = transformation rates computed
            internally (RIVAD/ARM3 scheme)
        4 = secondary organic aerosol formation
            computed (MESOPUFF II scheme for OH)
```

```
Aqueous phase transformation flag (MAQCHEM)
(Used only if MCHEM = 1, or 3)          Default: 0      ! MAQCHEM =  0   !
   0 = aqueous phase transformation
       not modeled
   1 = transformation rates adjusted
       for aqueous phase reactions

Wet removal modeled ? (MWET)            Default: 1      ! MWET =  1   !
   0 = no
   1 = yes

Dry deposition modeled ? (MDRY)         Default: 1      ! MDRY =  1   !
   0 = no
   1 = yes
   (dry deposition method specified
    for each species in Input Group 3)


Gravitational settling (plume tilt)
modeled ? (MTILT)                       Default: 0      ! MTILT =  0   !
   0 = no
   1 = yes
   (puff center falls at the gravitational
    settling velocity for 1 particle species)

Restrictions:
    - MDRY  = 1
    - NSPEC = 1  (must be particle species as well)
    - sg    = 0  GEOMETRIC STANDARD DEVIATION in Group 8 is
                 set to zero for a single particle diameter

Method used to compute dispersion
coefficients (MDISP)                    Default: 3      ! MDISP =  3   !

   1 = dispersion coefficients computed from measured values
       of turbulence, sigma v, sigma w
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.
   5 = CTDM sigmas used for stable and neutral conditions.
       For unstable conditions, sigmas are computed as in
       MDISP = 3, described above.  MDISP = 5 assumes that
       measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5)           Default: 3      ! MTURBVW =  3  !
   1 = use sigma-v or sigma-theta measurements
       from PROFILE.DAT to compute sigma-y
       (valid for METFM = 1, 2, 3, 4, 5)
   2 = use sigma-w measurements
       from PROFILE.DAT to compute sigma-z
       (valid for METFM = 1, 2, 3, 4, 5)
   3 = use both sigma-(v/theta) and sigma-w
       from PROFILE.DAT to compute sigma-y and sigma-z
       (valid for METFM = 1, 2, 3, 4, 5)
   4 = use sigma-theta measurements
       from PLMMET.DAT to compute sigma-y
       (valid only if METFM = 3)
```

```
Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2)                          Default: 3     ! MDISP2 =  3  !
(used only if MDISP = 1 or 5)
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]
Method used for Lagrangian timescale for Sigma-y
(used only if MDISP=1,2 or MDISP2=1,2)
(MTAULY)                                  Default: 0     ! MTAULY =  0  !
   0 = Draxler default 617.284 (s)
   1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
  10 < Direct user input (s)              -- e.g., 306.9


[DIAGNOSTIC FEATURE]
Method used for Advective-Decay timescale for Turbulence
(used only if MDISP=2 or MDISP2=2)
(MTAUADV)                                 Default: 0     ! MTAUADV =  0  !
   0 = No turbulence advection
   1 = Computed (OPTION NOT IMPLEMENTED)
  10 < Direct user input (s)   -- e.g., 300


Method used to compute turbulence sigma-v &
sigma-w using micrometeorological variables
(Used only if MDISP = 2 or MDISP2 = 2)
(MCTURB)                                  Default: 1     ! MCTURB =  1  !
   1 = Standard CALPUFF subroutines
   2 = AERMOD subroutines

PG sigma-y,z adj. for roughness?          Default: 0     ! MROUGH =  0  !
(MROUGH)
   0 = no
   1 = yes

Partial plume penetration of              Default: 1     ! MPARTL =  1  !
elevated inversion?
(MPARTL)
   0 = no
   1 = yes

Strength of temperature inversion         Default: 0     ! MTINV =  0  !
provided in PROFILE.DAT extended records?
(MTINV)
   0 = no (computed from measured/default gradients)
   1 = yes

PDF used for dispersion under convective conditions?
                                          Default: 0     ! MPDF =  0  !
(MPDF)
   0 = no
   1 = yes

Sub-Grid TIBL module used for shore line?
```

Default: 0 ! MSGTIBL = 0 !

(MSGTIBL)
0 = no
1 = yes

Boundary conditions (concentration) modeled?
Default: 0 ! MBCON = 0 !

(MBCON)
0 = no
1 = yes, using formatted BCON.DAT file
2 = yes, using unformatted CONC.DAT file

Note: MBCON > 0 requires that the last species modeled be 'BCON'. Mass is placed in species BCON when generating boundary condition puffs so that clean air entering the modeling domain can be simulated in the same way as polluted air. Specify zero emission of species BCON for all regular sources.

Individual source contributions saved?
Default: 0 ! MSOURCE = 0 !

(MSOURCE)
0 = no
1 = yes

Analyses of fogging and icing impacts due to emissions from arrays of mechanically-forced cooling towers can be performed using CALPUFF in conjunction with a cooling tower emissions processor (CTEMISS) and its associated postprocessors. Hourly emissions of water vapor and temperature from each cooling tower cell are computed for the current cell configuration and ambient conditions by CTEMISS. CALPUFF models the dispersion of these emissions and provides cloud information in a specialized format for further analysis. Output to FOG.DAT is provided in either 'plume mode' or 'receptor mode' format.

Configure for FOG Model output?
Default: 0 ! MFOG = 0 !

(MFOG)
0 = no
1 = yes - report results in PLUME Mode format
2 = yes - report results in RECEPTOR Mode format

Test options specified to see if they conform to regulatory values? (MREG)
Default: 1 ! MREG = 0 !

0 = NO checks are made
1 = Technical options must conform to USEPA Long Range Transport (LRT) guidance

METFM	1 or 2
AVET	60. (min)
PGTIME	60. (min)
MGAUSS	1
MCTADJ	3
MTRANS	1
MTIP	1
MCHEM	1 or 3 (if modeling SOx, NOx)
MWET	1
MDRY	1
MDISP	2 or 3

```
MPDF      0 if MDISP=3
          1 if MDISP=2
MROUGH    0
MPARTL    1
SYTDEP    550. (m)
MHFTSZ    0
SVMIN     0.5 (m/s)

!END!

------------------------------------------------------------------------------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------

  The following species are modeled:

  ! CSPEC =  SO2 !          !END!
  ! CSPEC =  SO4 !          !END!
  ! CSPEC =  NOX !          !END!
  ! CSPEC =  HNO3 !          !END!
  ! CSPEC =  NO3 !          !END!
  ! CSPEC =  PM800 !          !END!
  ! CSPEC =  PM425 !          !END!
  ! CSPEC =  PM187 !          !END!
  ! CSPEC =  PM112 !          !END!
  ! CSPEC =  PM081 !          !END!
  ! CSPEC =  PM056 !          !END!

                                                        Dry                  OUTPUT
GROUP
    SPECIES          MODELED          EMITTED          DEPOSITED              NUMBER
     NAME        (0=NO, 1=YES)    (0=NO, 1=YES)    (0=NO,                (0=NONE,
   (Limit: 12                                        1=COMPUTED-GAS        1=1st
CGRUP,
    Characters                                       2=COMPUTED-PARTICLE   2=2nd
CGRUP,
    in length)                                       3=USER-SPECIFIED)     3= etc.)

!          SO2  =          1,               1,          1,                 0   !
!          SO4  =          1,               0,          2,                 0   !
!          NOX  =          1,               1,          1,                 0   !
!          HNO3  =          1,               0,          1,                 0   !
!          NO3  =          1,               0,          2,                 0   !
!          PM800  =          1,               0,          2,                 0   !
!          PM425  =          1,               0,          2,                 0   !
!          PM187  =          1,               0,          2,                 0   !
!          PM112  =          1,               0,          2,                 0   !
!          PM081  =          1,               1,          2,                 0   !
!          PM056  =          1,               1,          2,                 0   !

!END!

  Note:  The last species in (3a) must be 'BCON' when using the
         boundary condition option (MBCON > 0).  Species BCON should
         typically be modeled as inert (no chem transformation or
         removal).
```

```
-------------
Subgroup (3b)
-------------
  The following names are used for Species-Groups in which results
  for certain species are combined (added) prior to output.  The
  CGRUP name will be used as the species name in output files.
  Use this feature to model specific particle-size distributions
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.


------------------------------------------------------------------------------


INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                      Default: UTM     ! PMAP = LCC !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                     Default=0.0      ! FEAST  = 0  !
     (FNORTH)                    Default=0.0      ! FNORTH = 0  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                    No Default       ! IUTMZN =  17   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                    Default: N       ! UTMHEM = N  !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
      (RLAT0)                     No Default       ! RLAT0 = 40N !
      (RLON0)                     No Default       ! RLON0 = 97W !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane
```

```
      Matching parallel(s) of latitude (decimal degrees) for projection
      (Used only if PMAP= LCC or PS)
       (XLAT1)                    No Default      ! XLAT1 = 33N !
       (XLAT2)                    No Default      ! XLAT2 = 45N !

          LCC :  Projection cone slices through Earth's surface at RLAT1 and RLAT2
          PS  :  Projection plane slices through Earth at RLAT1
                 (RLAT2 is not used)

      ----------
      Note:  Latitudes and longitudes should be positive, and include a
             letter N,S,E, or W indicating north or south latitude, and
             east or west longitude.  For example,
             35.9  N Latitude  =  35.9N
             118.7 E Longitude = 118.7E


      Datum-region
      ------------

      The Datum-Region for the coordinates is identified by a character
      string.  Many mapping products currently available use the model of the
      Earth known as the World Geodetic System 1984 (WGS-84).  Other local
      models may be in use, and their selection in CALMET will make its output
      consistent with local mapping products.  The list of Datum-Regions with
      official transformation parameters is provided by the National Imagery and
      Mapping Agency (NIMA).

      NIMA Datum - Regions(Examples)
      ------------------------------------------------------------------------------
      WGS-84     WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
      NAS-C      NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
      NAR-C      NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
      NWS-84     NWS 6370KM Radius, Sphere
      ESR-S      ESRI REFERENCE 6371KM Radius, Sphere

      Datum-region for output coordinates
      (DATUM)                    Default: WGS-84     ! DATUM = NWS-84  !


METEOROLOGICAL Grid:

      Rectangular grid defined for projection PMAP,
      with X the Easting and Y the Northing coordinate

            No. X grid cells (NX)      No default     ! NX =  248   !
            No. Y grid cells (NY)      No default     ! NY =  257   !
         No. vertical layers (NZ)      No default     ! NZ =  10    !

           Grid spacing (DGRIDKM)      No default     ! DGRIDKM = 4 !
                                       Units: km

               Cell face heights
                   (ZFACE(nz+1))       No defaults
                                       Units: m
 !  ZFACE = 0., 20, 40, 80, 160, 320, 640, 1200, 2000, 3000, 4000 !

            Reference Coordinates
          of SOUTHWEST corner of
               grid cell(1, 1):

        X coordinate (XORIGKM)         No default     ! XORIGKM = 718.005 !
```

```
Y coordinate (YORIGKM)          No default      ! YORIGKM = -1214.003 !
                                Units: km

COMPUTATIONAL Grid:

     The computational grid is identical to or a subset of the MET. grid.
     The lower left (LL) corner of the computational grid is at grid point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of the
     computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
     The grid spacing of the computational grid is the same as the MET. grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  76   !
             (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  136  !
             (1 <= JBCOMP <= NY)

        X index of UR corner (IECOMP)      No default     ! IECOMP =  127  !
             (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =  208  !
             (1 <= JECOMP <= NY)


SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of the
     sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
     The sampling grid must be identical to or a subset of the computational
     grid.  It may be a nested grid inside the computational grid.
     The grid spacing of the sampling grid is DGRIDKM/MESHDN.

        Logical flag indicating if gridded
        receptors are used (LSAMP)         Default: T     ! LSAMP = F !
        (T=yes, F=no)

        X index of LL corner (IBSAMP)      No default     ! IBSAMP =  76   !
          (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  136  !
          (JBCOMP <= JBSAMP <= JECOMP)

        X index of UR corner (IESAMP)      No default     ! IESAMP =  127  !
          (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =  208  !
          (JBCOMP <= JESAMP <= JECOMP)

       Nesting factor of the sampling
        grid (MESHDN)                      Default: 1     ! MESHDN =  1  !
        (MESHDN is an integer >= 1)

!END!
```

```
INPUT GROUP: 5 -- Output Options
--------------

                                        *                          *
     FILE                          DEFAULT VALUE                VALUE THIS RUN
     ----                          -------------                --------------

   Concentrations (ICON)                 1                    !  ICON =  1   !
   Dry Fluxes (IDRY)                     1                    !  IDRY =  1   !
   Wet Fluxes (IWET)                     1                    !  IWET =  1   !
   2D Temperature (IT2D)                 0                    !  IT2D =  0   !
   2D Density (IRHO)                     0                    !  IRHO =  0   !
   Relative Humidity (IVIS)              1                    !  IVIS =  1   !
    (relative humidity file is
     required for visibility
     analysis)
   Use data compression option in output file?
   (LCOMPRS)                          Default: T              ! LCOMPRS = T !

   *
    0 = Do not create file, 1 = create file


    QA PLOT FILE OUTPUT OPTION:

       Create a standard series of output files (e.g.
       locations of sources, receptors, grids ...)
       suitable for plotting?
       (IQAPLOT)                      Default: 1              !  IQAPLOT =  1   !
         0 = no
         1 = yes

    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported?
       (IMFLX)                        Default: 0              ! IMFLX =  0  !
         0 = no
         1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
                  are specified in Input Group 0)

       Mass balance for each species
       reported?
       (IMBAL)                        Default: 0              ! IMBAL =  0  !
         0 = no
         1 = yes (MASSBAL.DAT filename is
              specified in Input Group 0)


    LINE PRINTER OUTPUT OPTIONS:

       Print concentrations (ICPRT)   Default: 0              ! ICPRT =  0   !
       Print dry fluxes (IDPRT)       Default: 0              ! IDPRT =  0   !
       Print wet fluxes (IWPRT)       Default: 0              ! IWPRT =  0   !
       (0 = Do not print, 1 = Print)

       Concentration print interval
       (ICFRQ) in timesteps           Default: 1              ! ICFRQ =  1   !
       Dry flux print interval
       (IDFRQ) in timesteps           Default: 1              ! IDFRQ =  1   !
       Wet flux print interval
       (IWFRQ) in timesteps           Default: 1              ! IWFRQ =  1   !
```

Units for Line Printer Output
(IPRTU) Default: 1 ! IPRTU = 1 !

	for Concentration	for Deposition
1 =	g/m**3	g/m**2/s
2 =	mg/m**3	mg/m**2/s
3 =	ug/m**3	ug/m**2/s
4 =	ng/m**3	ng/m**2/s
5 =	Odour Units	

Messages tracking progress of run
written to the screen ?
(IMESG) Default: 2 ! IMESG = 2 !
0 = no
1 = yes (advection step, puff ID)
2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)

SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

SPECIES /GROUP	---- CONCENTRATIONS ---- PRINTED?	SAVED ON DISK?	------ DRY FLUXES ------ PRINTED?	SAVED ON DISK?	------ WET FLUXES ------ -- MASS FLUX -- PRINTED?	SAVED ON DISK?
SO2 =	0,	1,	0,	1,	0,	1, 0 !
SO4 =	0,	1,	0,	1,	0,	1, 0 !
NOX =	0,	1,	0,	1,	0,	1, 0 !
HNO3 =	0,	1,	0,	1,	0,	1, 0 !
NO3 =	0,	1,	0,	1,	0,	1, 0 !
PM800 =	0,	1,	0,	1,	0,	1, 0 !
PM425 =	0,	1,	0,	1,	0,	1, 0 !
PM187 =	0,	1,	0,	1,	0,	1, 0 !
PM112 =	0,	1,	0,	1,	0,	1, 0 !
PM081 =	0,	1,	0,	1,	0,	1, 0 !
PM056 =	0,	1,	0,	1,	0,	1, 0 !

Note: Species BCON (for MBCON > 0) does not need to be saved on disk.

OPTIONS FOR PRINTING DEBUG QUANTITIES (much output)

Logical for debug output
(LDEBUG) Default: F ! LDEBUG = F !

First puff to track
(IPFDEB) Default: 1 ! IPFDEB = 1 !

Number of puffs to track
(NPFDEB) Default: 1 ! NPFDEB = 1000 !

```
       Met. period to start output
       (NN1)                                    Default: 1     ! NN1 =  1   !

       Met. period to end output
       (NN2)                                    Default: 10    ! NN2 =  8760  !

!END!

------------------------------------------------------------------------------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
-------------------------

---------------
Subgroup (6a)
---------------
       Number of terrain features (NHILL)       Default: 0     ! NHILL =  0   !

       Number of special complex terrain
       receptors  (NCTREC)                      Default: 0     ! NCTREC =  0   !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                  No Default     ! MHILL =  2   !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions  Default: 1.0   ! XHILL2M = 1. !
       to meters (MHILL=1)

       Factor to convert vertical dimensions    Default: 1.0   ! ZHILL2M = 1. !
       to meters (MHILL=1)

       X-origin of CTDM system relative to      No Default     ! XCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                      1 **
     HILL information

HILL            XC         YC        THETAH   ZGRID   RELIEF     EXPO 1     EXPO 2    SCALE
1    SCALE 2    AMAX1      AMAX2
 NO.            (km)       (km)      (deg.)   (m)     (m)        (m)        (m)       (m)
      (m)        (m)        (m)
----            ----       ----      ------   -----   ------     ------     ------
--------    --------    -----     -----
```

Subgroup (6c)

COMPLEX TERRAIN RECEPTOR INFORMATION

XRCT (km)	YRCT (km)	ZRCT (m)	XHH

1

Description of Complex Terrain Variables:
- XC, YC = Coordinates of center of hill
- THETAH = Orientation of major axis of hill (clockwise from North)
- ZGRID = Height of the 0 of the grid above mean sea level
- RELIEF = Height of the crest of the hill above the grid elevation
- EXPO 1 = Hill-shape exponent for the major axis
- EXPO 2 = Hill-shape exponent for the major axis
- SCALE 1 = Horizontal length scale along the major axis
- SCALE 2 = Horizontal length scale along the minor axis
- AMAX = Maximum allowed axis length for the major axis
- BMAX = Maximum allowed axis length for the major axis

- XRCT, YRCT = Coordinates of the complex terrain receptors
- ZRCT = Height of the ground (MSL) at the complex terrain Receptor
- XHH = Hill number associated with each complex terrain receptor (NOTE: MUST BE ENTERED AS A REAL NUMBER)

**

NOTE: DATA for each hill and CTSG receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
---

SPECIES NAME	DIFFUSIVITY (cm**2/s)	ALPHA STAR (dimensionless)	REACTIVITY	MESOPHYLL RESISTANCE (s/cm)	HENRY'S LAW COEFFICIENT
! SO2 =	0.1509,	1000,	8,	0,	0.04 !
! NOX =	0.1656,	1,	8,	5,	3.5 !
! HNO3 =	0.1628,	1,	18,	0,	8E-08 !

!END!

INPUT GROUP: 8 -- Size parameters for dry deposition of particles

For SINGLE SPECIES, the mean and standard deviation are used to compute a deposition velocity for NINT (see group 9) size-ranges, and these are then averaged to obtain a mean deposition velocity.

For GROUPED SPECIES, the size distribution should be explicitly specified (by the 'species' in the group), and the standard deviation for each should be entered as 0. The model will then use the deposition velocity for the stated mean diameter.

SPECIES NAME	GEOMETRIC MASS MEAN DIAMETER (microns)	GEOMETRIC STANDARD DEVIATION (microns)
! SO4 =	0.48,	2 !
! NO3 =	0.48,	2 !
! PM800 =	8,	0 !
! PM425 =	4.25,	0 !
! PM187 =	1.875,	0 !
! PM112 =	1.125,	0 !
! PM081 =	0.8125,	0 !
! PM056 =	0.5625,	0 !

!END!

INPUT GROUP: 9 -- Miscellaneous dry deposition parameters

Reference cuticle resistance (s/cm)
(RCUTR) Default: 30 ! RCUTR = 30.0 !
Reference ground resistance (s/cm)
(RGR) Default: 10 ! RGR = 10.0 !
Reference pollutant reactivity
(REACTR) Default: 8 ! REACTR = 8.0 !

Number of particle-size intervals used to evaluate effective particle deposition velocity
(NINT) Default: 9 ! NINT = 9 !

Vegetation state in unirrigated areas
(IVEG) Default: 1 ! IVEG = 1 !
IVEG=1 for active and unstressed vegetation
IVEG=2 for active and stressed vegetation
IVEG=3 for inactive vegetation

!END!

INPUT GROUP: 10 -- Wet Deposition Parameters

Scavenging Coefficient -- Units: (sec)**(-1)

```
!        Pollutant      Liquid Precip.       Frozen Precip.
!        ---------      --------------       --------------
!            SO2  =          0.00003,              0 !
!            SO4  =          0.0001,            0.00003 !
!            NOX  =          0,               0 !
!            HNO3  =          0.00006,             0 !
!            NO3  =          0.0001,            0.00003 !
!            PM800  =          0.0001,              0.00003 !
!            PM425  =          0.0001,              0.00003 !
!            PM187  =          0.0001,              0.00003 !
!            PM112  =          0.0001,              0.00003 !
!            PM081  =          0.0001,              0.00003 !
!            PM056  =          0.0001,              0.00003 !

!END!

------------------------------------------------------------------------------


INPUT GROUP: 11 -- Chemistry Parameters
---------------

     Ozone data input option (MOZ)     Default: 1            ! MOZ =     1    !
     (Used only if MCHEM = 1, 3, or 4)
        0 = use a monthly background ozone value
        1 = read hourly ozone concentrations from
            the OZONE.DAT data file

     Monthly ozone concentrations
     (Used only if MCHEM = 1, 3, or 4 and
      MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
     (BCKO3) in ppb                    Default: 12*80.
 !   BCKO3 = 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80, 80 !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
 !   BCKNH3 = 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 = 0.2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 = 2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 = 2.0 !

     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =  1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                  Default: 12*1.
     !  BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00 !
```

--- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
(used only if MCHEM = 4)

The SOA module uses monthly values of:
Fine particulate concentration in ug/m^3 (BCKPMF)
Organic fraction of fine particulate (OFRAC)
VOC / NOX ratio (after reaction) (VCNX)
to characterize the air mass when computing
the formation of SOA from VOC emissions.
Typical values for several distinct air mass types are:

Month	1 Jan	2 Feb	3 Mar	4 Apr	5 May	6 Jun	7 Jul	8 Aug	9 Sep	10 Oct	11 Nov	12 Dec
Clean Continental												
BCKPMF	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
OFRAC	.15	.15	.20	.20	.20	.20	.20	.20	.20	.20	.20	.15
VCNX	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
Clean Marine (surface)												
BCKPMF	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
OFRAC	.25	.25	.30	.30	.30	.30	.30	.30	.30	.30	.30	.25
VCNX	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
Urban - low biogenic (controls present)												
BCKPMF	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
OFRAC	.20	.20	.25	.25	.25	.25	.25	.25	.20	.20	.20	.20
VCNX	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
Urban - high biogenic (controls present)												
BCKPMF	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.
OFRAC	.25	.25	.30	.30	.30	.55	.55	.55	.35	.35	.35	.25
VCNX	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
Regional Plume												
BCKPMF	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
OFRAC	.20	.20	.25	.35	.25	.40	.40	.40	.30	.30	.30	.20
VCNX	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
Urban - no controls present												
BCKPMF	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.
OFRAC	.30	.30	.35	.35	.35	.55	.55	.55	.35	.35	.35	.30
VCNX	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

Default: Clean Continental

! BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00
!
! OFRAC = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15 !

! VCNX = 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0, 50.0 !

!END!

INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters

---

Horizontal size of puff (m) beyond which
time-dependent dispersion equations (Heffter)

```
are used to determine sigma-y and
sigma-z (SYTDEP)                          Default: 550.    ! SYTDEP = 5.5E02 !

Switch for using Heffter equation for sigma z
as above (0 = Not use Heffter; 1 = use Heffter
(MHFTSZ)                                  Default: 0       ! MHFTSZ =  0    !

Stability class used to determine plume
growth rates for puffs above the boundary
layer (JSUP)                              Default: 5       ! JSUP =  5    !

Vertical dispersion constant for stable
conditions (k1 in Eqn. 2.7-3)  (CONK1)    Default: 0.01    ! CONK1 = 0.01 !

Vertical dispersion constant for neutral/
unstable conditions (k2 in Eqn. 2.7-4)
(CONK2)                                   Default: 0.1     ! CONK2 = 0.1 !

Factor for determining Transition-point from
Schulman-Scire to Huber-Snyder Building Downwash
scheme (SS used for Hs < Hb + TBD * HL)
(TBD)                                     Default: 0.5     ! TBD = 0.5 !
   TBD < 0   ==> always use Huber-Snyder
   TBD = 1.5 ==> always use Schulman-Scire
   TBD = 0.5 ==> ISC Transition-point

Range of land use categories for which
urban dispersion is assumed
(IURB1, IURB2)                            Default: 10      ! IURB1 =  10  !
                                                   19      ! IURB2 =  19  !

Site characterization parameters for single-point Met data files ---------
(needed for METFM = 2,3,4,5)

   Land use category for modeling domain
   (ILANDUIN)                             Default: 20      ! ILANDUIN =  20  !

   Roughness length (m) for modeling domain
   (ZOIN)                                 Default: 0.25    ! ZOIN = 0.25 !

   Leaf area index for modeling domain
   (XLAIIN)                               Default: 3.0     ! XLAIIN = 3.0 !

   Elevation above sea level (m)
   (ELEVIN)                               Default: 0.0     ! ELEVIN = 0.0 !

   Latitude (degrees) for met location
   (XLATIN)                               Default: -999.   ! XLATIN = -999. !

   Longitude (degrees) for met location
   (XLONIN)                               Default: -999.   ! XLONIN = -999. !

Specialized information for interpreting single-point Met data files -----

   Anemometer height (m) (Used only if METFM = 2,3)
   (ANEMHT)                               Default: 10.     ! ANEMHT = 10. !

   Form of lateral turbulance data in PROFILE.DAT file
   (Used only if METFM = 4,5 or MTURBVW = 1 or 3)
   (ISIGMAV)                              Default: 1       ! ISIGMAV =  1  !
       0 = read sigma-theta
       1 = read sigma-v
```

Choice of mixing heights (Used only if METFM = 4)
(IMIXCTDM) Default: 0 ! IMIXCTDM = 0 !
0 = read PREDICTED mixing heights
1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)
(XMXLEN) Default: 1.0 ! XMXLEN = 1. !

Maximum travel distance of a puff/slug (in grid units) during one sampling step
(XSAMLEN) Default: 1.0 ! XSAMLEN = 1. !

Maximum Number of slugs/puffs release from one source during one time step
(MXNEW) Default: 99 ! MXNEW = 99 !

Maximum Number of sampling steps for one puff/slug during one time step
(MXSAM) Default: 99 ! MXSAM = 99 !

Number of iterations used when computing the transport wind for a sampling step that includes gradual rise (for CALMET and PROFILE winds)
(NCOUNT) Default: 2 ! NCOUNT = 2 !

Minimum sigma y for a new puff/slug (m)
(SYMIN) Default: 1.0 ! SYMIN = 1. !

Minimum sigma z for a new puff/slug (m)
(SZMIN) Default: 1.0 ! SZMIN = 1. !

Default minimum turbulence velocities sigma-v and sigma-w for each stability class over land and over water (m/s)
(SVMIN(12) and SWMIN(12))

	LAND						WATER					
Stab Class :	A	B	C	D	E	F	A	B	C	D	E	F
Default SVMIN :	.50,	.50,	.50,	.50,	.50,	.50,	.37,	.37,	.37,	.37,	.37,	.37
Default SWMIN :	.20,	.12,	.08,	.06,	.03,	.016,	.20,	.12,	.08,	.06,	.03,	.016

! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370, 0.370, 0.370, 0.370, 0.370, 0.370 !
! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016 !

Divergence criterion for dw/dz across puff used to initiate adjustment for horizontal convergence (1/s)
Partial adjustment starts at CDIV(1), and full adjustment is reached at CDIV(2)
(CDIV(2)) Default: 0.0,0.0 ! CDIV = .0, .0 !

Minimum wind speed (m/s) allowed for non-calm conditions. Also used as minimum speed returned when using power-law extrapolation toward surface
(WSCALM) Default: 0.5 ! WSCALM = 0.5 !

Maximum mixing height (m)
(XMAXZI) Default: 3000. ! XMAXZI = 3000. !

```
     Minimum mixing height (m)
     (XMINZI)                                    Default: 50.     ! XMINZI = 50.0 !

     Default wind speed classes --
     5 upper bounds (m/s) are entered;
     the 6th class has no upper limit
     (WSCAT(5))                        Default   :
                                       ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8
(10.8+)

                                  Wind Speed Class :  1     2     3     4     5
                                                     ---   ---   ---   ---   ---
 !  WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

     Default wind speed profile power-law
     exponents for stabilities 1-6
     (PLX0(6))                         Default   : ISC RURAL values
                                       ISC RURAL : .07, .07, .10, .15, .35, .55
                                       ISC URBAN : .15, .15, .20, .25, .30, .30

                                  Stability Class :  A     B     C     D     E     F
                                                     ---   ---   ---   ---   ---   ---
 !  PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

     Default potential temperature gradient
     for stable classes E, F (degK/m)
     (PTG0(2))                         Default: 0.020, 0.035
                                          ! PTG0 = 0.020, 0.035 !

     Default plume path coefficients for
     each stability class (used when option
     for partial plume height terrain adjustment
     is selected -- MCTADJ=3)
     (PPC(6))                     Stability Class :  A     B     C     D     E     F
                                     Default  PPC :  .50,  .50,  .50,  .50,  .35,  .35
                                                     ---   ---   ---   ---   ---   ---
 !  PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

     Slug-to-puff transition criterion factor
     equal to sigma-y/length of slug
     (SL2PF)                                Default: 10.       ! SL2PF = 5.0 !

     Puff-splitting control variables -----------------------

       VERTICAL SPLIT
       --------------

       Number of puffs that result every time a puff
       is split - nsplit=2 means that 1 puff splits
       into 2
       (NSPLIT)                             Default:   3       ! NSPLIT =  3  !

       Time(s) of a day when split puffs are eligible to
       be split once again; this is typically set once
       per day, around sunset before nocturnal shear develops.
       24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
       0=do not re-split    1=eligible for re-split
       (IRESPLIT(24))                       Default:  Hour 17 = 1
 !  IRESPLIT = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
0 !

       Split is allowed only if last hour's mixing
```

height (m) exceeds a minimum value
(ZISPLIT) Default: 100. ! ZISPLIT = 100.0 !

Split is allowed only if ratio of last hour's
mixing ht to the maximum mixing ht experienced
by the puff is less than a maximum value (this
postpones a split until a nocturnal layer develops)
(ROLDMAX) Default: 0.25 ! ROLDMAX = 0.25 !

HORIZONTAL SPLIT

Number of puffs that result every time a puff
is split - nsplith=5 means that 1 puff splits
into 5
(NSPLITH) Default: 5 ! NSPLITH = 5 !

Minimum sigma-y (Grid Cells Units) of puff
before it may be split
(SYSPLITH) Default: 1.0 ! SYSPLITH = 1.0 !

Minimum puff elongation rate (SYSPLITH/hr) due to
wind shear, before it may be split
(SHSPLITH) Default: 2. ! SHSPLITH = 2.0 !

Minimum concentration (g/m^3) of each
species in puff before it may be split
Enter array of NSPEC values; if a single value is
entered, it will be used for ALL species
(CNSPLITH) Default: 1.0E-07 ! CNSPLITH = 1.0E-07
!

Integration control variables ---

Fractional convergence criterion for numerical SLUG
sampling integration
(EPSSLUG) Default: 1.0e-04 ! EPSSLUG = 1.0E-04 !

Fractional convergence criterion for numerical AREA
source integration
(EPSAREA) Default: 1.0e-06 ! EPSAREA = 1.0E-06 !

Trajectory step-length (m) used for numerical rise
integration
(DSRISE) Default: 1.0 ! DSRISE = 1.0 !

Boundary Condition (BC) Puff control variables ---

Minimum height (m) to which BC puffs are mixed as they are emitted
(MBCON=2 ONLY). Actual height is reset to the current mixing height
at the release point if greater than this minimum.
(HTMINBC) Default: 500. ! HTMINBC = 500.0 !

Search radius (km) about a receptor for sampling nearest BC puff.
BC puffs are typically emitted with a spacing of one grid cell
length, so the search radius should be greater than DGRIDKM.
(RSAMPBC) Default: 10. ! RSAMPBC = 10.0 !
Near-Surface depletion adjustment to concentration profile used when
sampling BC puffs?
(MDEPBC) Default: 1 ! MDEPBC = 1 !
0 = Concentration is NOT adjusted for depletion
1 = Adjust Concentration for depletion

!END!

INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters

Subgroup (13a)

Number of point sources with parameters provided below (NPT1) No default ! NPT1 = 6 !

Units used for point source emissions below (IPTU) Default: 1 ! IPTU = 3 !

1 = g/s
2 = kg/hr
3 = lb/hr
4 = tons/yr
5 = Odour Unit * m**3/s (vol. flux of odour compound)
6 = Odour Unit * m**3/min
7 = metric tons/yr

Number of source-species combinations with variable emissions scaling factors provided below in (13d) (NSPT1) Default: 0 ! NSPT1 = 0 !

Number of point sources with variable emission parameters provided in external file (NPT2) No default ! NPT2 = 0 !

(If NPT2 > 0, these point source emissions are read from the file: PTEMARB.DAT)

!END!

Subgroup (13b)

POINT SOURCE: CONSTANT DATA [a]

Source No. [c]	X Coordinate (km)	Y Coordinate (km)	Stack Height (m)	Base Elevation (m)	Stack Diameter (m)	Exit Vel. (m/s)	Exit Temp. (deg. K)	Bldg. Dwash [b] Emission Rates
1 ! SRCNAM = BCZ1 !								
1 ! X =	1118.2763,	-572.1253,	13.72,	228.6,	0.69,	15.24,	477.59,	0.,
12.709,	0,	3.58,	0,	0,	0,	0,	0,	0, 6.425, 6.425!
1 ! SIGYZI =	0, 0 !							
1 ! ZPLTFM =	.0 !							

```
 1 ! FMFAC =   0 !   !END!
 2 ! SRCNAM = BDZ1 !
   2 ! X =    1118.2958,   -572.1236,    14.63, 229.51,       0.61,   3.96,  422.04,
  0.,
     4.686,   0,   1.32,   0,   0,   0,   0,   0,   0,   5.19,   5.19!
 2 ! SIGYZI =   0, 0 !
 2 ! ZPLTFM =   .0 !
 2 ! FMFAC =   0 !   !END!
 3 ! SRCNAM = BDZ3 !
   3 ! X =    1118.2795,   -572.1414,    14.63, 229.51,       0.41,   10.67,
422.04,   0.,
     3.124,   0,   0.88,   0,   0,   0,   0,   0,   0,   4.745,   4.745!
 3 ! SIGYZI =   0, 0 !
 3 ! ZPLTFM =   .0 !
 3 ! FMFAC =   0 !   !END!
 4 ! SRCNAM = BDZ4 !
   4 ! X =    1118.2694,   -572.1356,    9.14, 224.03,       0.51,   3.66,  394.26,
 0.,
     2.414,   0,   0.68,   0,   0,   0,   0,   0,   0,   4.28,   4.28!
 4 ! SIGYZI =   0, 0 !
 4 ! ZPLTFM =   .0 !
 4 ! FMFAC =   0 !   !END!
 5 ! SRCNAM = BKZ1 !
   5 ! X =    1118.3555,   -572.1482,    59.44, 274.32,       1.22,   16.46,
477.59,   0.,
     305.966,   0,   4.18,   0,   0,   0,   0,   0,   0,   6.025,   6.025!
 5 ! SIGYZI =   0, 0 !
 5 ! ZPLTFM =   .0 !
 5 ! FMFAC =   0 !   !END!
 6 ! SRCNAM = GBZ1 !
   6 ! X =    1118.3757,   -572.1623,    16.76, 231.65,       0.91,   11.58,
533.15,   0.,
     52.966,   0,   14.92,   0,   0,   0,   0,   0,   0,   7.905,   7.905!
 6 ! SIGYZI =   0, 0 !
 6 ! ZPLTFM =   .0 !
 6 ! FMFAC =   0 !   !END!
```

---

a
Data for each source are treated as a separate input subgroup
and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source
(No default)

X is an array holding the source data listed by the column headings
(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)
(Default: 0.,0.)

FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent the effect of rain-caps or other physical configurations that reduce momentum rise associated with the actual exit velocity.
(Default: 1.0 -- full momentum used)

ZPLTFM is the platform height (m) for sources influenced by an isolated structure that has a significant open area between the surface and the bulk of the structure, such as an offshore oil platform. The Base Elevation is that of the surface (ground or ocean), and the Stack Height is the release height above the Base (not above the platform). Building heights entered in Subgroup 13c must be those of the buildings on the platform, measured from the platform deck. ZPLTFM is used only with MBDW=1 (ISC downwash method) for sources with building downwash.
(Default: 0.0)

b
0. = No building downwash modeled
1. = Downwash modeled for buildings resting on the surface
2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)
NOTE: must be entered as a REAL number (i.e., with decimal point)

c
An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are
modeled, but not emitted. Units are specified by IPTU
(e.g. 1 for g/s).

Subgroup (13c)

BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH

Source No.	Effective building height, width, length and X/Y offset (in meters)[a] every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for MBDW=2 (PRIME downwash option)

---

a
Building height, width, length, and X/Y offset from the source are treated as a separate input subgroup for each source and therefore must end with an input group terminator. The X/Y offset is the position, relative to the stack, of the center of the upwind face of the projected building, with the x-axis pointing along the flow direction.

Subgroup (13d)

POINT SOURCE: VARIABLE EMISSIONS DATA[a]

Use this subgroup to describe temporal variations in the emission rates given in 13b. Factors entered multiply the rates in 13b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

0 =	Constant	
1 =	Diurnal cycle	(24 scaling factors: hours 1-24)
2 =	Monthly cycle	(12 scaling factors: months 1-12)
3 =	Hour & Season	(4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
4 =	Speed & Stab.	(6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
5 =	Temperature	(12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

---

a
Data for each species are treated as a separate input subgroup
and therefore must end with an input group terminator.

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

Subgroup (14a)

Number of polygon area sources with parameters specified below (NAR1) No default ! NAR1 = 0 !

Units used for area source emissions below (IARU) Default: 1 ! IARU = 1 !

1 = g/m**2/s
2 = kg/m**2/hr
3 = lb/m**2/hr
4 = tons/m**2/yr
5 = Odour Unit * m/s (vol. flux/m**2 of odour compound)
6 = Odour Unit * m/min
7 = metric tons/m**2/yr

Number of source-species combinations with variable emissions scaling factors provided below in (14d) (NSAR1) Default: 0 ! NSAR1 = 0 !

Number of buoyant polygon area sources with variable location and emission parameters (NAR2) No default ! NAR2 = 0 !
(If NAR2 > 0, ALL parameter data for these sources are read from the file: BAEMARB.DAT)

!END!

Subgroup (14b)

AREA SOURCE: CONSTANT DATA [a]

Source No.	Effect. Height (m)	Base Elevation (m)	Initial Sigma z (m)	Emission Rates [b]
-------	------	------	--------	---------

---

a
Data for each source are treated as a separate input subgroup
and therefore must end with an input group terminator.

b
An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are

modeled, but not emitted. Units are specified by IARU (e.g. 1 for g/m**2/s).

Subgroup (14c)

Source No.	COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON Ordered list of X followed by list of Y, grouped by source[a]

---
[a] Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

Subgroup (14d)

AREA SOURCE: VARIABLE EMISSIONS DATA[a]

Use this subgroup to describe temporal variations in the emission rates given in 14b. Factors entered multiply the rates in 14b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

0 =	Constant	
1 =	Diurnal cycle	(24 scaling factors: hours 1-24)
2 =	Monthly cycle	(12 scaling factors: months 1-12)
3 =	Hour & Season	(4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
4 =	Speed & Stab.	(6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
5 =	Temperature	(12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

---
[a] Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters

Subgroup (15a)

```
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                                  No default  ! NLN2 =  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)        No default   ! NLINES =  0  !

     Units used for line source
     emissions below                (ILNU)          Default: 1  ! ILNU =   1  !
           1 =         g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (15c)        (NSLN1) Default: 0  !  NSLN1 =  0  !

     Maximum number of segments used to model
     each line (MXNSEG)                                 Default: 7   ! MXNSEG =  7  !

     The following variables are required only if NLINES > 0.  They are
     used in the buoyant line source plume rise calculations.

        Number of distances at which                    Default: 6   ! NLRISE =  6  !
        transitional rise is computed

        Average building length (XL)                    No default   ! XL = 0. !
                                                        (in meters)

        Average building height (HBL)                   No default   ! HBL = 0. !
                                                        (in meters)

        Average building width (WBL)                    No default   ! WBL = 0. !
                                                        (in meters)

        Average line source width (WML)                 No default   ! WML = 0. !
                                                        (in meters)

        Average separation between buildings (DXL)      No default   ! DXL = 0. !
                                                        (in meters)

        Average buoyancy parameter (FPRIMEL)            No default   ! FPRIMEL = 0. !
                                                        (in m**4/s**3)

!END!

---------------
Subgroup (15b)
---------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------

     a
```

Source No.	Beg. X Coordinate (km)	Beg. Y Coordinate (km)	End. X Coordinate (km)	End. Y Coordinate (km)	Release Height (m)	Base Elevation (m)	Emission Rates

---

a
Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

b
An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by ILNTU (e.g. 1 for g/s).

Subgroup (15c)

BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA [a]

Use this subgroup to describe temporal variations in the emission rates given in 15b. Factors entered multiply the rates in 15b. Skip sources here that have constant emissions.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

0 =	Constant	
1 =	Diurnal cycle	(24 scaling factors: hours 1-24)
2 =	Monthly cycle	(12 scaling factors: months 1-12)
3 =	Hour & Season	(4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
4 =	Speed & Stab.	(6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
5 =	Temperature	(12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

---
a
Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters

Subgroup (16a)

Number of volume sources with parameters provided in 16b,c (NVL1) No default ! NVL1 = 0 !

Units used for volume source emissions below in 16b (IVLU) Default: 1 ! IVLU = 1 !
1 = g/s
2 = kg/hr
3 = lb/hr
4 = tons/yr
5 = Odour Unit * m**3/s (vol. flux of odour compound)
6 = Odour Unit * m**3/min
7 = metric tons/yr

Number of source-species combinations with variable emissions scaling factors provided below in (16c) (NSVL1) Default: 0 ! NSVL1 = 0 !

Number of volume sources with variable location and emission parameters (NVL2) No default ! NVL2 = 0 !

(If NVL2 > 0, ALL parameter data for these sources are read from the VOLEMARB.DAT file(s))

!END!

Subgroup (16b)

VOLUME SOURCE: CONSTANT DATA [a]

X Coordinate (km)	Y Coordinate (km)	Effect. Height (m)	Base Elevation (m)	Initial Sigma y (m)	Initial Sigma z (m)	Emission Rates [b]

---

[a] Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

[b] An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by IVLU (e.g. 1 for g/s).

Subgroup (16c)

VOLUME SOURCE: VARIABLE EMISSIONS DATA [a]

Use this subgroup to describe temporal variations in the emission rates given in 16b. Factors entered multiply the rates in 16b. Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

0 =	Constant	
1 =	Diurnal cycle	(24 scaling factors: hours 1-24)
2 =	Monthly cycle	(12 scaling factors: months 1-12)
3 =	Hour & Season	(4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
4 =	Speed & Stab.	(6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
5 =	Temperature	(12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

---

[a] Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information

---

Subgroup (17a)

Number of non-gridded receptors (NREC) No default ! NREC = 220 !

!END!

Subgroup (17b)

NON-GRIDDED (DISCRETE) RECEPTOR DATA[a]

Receptor No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground[b] (m)	
1 ! X =	1124.3588,	-493.5101,	903,	0	! !END!
2 ! X =	1125.1100,	-493.4070,	958,	0	! !END!
3 ! X =	1125.8612,	-493.3038,	1057,	0	! !END!
4 ! X =	1123.4821,	-492.6979,	969,	0	! !END!
5 ! X =	1124.2332,	-492.5948,	846,	0	! !END!
6 ! X =	1124.9843,	-492.4917,	853,	0	! !END!
7 ! X =	1125.7354,	-492.3885,	873,	0	! !END!
8 ! X =	1121.1035,	-492.0913,	1070,	0	! !END!
9 ! X =	1121.8545,	-491.9885,	1189,	0	! !END!
10 ! X =	1122.6055,	-491.8856,	1015,	0	! !END!
11 ! X =	1123.3566,	-491.7826,	893,	0	! !END!
12 ! X =	1124.1076,	-491.6796,	763,	0	! !END!

```
13 ! X =        1124.8586,     -491.5764,     732,        0 !  !END!
14 ! X =        1125.6096,     -491.4733,     805,        0 !  !END!
15 ! X =        1126.3606,     -491.3700,     962,        0 !  !END!
16 ! X =        1120.2272,     -491.2788,     934,        0 !  !END!
17 ! X =        1120.9782,     -491.1760,     926,        0 !  !END!
18 ! X =        1121.7291,     -491.0732,     1023,        0 !  !END!
19 ! X =        1122.4801,     -490.9703,     950,        0 !  !END!
20 ! X =        1123.2310,     -490.8673,     823,        0 !  !END!
21 ! X =        1123.9819,     -490.7643,     762,        0 !  !END!
22 ! X =        1124.7329,     -490.6612,     775,        0 !  !END!
23 ! X =        1125.4838,     -490.5580,     764,        0 !  !END!
24 ! X =        1126.2347,     -490.4548,     908,        0 !  !END!
25 ! X =        1120.1020,     -490.3634,     918,        0 !  !END!
26 ! X =        1120.8529,     -490.2607,     822,        0 !  !END!
27 ! X =        1121.6038,     -490.1579,     876,        0 !  !END!
28 ! X =        1122.3546,     -490.0550,     918,        0 !  !END!
29 ! X =        1123.1055,     -489.9520,     673,        0 !  !END!
30 ! X =        1123.8563,     -489.8490,     671,        0 !  !END!
31 ! X =        1124.6072,     -489.7459,     785,        0 !  !END!
32 ! X =        1125.3580,     -489.6428,     937,        0 !  !END!
33 ! X =        1126.1088,     -489.5395,     883,        0 !  !END!
34 ! X =        1126.8596,     -489.4362,     967,        0 !  !END!
35 ! X =        1119.9768,     -489.4481,     785,        0 !  !END!
36 ! X =        1120.7276,     -489.3454,     821,        0 !  !END!
37 ! X =        1121.4784,     -489.2426,     846,        0 !  !END!
38 ! X =        1122.2292,     -489.1397,     766,        0 !  !END!
39 ! X =        1122.9799,     -489.0368,     610,        0 !  !END!
40 ! X =        1123.7307,     -488.9338,     793,        0 !  !END!
41 ! X =        1124.4815,     -488.8307,     959,        0 !  !END!
42 ! X =        1125.2322,     -488.7275,     928,        0 !  !END!
43 ! X =        1125.9829,     -488.6243,     1090,        0 !  !END!
44 ! X =        1126.7337,     -488.5210,     1154,        0 !  !END!
45 ! X =        1127.4844,     -488.4177,     1002,        0 !  !END!
46 ! X =        1128.2351,     -488.3143,     893,        0 !  !END!
47 ! X =        1120.6023,     -488.4301,     610,        0 !  !END!
48 ! X =        1121.3530,     -488.3273,     706,        0 !  !END!
49 ! X =        1122.1037,     -488.2244,     581,        0 !  !END!
50 ! X =        1122.8544,     -488.1215,     628,        0 !  !END!
51 ! X =        1123.6051,     -488.0185,     673,        0 !  !END!
52 ! X =        1124.3557,     -487.9154,     878,        0 !  !END!
53 ! X =        1125.1064,     -487.8123,     1099,        0 !  !END!
54 ! X =        1125.8571,     -487.7091,     1175,        0 !  !END!
55 ! X =        1126.6077,     -487.6058,     1139,        0 !  !END!
56 ! X =        1127.3583,     -487.5025,     1097,        0 !  !END!
57 ! X =        1128.1090,     -487.3991,     862,        0 !  !END!
58 ! X =        1120.4770,     -487.5148,     606,        0 !  !END!
59 ! X =        1121.2276,     -487.4120,     557,        0 !  !END!
60 ! X =        1121.9783,     -487.3092,     598,        0 !  !END!
61 ! X =        1122.7289,     -487.2063,     646,        0 !  !END!
62 ! X =        1123.4795,     -487.1033,     777,        0 !  !END!
63 ! X =        1124.2300,     -487.0002,     939,        0 !  !END!
64 ! X =        1124.9806,     -486.8971,     1000,        0 !  !END!
65 ! X =        1125.7312,     -486.7939,     1134,        0 !  !END!
66 ! X =        1126.4817,     -486.6906,     1042,        0 !  !END!
67 ! X =        1127.2323,     -486.5873,     1096,        0 !  !END!
68 ! X =        1127.9828,     -486.4839,     905,        0 !  !END!
69 ! X =        1128.7334,     -486.3804,     796,        0 !  !END!
70 ! X =        1120.3517,     -486.5995,     498,        0 !  !END!
71 ! X =        1121.1023,     -486.4968,     532,        0 !  !END!
72 ! X =        1121.8528,     -486.3939,     579,        0 !  !END!
73 ! X =        1122.6033,     -486.2910,     620,        0 !  !END!
74 ! X =        1123.3538,     -486.1881,     753,        0 !  !END!
75 ! X =        1124.1043,     -486.0850,     971,        0 !  !END!
```

```
 76 ! X =        1124.8548,     -485.9819,     995,        0 !  !END!
 77 ! X =        1125.6053,     -485.8787,     1063,        0 !  !END!
 78 ! X =        1126.3558,     -485.7755,     912,        0 !  !END!
 79 ! X =        1127.1063,     -485.6721,     1072,        0 !  !END!
 80 ! X =        1127.8567,     -485.5688,     970,        0 !  !END!
 81 ! X =        1128.6071,     -485.4653,     828,        0 !  !END!
 82 ! X =        1120.2265,     -485.6843,     460,        0 !  !END!
 83 ! X =        1120.9769,     -485.5815,     567,        0 !  !END!
 84 ! X =        1121.7274,     -485.4787,     524,        0 !  !END!
 85 ! X =        1122.4778,     -485.3758,     596,        0 !  !END!
 86 ! X =        1123.2282,     -485.2728,     661,        0 !  !END!
 87 ! X =        1123.9786,     -485.1698,     732,        0 !  !END!
 88 ! X =        1124.7290,     -485.0667,     963,        0 !  !END!
 89 ! X =        1125.4794,     -484.9635,     957,        0 !  !END!
 90 ! X =        1126.2298,     -484.8603,     924,        0 !  !END!
 91 ! X =        1126.9802,     -484.7570,     1039,        0 !  !END!
 92 ! X =        1127.7306,     -484.6536,     867,        0 !  !END!
 93 ! X =        1128.4809,     -484.5502,     846,        0 !  !END!
 94 ! X =        1129.2313,     -484.4466,     715,        0 !  !END!
 95 ! X =        1129.9816,     -484.3431,     734,        0 !  !END!
 96 ! X =        1130.7320,     -484.2394,     761,        0 !  !END!
 97 ! X =        1131.4823,     -484.1357,     798,        0 !  !END!
 98 ! X =        1118.6004,     -484.9743,     476,        0 !  !END!
 99 ! X =        1119.3508,     -484.8717,     488,        0 !  !END!
100 ! X =         1120.1012,      -484.7690,      446,         0 !  !END!
101 ! X =         1120.8515,      -484.6663,      443,         0 !  !END!
102 ! X =         1121.6019,      -484.5635,      549,         0 !  !END!
103 ! X =         1122.3523,      -484.4606,      526,         0 !  !END!
104 ! X =         1123.1026,      -484.3576,      596,         0 !  !END!
105 ! X =         1123.8529,      -484.2546,      733,         0 !  !END!
106 ! X =         1124.6033,      -484.1515,      905,         0 !  !END!
107 ! X =         1125.3536,      -484.0484,      867,         0 !  !END!
108 ! X =         1126.1039,      -483.9451,      781,         0 !  !END!
109 ! X =         1126.8542,      -483.8418,      900,         0 !  !END!
110 ! X =         1127.6045,      -483.7385,      808,         0 !  !END!
111 ! X =         1128.3547,      -483.6350,      638,         0 !  !END!
112 ! X =         1129.1050,      -483.5315,      774,         0 !  !END!
113 ! X =         1129.8553,      -483.4280,      881,         0 !  !END!
114 ! X =         1130.6055,      -483.3243,      769,         0 !  !END!
115 ! X =         1118.4753,      -484.0591,      487,         0 !  !END!
116 ! X =         1119.2256,      -483.9565,      396,         0 !  !END!
117 ! X =         1119.9759,      -483.8538,      426,         0 !  !END!
118 ! X =         1120.7262,      -483.7511,      458,         0 !  !END!
119 ! X =         1121.4765,      -483.6482,      475,         0 !  !END!
120 ! X =         1122.2267,      -483.5454,      514,         0 !  !END!
121 ! X =         1122.9770,      -483.4424,      546,         0 !  !END!
122 ! X =         1123.7272,      -483.3394,      623,         0 !  !END!
123 ! X =         1124.4775,      -483.2363,      833,         0 !  !END!
124 ! X =         1125.2277,      -483.1332,      909,         0 !  !END!
125 ! X =         1125.9779,      -483.0300,      655,         0 !  !END!
126 ! X =         1126.7281,      -482.9267,      841,         0 !  !END!
127 ! X =         1127.4783,      -482.8233,      717,         0 !  !END!
128 ! X =         1128.2285,      -482.7199,      579,         0 !  !END!
129 ! X =         1128.9787,      -482.6164,      680,         0 !  !END!
130 ! X =         1129.7289,      -482.5129,      838,         0 !  !END!
131 ! X =         1130.4791,      -482.4092,      810,         0 !  !END!
132 ! X =         1122.8514,      -482.5272,      578,         0 !  !END!
133 ! X =         1123.6015,      -482.4242,      640,         0 !  !END!
134 ! X =         1124.3517,      -482.3212,      605,         0 !  !END!
135 ! X =         1125.1018,      -482.2180,      722,         0 !  !END!
136 ! X =         1125.8520,      -482.1148,      654,         0 !  !END!
137 ! X =         1126.6021,      -482.0116,      858,         0 !  !END!
138 ! X =         1127.3522,      -481.9082,      695,         0 !  !END!
```

```
139 ! X =        1128.1023,     -481.8048,     552,        0 !  !END!
140 ! X =        1128.8524,     -481.7013,     646,        0 !  !END!
141 ! X =        1129.6025,     -481.5978,     848,        0 !  !END!
142 ! X =        1130.3526,     -481.4942,     870,        0 !  !END!
143 ! X =        1131.1027,     -481.3905,     732,        0 !  !END!
144 ! X =        1122.7258,     -481.6121,     549,        0 !  !END!
145 ! X =        1123.4758,     -481.5091,     522,        0 !  !END!
146 ! X =        1124.2259,     -481.4060,     518,        0 !  !END!
147 ! X =        1124.9760,     -481.3029,     566,        0 !  !END!
148 ! X =        1125.7260,     -481.1997,     582,        0 !  !END!
149 ! X =        1126.4761,     -481.0964,     709,        0 !  !END!
150 ! X =        1127.2261,     -480.9931,     619,        0 !  !END!
151 ! X =        1127.9761,     -480.8897,     598,        0 !  !END!
152 ! X =        1128.7262,     -480.7862,     732,        0 !  !END!
153 ! X =        1129.4762,     -480.6827,     896,        0 !  !END!
154 ! X =        1130.2262,     -480.5791,     949,        0 !  !END!
155 ! X =        1130.9761,     -480.4754,     760,        0 !  !END!
156 ! X =        1131.7261,     -480.3717,     644,        0 !  !END!
157 ! X =        1122.6001,     -480.6969,     579,        0 !  !END!
158 ! X =        1123.3501,     -480.5939,     511,        0 !  !END!
159 ! X =        1124.1001,     -480.4909,     513,        0 !  !END!
160 ! X =        1124.8501,     -480.3878,     549,        0 !  !END!
161 ! X =        1125.6001,     -480.2846,     579,        0 !  !END!
162 ! X =        1126.3500,     -480.1813,     594,        0 !  !END!
163 ! X =        1127.1000,     -480.0780,     536,        0 !  !END!
164 ! X =        1127.8499,     -479.9746,     598,        0 !  !END!
165 ! X =        1128.5999,     -479.8712,     670,        0 !  !END!
166 ! X =        1129.3498,     -479.7676,     815,        0 !  !END!
167 ! X =        1130.0997,     -479.6640,     975,        0 !  !END!
168 ! X =        1130.8496,     -479.5604,     839,        0 !  !END!
169 ! X =        1131.5995,     -479.4566,     696,        0 !  !END!
170 ! X =        1123.2245,     -479.6788,     457,        0 !  !END!
171 ! X =        1123.9744,     -479.5757,     457,        0 !  !END!
172 ! X =        1124.7243,     -479.4726,     429,        0 !  !END!
173 ! X =        1125.4741,     -479.3695,     487,        0 !  !END!
174 ! X =        1126.2240,     -479.2662,     502,        0 !  !END!
175 ! X =        1126.9739,     -479.1629,     582,        0 !  !END!
176 ! X =        1127.7237,     -479.0595,     587,        0 !  !END!
177 ! X =        1128.4736,     -478.9561,     760,        0 !  !END!
178 ! X =        1129.2234,     -478.8526,     914,        0 !  !END!
179 ! X =        1129.9733,     -478.7490,     1039,        0 !  !END!
180 ! X =        1130.7231,     -478.6453,     917,        0 !  !END!
181 ! X =        1131.4729,     -478.5416,     903,        0 !  !END!
182 ! X =        1132.2227,     -478.4378,     654,        0 !  !END!
183 ! X =        1122.3489,     -478.8666,     456,        0 !  !END!
184 ! X =        1123.0988,     -478.7636,     495,        0 !  !END!
185 ! X =        1123.8486,     -478.6606,     400,        0 !  !END!
186 ! X =        1124.5984,     -478.5575,     519,        0 !  !END!
187 ! X =        1125.3482,     -478.4544,     630,        0 !  !END!
188 ! X =        1126.0980,     -478.3511,     582,        0 !  !END!
189 ! X =        1126.8478,     -478.2478,     611,        0 !  !END!
190 ! X =        1127.5975,     -478.1445,     769,        0 !  !END!
191 ! X =        1128.3473,     -478.0410,     610,        0 !  !END!
192 ! X =        1129.0971,     -477.9375,     701,        0 !  !END!
193 ! X =        1129.8468,     -477.8340,     915,        0 !  !END!
194 ! X =        1130.5965,     -477.7303,     890,        0 !  !END!
195 ! X =        1131.3463,     -477.6266,     762,        0 !  !END!
196 ! X =        1132.0960,     -477.5228,     616,        0 !  !END!
197 ! X =        1119.9740,     -478.2599,     310,        0 !  !END!
198 ! X =        1120.7238,     -478.1571,     408,        0 !  !END!
199 ! X =        1121.4736,     -478.0543,     449,        0 !  !END!
200 ! X =        1122.2233,     -477.9514,     476,        0 !  !END!
201 ! X =        1122.9731,     -477.8485,     449,        0 !  !END!
```

```
202 ! X =        1123.7228,      -477.7455,      468,        0 !  !END!
203 ! X =        1124.4725,      -477.6424,      482,        0 !  !END!
204 ! X =        1125.2222,      -477.5393,      615,        0 !  !END!
205 ! X =        1125.9720,      -477.4360,      647,        0 !  !END!
206 ! X =        1126.7217,      -477.3328,      614,        0 !  !END!
207 ! X =        1127.4713,      -477.2294,      747,        0 !  !END!
208 ! X =        1128.2210,      -477.1260,      942,        0 !  !END!
209 ! X =        1128.9707,      -477.0225,      893,        0 !  !END!
210 ! X =        1129.7204,      -476.9189,      955,        0 !  !END!
211 ! X =        1130.4700,      -476.8153,      874,        0 !  !END!
212 ! X =        1131.2197,      -476.7116,      662,        0 !  !END!
213 ! X =        1131.9693,      -476.6078,      636,        0 !  !END!
214 ! X =        1132.7189,      -476.5040,      544,        0 !  !END!
215 ! X =        1126.5955,      -476.4177,      717,        0 !  !END!
216 ! X =        1127.3452,      -476.3144,      750,        0 !  !END!
217 ! X =        1128.0947,      -476.2109,      982,        0 !  !END!
218 ! X =        1128.8443,      -476.1075,      1141,        0 !  !END!
219 ! X =        1126.4694,      -475.5026,      847,        0 !  !END!
220 ! X =        1127.2190,      -475.3993,      1013,        0 !  !END!
```

---

a
Data for each receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

b
Receptor height above ground is optional. If no value is entered, the receptor is placed on the ground.

Appendix C

Example of Proposed POSTUTIL Input File for Cohutta Wilderness Area (2001)

AppendixCCohutta2001POSTUTIL.INP
VISTAS BART - Chem Products Corp. - 4km Domain No. 4 - COHUTTA - 2001
Computational Grid X (Easterly): From 76 To 127
Computational Grid Y (Northerly): From 136 To 208
---------- Run title (3 lines) ----------

POSTUTIL MODEL CONTROL FILE

INPUT GROUP: 0 -- Input and Output File Names

Subgroup (0a)

Output Files

File	Default File Name	
List File	POSTUTIL.LST	! UTLLST =POSTUTIL.LST !
Data File	MODEL.DAT	! UTLDAT =PostUtilConcOut.dat !

Input Files

A time-varying file of "background" concentrations can be included when the ammonia-limiting method (ALM) for setting the HNO3/NO3 concentration partition is accomplished in 1 step. This option is selected by setting MNITRATE=3 in Input Group 1.
Species required in the "background" concentration file are:
SO4, NO3, HNO3 and TNH3 (total NH3 = NH3gaseous + NH3particulate).

File	Default File Name	
BCKG File	BCKGALM.DAT	* BCKGALM =BCKGALM.DAT *

A number of CALPUFF data files may be processed in this application. The files may represent individual CALPUFF simulations that were made for a specific set of species and/or sources. Specify the total number of CALPUFF runs you wish to combine, and provide the filename for each in subgroup 0b.

Number of CALPUFF data files (NFILES)
Default: 1 ! NFILES = 1 !

Meteorological data files are needed for the HNO3/NO3 partition option.
Three types of meteorological data files can be used:
METFM = 0 - CALMET.DAT
METFM= 1 - 1-D file with RH, Temp and Rhoair timeseries
METFM= 2 - 2-D files with either Rh, Temp or Rhoair in each (3 2_D files are needed)
The default is to use CALMET.DAT files.

Default: 0 * METFM = 0 *

```
 Multiple meteorological data files may be used in sequence to span the
 processing period.  Specify the number of time-period files (NMET) that
 you need to use, and provide a filename for each in subgroup 0b.
 - NMET is 0 if no meteorological files are provided
 - NMET is 1 if METFM=1 (multiple file feature is not available)
 - NMET is 1 or more if METFM=0 or 2 (multiple CALMET files or 2DMET files)

                                    Default: 0       ! NMET    = 0   !


 All filenames will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, filenames will be converted to UPPER CASE

     Convert filenames to lower case?  Default: T     ! LCFILES = T !
         T = lower case
         F = UPPER CASE

!END!

------------------------------------------------------------
 NOTE: file/path names can be up to 70 characters in length
------------------------------------------------------------

-------------
Subgroup (0b)
-------------

NMET CALMET Data Files (METFM=0):

Input File      Default File Name
----------      -----------------
   1            MET.DAT            * UTLMET =CALMET.DAT  * *END*

NMET 1-D Data Files (METFM=1):

Input File      Default File Name
----------      -----------------
   1            MET_1D.DAT         * MET1D   = MET_1D.DAT * *END*

NMET 2-D Data Files of Each Type (METFM=2):

Input File      Default File Name
----------      -----------------
   1            RHUMD.DAT          * M2DRHU  = RELHUM.DAT * *END*
   1            TEMP.DAT           * M2DTMP  = TEMP.DAT   * *END*
   1            RHOAIR.DAT         * M2DRHO  = RHOAIR.DAT * *END*

NFILES CALPUFF Data Files:

Input File      Default File Name
----------      -----------------
   0            CALPUFF.DAT        ! MODDAT = ..\Cohutta\conc.dat    ! !END!

-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*

                                    or   * MET1D  = name * *END*
```

```
                                or    * M2DRHU = name * *END*
                              (and)   * M2DTMP = name * *END*
                              (and)   * M2DRHO = name * *END*

      and NFILES lines of the form     * MODDAT = name * *END*

      where the * should be replaced with an exclamation point,
      the special delimiter character.

-------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:    Year  (ISYR) --    No default   ! ISYR  = 2001   !
                       Month (ISMO) --    No default   ! ISMO  = 1    !
                       Day   (ISDY) --    No default   ! ISDY  = 1    !
                       Hour  (ISHR) --    No default   ! ISHR  = 1    !

     Number of periods to process
                              (NPER) -- No default   ! NPER  = 8760   !

     Number of species to process from CALPUFF runs
                           (NSPECINP) -- No default   ! NSPECINP = 11 !

     Number of species to write to output file
                           (NSPECOUT) -- No default   ! NSPECOUT = 6 !

     Number of species to compute from those modeled
     (must be no greater than NSPECOUT)
                           (NSPECCMP) -- No default   ! NSPECCMP = 1 !


 When multiple files are used, a species name may appear in more than
 one file.  Data for this species will be summed (appropriate if the
 CALPUFF runs use different source groups).  If this summing is not
 appropriate, remove duplicate species from the file(s).

     Stop run if duplicate species names
     are found? (MDUPLCT)              Default: 0       ! MDUPLCT  =  0  !
        0 = no  (i.e., duplicate species are summed)
        1 = yes (i.e., run is halted)

 Data for each species in a CALPUFF data file may also be scaled as
 they are read.  This can be done to alter the emission rate of all
 sources that were modeled in a particular CALPUFF application.
 The scaling factor for each species is entered in Subgroup (2d), for
 each file for which scaling is requested.

     Number of CALPUFF data files that will be scaled
     (must be no greater than NFILES)
     (NSCALED)                         Default: 0       ! NSCALED = 0 !


 Ammonia-Limiting Method Option to recompute the HNO3/NO3 concentration
 partition prior to performing other actions is controlled by MNITRATE.
 This option will NOT alter any deposition fluxes contained in the CALPUFF
 file(s).  Three partition selections are provided.  The first two are
 typically used in sequence (POSTUTIL is run more than once).  The first
 selection (MNITRATE=1) computes the partition for the TOTAL (all sources)
 concentration fields (SO4, NO3, HNO3; NH3), and the second (MNITRATE=2)
```

uses this partition (from the previous application of POSTUTIL) to compute the partition for individual source groups. The third selection (MNITRATE=3) can be used instead in a single POSTUTIL application if a file of background concentrations is provided (BCKGALM in Input Group 0).

Required information for MNITRATE=1 includes:
species NO3, HNO3, and SO4
NH3 concentration(s)
met. data file for RH and T

Required information for MNITRATE=2 includes:
species NO3 and HNO3 for a source group
species NO3ALL and HNO3ALL for all source groups, properly partitioned

Required information for MNITRATE=3 includes:
species NO3, HNO3, and SO4 for a source group
species NO3, HNO3, SO4 and TNH3 from the background BCKGALM file
If TNH3 is not in the background BCKGALM file, monthly TNH3 concentrations are used (BCKTNH3)
TNH3= total NH3 = NH3gaseous+NH3particulate

Recompute the HNO3/NO3 partition for concentrations?
(MNITRATE) Default: 0 ! MNITRATE = 0 !
0 = no
1 = yes, for all sources combined
2 = yes, for a source group
3 = yes, ALM application in one step

SOURCE OF AMMONIA:

Ammonia may be available as a modeled species in the CALPUFF files, and it may or may not be appropriate to use it for repartitioning NO3/HNO3 (in option MNITRATE=1 or MNITRATE=3). Its use is contolled by NH3TYP. When NH3 is listed as a processed species in Subgroup (2a), as one of the NSPECINP ASPECI entries, and the right option is chosen for NH3TYP, the NH3 modeled values from the CALPUFF concentration files will be used in the chemical equilibrium calculation.

NH3TYP also controls when monthly background ammonia values are used. Both gaseous (NH3) and total (TNH3=NH3gaseous+NH3particulate) ammonia can be provided monthly as BCKNH3/BCKTNH3.

What is the input source of Ammonia?
(NH3TYP) No Default ! NH3TYP = 3 !
0 = No background will be used.
ONLY NH3 from the concentration files listed in Subgroup (2a) as a processed species will be used.
(Cannot be used with MNITRATE=3)

1 = NH3 Monthly averaged background (BCKNH3) listed below will be added to NH3 from concentration files listed in Subgroup (2a)

2 = NH3 from background concentration file BCKGALM will be added to NH3 from concentration files listed in Subgroup (2a)
(ONLY possible for MNITRATE=3)

3 = NH3 Monthly averaged background (BCKNH3) listed below will be used alone.

4 = NH3 from background concentration file BCKGALM
will be used alone
(ONLY possible for MNITRATE=3)

NH3TYP	NH3 CONC	NH3 FROM BCKNH3	NH3 FROM BCKGALM
0	X	0	0
1	X	X	0
2	X	0	X
3	0	X	0
4	0	0	X

Default monthly (12 values) background ammonia concentration (ppb)
used for HNO3/NO3 partition:

Gaseous NH3 (BCKNH3) Default: -999
* BCKNH3 = 1., 1., 1., 1.1, 1.4, 1.3, 1.3, 1.2, 4*1. *

Total TNH3 (BCKTNH3) Default: -999
* BCKTNH3 = 1., 1., 1., 1.1, 1.4, 1.3, 1.3, 1.2, 4*1. *

If a single value is entered, this is used for all 12 months.
Month 1 is JANUARY, Month 12 is DECEMBER.

!END!

INPUT GROUP: 2 -- Species Processing Information

Subgroup (2a)

The following NSPECINP species will be processed:

```
! ASPECI =          SO2 !          !END!
! ASPECI =          SO4 !          !END!
! ASPECI =          NOX !          !END!
! ASPECI =          HNO3 !          !END!
! ASPECI =          NO3 !          !END!
! ASPECI =          PM800 !          !END!
! ASPECI =          PM425 !          !END!
! ASPECI =          PM187 !          !END!
! ASPECI =          PM112 !          !END!
! ASPECI =          PM081 !          !END!
! ASPECI =          PM056 !          !END!
```

Subgroup (2b)

The following NSPECOUT species will be written:

```
! ASPECO =          SO2 !          !END!
```

```
! ASPECO =              SO4 !          !END!
! ASPECO =              NOX !          !END!
! ASPECO =              HNO3 !          !END!
! ASPECO =              NO3 !          !END!
! ASPECO =              SOA !          !END!
```

Subgroup (2c)

The following NSPECCMP species will be computed by scaling and summing one or more of the processed input species. Identify the name(s) of the computed species and provide the scaling factors for each of the NSPECINP input species (NSPECCMP groups of NSPECINP+1 lines each):

```
! CSPECCMP = SOA !
! PM081 = 1.0 !
! PM056 = 1.0 !
! END !
```

Subgroup (2d)

Each species in NSCALED CALPUFF data files may be scaled before being processed (e.g., to change the emission rate for all sources modeled in the run that produced a data file). For each file, identify the file name and then provide the name(s) of the scaled species and the corresponding scaling factors (A,B where x' = Ax+B).

```
                A(Default=1.0)       B(Default=0.0)
                --------------       --------------

* MODDAT =NOFILES.DAT     *
*      SO2  =       1.1,                  0.0    *
*      SO4  =       1.5,                  0.0    *
*     HNO3  =       0.8,                  0.0    *
*      NO3  =       0.1,                  0.0    *
*END*
```

```
1) Visibility: daily visibility tabulations are always reported
               for the selected receptors when ASPEC = VISIB.
               In addition, any of the other tabulations listed
               below may be chosen to characterize the light
               extinction coefficients.
               [List file or Plot/Analysis File]


2) Top 50 table for each averaging time selected
   [List file only]
                        (LT50) -- Default: T    !    LT50 = F   !

3) Top 'N' table for each averaging time selected
   [List file or Plot file]
                       (LTOPN) -- Default: F    !   LTOPN = F   !

     -- Number of 'Top-N' values at each receptor
        selected (NTOP must be <= 4)
                        (NTOP) -- Default: 4    ! NTOP =  1   !

     -- Specific ranks of 'Top-N' values reported
        (NTOP values must be entered)
                (ITOP(4) array) -- Default:     ! ITOP =  0 !


4) Threshold exceedance counts for each receptor and each averaging
   time selected
   [List file or Plot file]
                      (LEXCD) -- Default: F    !   LEXCD = F   !

     -- Identify the threshold for each averaging time by assigning a
        non-negative value (output units).

                                  -- Default: -1.0
        Threshold for  1-hr averages   (THRESH1) !  THRESH1 = -1.0   !
        Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0   !
        Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0   !
        Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0   !


     -- Counts for the shortest averaging period selected can be
        tallied daily, and receptors that experience more than NCOUNT
        counts over any NDAY period will be reported.  This type of
        exceedance violation output is triggered only if NDAY > 0.

        Accumulation period(Days)
                         (NDAY) -- Default: 0    !     NDAY =  0   !
        Number of exceedances allowed
                      (NCOUNT) -- Default: 1    !   NCOUNT =  1   !


5) Selected day table(s)

   Echo Option -- Many records are written each averaging period
   selected and output is grouped by day
   [List file or Plot file]
                       (LECHO) -- Default: F    !   LECHO = F   !

   Timeseries Option -- Averages at all selected receptors for
   each selected averaging period are written to timeseries files.
   Each file contains one averaging period, and all receptors are
   written to a single record each averaging time.
   [TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT files]
```

Appendix D

Example of Proposed CALPOST Input File for Cohutta Wilderness Area (2001)

AppendixDCohutta2001CALPOST.INP

```
VISTAS BART - Chem Products Corp. 4km Domain No. 4 - COHUTTA - 2001
Computational Grid X (Easterly):   From  76  To  127
Computational Grid Y (Northerly):   From  136  To  208
---------------- Run title (3 lines) ------------------------------------------

                    CALPOST MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                        Default File Name
----                        -----------------
Conc/Dep Flux File          MODEL.DAT           ! MODDAT = ..\PostUtilConcOut.dat   !
Relative Humidity File      VISB.DAT            * VISDAT = ..\VISB.DAT  *
Background Data File        BACK.DAT            *BACKDAT =   *
Transmissometer or          VSRN.DAT            *VSRDAT =   *
Nephelometer Data File       or
DATSAV Weather Data File     or
Prognostic Weather  File

Output Files
------------

File                        Default File Name
----                        -----------------
List File                   CALPOST.LST         ! PSTLST = CalPost.lst  !

Pathname for Timeseries Files   (blank)         * TSPATH =   *
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)               * PLPATH =   *
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String (U) to augment default filenames
(activate with exclamation points only if
 providing NON-BLANK character string)

Timeseries TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT
Peak Value          PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

                                                * TSUNAM =   *

Top Nth Rank Plot   RANK(ALL)_ASPEC_ttHR_CONC_TUNAM.DAT
                or  RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD

                                                * TUNAM =   *

Exceedance Plot       EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT
                  or  EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD

                                                * XUNAM =   *

Echo Plot
(Specific Days)
          yyyy_Mmm_Ddd_hh00(UTCszzzz)_L00_ASPEC_ttHR_CONC.DAT
```

```
                                AppendixDCohutta2001CALPOST.INP
      or     yyyy_Mmm_Ddd_hh00(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD

Visibility Plot      DAILY_VISIB_VUNAM.DAT    * VUNAM =     *
(Daily Peak Summary)


Auxiliary Output Files
----------------------

File                        Default File Name
----                        -----------------
Visibility Change           DELVIS.DAT           ! DVISDAT = deciview.dat  !

------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 132 characters in length
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and context-specific strings, where
             ASPEC = Species Name
             CONC = CONC Or WFLX Or DFLX Or TFLX
               tt = Averaging Period (e.g. 03)
               ii = Rank (e.g. 02)
               hh = Hour(ending) in LST
            szzzz = LST time zone shift (EST is -0500)
             yyyy = Year(LST)
               mm = Month(LST)
               dd = day of month (LST)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
          must contain at least 1 non-blank character.

!END!
------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Option to run all periods found
     in the met. file(s)  (METRUN)        Default: 0   ! METRUN =   1  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in CALPUFF data file(s)

     Starting date:    Year   (ISYR)  --    No default   ! ISYR  =  1990  !
                       Month  (ISMO)  --    No default   ! ISMO  =  0  !
                       Day    (ISDY)  --    No default   ! ISDY  =  0  !
     Starting time:    Hour   (ISHR)  --    No default   ! ISHR  =  0  !

     Number of hours to process (NHRS) -- No default   ! NHRS  =  0  !

     Process every hour of data?(NREP) -- Default: 1   ! NREP  =  1  !
      (1 = every hour processed,
       2 = every 2nd hour processed,
       5 = every 5th hour processed, etc.)

Species & Concentration/Deposition Information
```

```
-------------------------------------------------

      Species to process (ASPEC)       -- No default   ! ASPEC =  VISIB   !
      (ASPEC = VISIB for visibility processing)

      Layer/deposition code (ILAYER)   -- Default: 1   ! ILAYER =  1  !
        '1'  for CALPUFF concentrations,
        '-1' for dry deposition fluxes,
        '-2' for wet deposition fluxes,
        '-3' for wet+dry deposition fluxes.

      Scaling factors of the form:     -- Defaults:    ! A =  0  !
           X(new) = X(old) * A + B          A = 0.0    ! B =  0  !
        (NOT applied if A = B = 0.0)        B = 0.0

      Add Hourly Background Concentrations/Fluxes?
                              (LBACK)  -- Default: F   ! LBACK =  F !

Source Information
------------------

  Option to process source contributions:
        0 =  Process only total reported contributions
        1 =  Sum all individual source contributions and process
        2 =  Run in TRACEBACK mode to identify source
             contributions at a SINGLE receptor
                           (MSOURCE) -- Default: 0   ! MSOURCE =  0  !

Receptor information
--------------------

  Gridded receptors processed?    (LG) -- Default: F   ! LG  = F  !
  Discrete receptors processed?   (LD) -- Default: F   ! LD  = T  !
  CTSG Complex terrain receptors processed?
                                 (LCT) -- Default: F   ! LCT = F  !

--Report results by DISCRETE receptor RING?
  (only used when LD = T)     (LDRING) -- Default: F   ! LDRING = F  !

--Select range of DISCRETE receptors (only used when LD = T):

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                              OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
                                              ! NDRECP =  -1  !


--Select range of GRIDDED receptors (only used when LG = T):

      X index of LL corner (IBGRID) -- Default: -1     ! IBGRID = -1  !
          (-1 OR 1 <= IBGRID <= NX)

      Y index of LL corner (JBGRID) -- Default: -1     ! JBGRID = -1  !
          (-1 OR 1 <= JBGRID <= NY)

      X index of UR corner (IEGRID) -- Default: -1     ! IEGRID = -1  !
          (-1 OR 1 <= IEGRID <= NX)
```

```
      Y index of UR corner (JEGRID) -- Default: -1     ! JEGRID = -1  !
          (-1 OR 1 <= JEGRID <= NY)

  Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1


--Specific gridded receptors can also be excluded from CALPOST
  processing by filling a processing grid array with 0s and 1s.  If the
  processing flag for receptor index (i,j) is 1 (ON), that receptor
  will be processed if it lies within the range delineated by IBGRID,
  JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
  processed in the run.  By default, all array values are set to 1 (ON).

  Number of gridded receptor rows provided in Subgroup (1a) to
  identify specific gridded receptors to process
                          (NGONOFF) -- Default: 0      ! NGONOFF =  0  !

!END!


--------------
Subgroup (1a) -- Specific gridded receptors included/excluded
--------------

    Specific gridded receptors are excluded from CALPOST processing
    by filling a processing grid array with 0s and 1s.  A total of
    NGONOFF lines are read here.  Each line corresponds to one 'row'
    in the sampling grid, starting with the NORTHERNMOST row that
    contains receptors that you wish to exclude, and finishing with
    row 1 to the SOUTH (no intervening rows may be skipped).  Within
    a row, each receptor position is assigned either a 0 or 1,
    starting with the westernmost receptor.
       0 = gridded receptor not processed
       1 = gridded receptor processed

    Repeated value notation may be used to select blocks of receptors:
       23*1, 15*0, 12*1

    Because all values are initially set to 1, any receptors north of
    the first row entered, or east of the last value provided in a row,
    remain ON.

    (NGXRECP) -- Default: 1


------------------------------------------------------------------------------

INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)
--------------

     Identify the Base Time Zone for the CALPUFF simulation
                           (BTZONE) -- No default   ! BTZONE = 5 !

    Particle growth curve f(RH) for hygroscopic species
                            (MFRH) -- Default: 2   ! MFRH   =  2  !

         1 =  IWAQM (1998) f(RH) curve (originally used with MVISBK=1)
         2 =  FLAG (2000) f(RH) tabulation
         3 =  EPA (2003) f(RH) tabulation

    Maximum relative humidity (%) used in particle growth curve
                           (RHMAX) -- Default: 98   ! RHMAX  = 98  !
```

```
     Modeled species to be included in computing the light extinction
      Include SULFATE?          (LVSO4) -- Default: T   ! LVSO4  = T  !
      Include NITRATE?          (LVNO3) -- Default: T   ! LVNO3  = T  !
      Include ORGANIC CARBON?   (LVOC)  -- Default: T   ! LVOC   = T  !
      Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC  = F  !
      Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF  = F  !
      Include ELEMENTAL CARBON? (LVEC)  -- Default: T   ! LVEC   = F  !

     And, when ranking for TOP-N, TOP-50, and Exceedance tables,
      Include BACKGROUND?       (LVBK)  -- Default: T   ! LVBK   = T  !

     Species name used for particulates in MODEL.DAT file
                    COARSE    (SPECPMC) -- Default: PMC ! SPECPMC =   !
                    FINE      (SPECPMF) -- Default: PMF ! SPECPMF =   !

Extinction Efficiency (1/Mm per ug/m**3)
----------------------------------------
     MODELED particulate species:
                PM  COARSE      (EEPMC) -- Default: 0.6 ! EEPMC  = 0.6 !
                PM  FINE        (EEPMF) -- Default: 1.0 ! EEPMF  = 1.0 !
     BACKGROUND particulate species:
                PM  COARSE    (EEPMCBK) -- Default: 0.6 ! EEPMCBK = 0.6 !
     Other species:
               AMMONIUM SULFATE (EESO4) -- Default: 3.0 ! EESO4  = 3. !
               AMMONIUM NITRATE (EENO3) -- Default: 3.0 ! EENO3  = 3. !
               ORGANIC CARBON   (EEOC)  -- Default: 4.0 ! EEOC   = 4. !
               SOIL             (EESOIL)-- Default: 1.0 ! EESOIL = 1. !
               ELEMENTAL CARBON (EEEC)  -- Default: 10. ! EEEC   = 10. !

Background Extinction Computation
---------------------------------

     Method used for the 24h-average of percent change of light extinction:
     Hourly ratio of source light extinction / background light extinction
     is averaged?                 (LAVER) -- Default: F   ! LAVER = F  !


     Method used for background light extinction
                              (MVISBK) -- Default: 2   ! MVISBK =  6  !

          1 =  Supply single light extinction and hygroscopic fraction
               - Hourly F(RH) adjustment applied to hygroscopic background
                 and modeled sulfate and nitrate
          2 =  Compute extinction from speciated PM measurements (A)
               - Hourly F(RH) adjustment applied to observed and modeled sulfate
                 and nitrate
               - F(RH) factor is capped at F(RHMAX)
          3 =  Compute extinction from speciated PM measurements (B)
               - Hourly F(RH) adjustment applied to observed and modeled sulfate
                 and nitrate
               - Receptor-hour excluded if RH>RHMAX
               - Receptor-day excluded if fewer than 6 valid receptor-hours
          4 =  Read hourly transmissometer background extinction measurements
               - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
               - Hour excluded if measurement invalid (missing, interference,
                 or large RH)
               - Receptor-hour excluded if RH>RHMAX
               - Receptor-day excluded if fewer than 6 valid receptor-hours
          5 =  Read hourly nephelometer background extinction measurements
               - Rayleigh extinction value (BEXTRAY) added to measurement
               - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
               - Hour excluded if measurement invalid (missing, interference,
```

```
          or large RH)
        - Receptor-hour excluded if RH>RHMAX
        - Receptor-day excluded if fewer than 6 valid receptor-hours
    6 = Compute extinction from speciated PM measurements
        - FLAG monthly RH adjustment factor applied to observed and
          modeled sulfate And nitrate
    7 = Use observed weather or prognostic weather information for
        background extinction during weather events; otherwise, use Method 2
        - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
        - F(RH) factor is capped at F(RHMAX)
        - During observed weather events, compute Bext from visual range
          if using an observed weather data file, or
        - During prognostic weather events, use Bext from the prognostic
          weather file
        - Use Method 2 for hours without a weather event

 Additional inputs used for MVISBK = 1:
 ---------------------------------------
  Background light extinction (1/Mm)
                          (BEXTBK) -- No default   ! BEXTBK =  !
  Percentage of particles affected by relative humidity
                          (RHFRAC) -- No default   ! RHFRAC =  !

 Additional inputs used for MVISBK = 6:
 ---------------------------------------
  Extinction coefficients for hygroscopic species (modeled and
  background) are computed using a monthly RH adjustment factor
  in place of an hourly RH factor (VISB.DAT file is NOT needed).
  Enter the 12 monthly factors here (RHFAC).  Month 1 is January.

  (RHFAC)  -- No default     ! RHFAC = 3.3, 3.1, 3, 2.8, 3.4, 3.8, 4, 4.2, 4.2,
3.8, 3.4, 3.5 !

 Additional inputs used for MVISBK = 7:
 ---------------------------------------
  The weather data file (DATSAV abbreviated space-delimited) that
  is identified as VSRN.DAT may contain data for more than one
  station.  Identify the stations that are needed in the order in
  which they will be used to obtain valid weather and visual range.
  The first station that contains valid data for an hour will be
  used.  Enter up to MXWSTA (set in PARAMS file) integer station IDs
  of up to 6 digits each as variable IDWSTA, and enter the corresponding
  time zone for each, as variable TZONE (= UTC-LST).

  A prognostic weather data file with Bext for weather events may be used
  in place of the observed weather file.  Identify this as the VSRN.DAT
  file and use a station ID of IDWSTA = 999999, and TZONE = 0.

  NOTE:  TZONE identifies the time zone used in the dataset.  The
         DATSAV abbreviated space-delimited data usually are prepared
         with UTC time rather than local time, so TZONE is typically
         set to zero.

  (IDWSTA)    -- No default    * IDWSTA = 000000 *
  (TZONE)     -- No default    * TZONE =      0. *

 Additional inputs used for MVISBK = 2,3,6,7:
 ---------------------------------------
  Background extinction coefficients are computed from monthly
  CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
  coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and
  elemental carbon (BKEC).  Month 1 is January.
  (ug/m**3)
```

```
      (BKSO4)  -- No default      ! BKSO4 = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
      (BKNO3)  -- No default      ! BKNO3 = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
      (BKPMC)  -- No default      ! BKPMC = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
      (BKOC)   -- No default      ! BKOC  = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !
      (BKSOIL) -- No default      ! BKSOIL= 11.38, 11.38, 11.38, 11.38, 11.38, 11.38,
11.38, 11.38, 11.38, 11.38, 11.38, 11.38 !
      (BKEC)   -- No default      ! BKEC  = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !

    Additional inputs used for MVISBK = 2,3,5,6,7:
    ----------------------------------------------
     Extinction due to Rayleigh scattering is added (1/Mm)
                              (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10   !

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output options
--------------

Documentation
-------------

    Documentation records contained in the header of the
    CALPUFF output file may be written to the list file.
    Print documentation image?
                                  (LDOC) -- Default: F    !  LDOC =  F   !

Output Units
------------
    Units for All Output       (IPRTU) -- Default: 1    ! IPRTU =  3    !
                      for           for
                Concentration   Deposition
       1 =          g/m**3         g/m**2/s
       2 =         mg/m**3        mg/m**2/s
       3 =         ug/m**3        ug/m**2/s
       4 =         ng/m**3        ng/m**2/s
       5 =       Odour Units

    Visibility: extinction expressed in 1/Mega-meters (IPRTU is ignored)

Averaging time(s) reported
--------------------------

    1-hr averages            (L1HR) -- Default: T    !   L1HR = F   !

    3-hr averages            (L3HR) -- Default: T    !   L3HR =  F   !

    24-hr averages          (L24HR) -- Default: T    !  L24HR =  F   !

    Run-length averages     (LRUNL) -- Default: T    !  LRUNL =  F   !

    User-specified averaging time in hours - results for
    an averaging time of NAVG hours are reported for
    NAVG greater than 0:
                              (NAVG) -- Default: 0    !   NAVG =  0   !

Types of tabulations reported
-----------------------------
```

```
1) Visibility: daily visibility tabulations are always reported
               for the selected receptors when ASPEC = VISIB.
               In addition, any of the other tabulations listed
               below may be chosen to characterize the light
               extinction coefficients.
               [List file or Plot/Analysis File]


2) Top 50 table for each averaging time selected
   [List file only]
                        (LT50) -- Default: T   !   LT50 = F  !

3) Top 'N' table for each averaging time selected
   [List file or Plot file]
                       (LTOPN) -- Default: F   !  LTOPN = F  !

     -- Number of 'Top-N' values at each receptor
        selected (NTOP must be <= 4)
                        (NTOP) -- Default: 4   ! NTOP =  1  !

     -- Specific ranks of 'Top-N' values reported
        (NTOP values must be entered)
                (ITOP(4) array) -- Default:     ! ITOP =  0 !


4) Threshold exceedance counts for each receptor and each averaging
   time selected
   [List file or Plot file]
                       (LEXCD) -- Default: F   !  LEXCD = F  !

     -- Identify the threshold for each averaging time by assigning a
        non-negative value (output units).

                                -- Default: -1.0
        Threshold for  1-hr averages   (THRESH1) !  THRESH1 = -1.0  !
        Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0  !
        Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0  !
        Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0  !


     -- Counts for the shortest averaging period selected can be
        tallied daily, and receptors that experience more than NCOUNT
        counts over any NDAY period will be reported.  This type of
        exceedance violation output is triggered only if NDAY > 0.

        Accumulation period(Days)
                         (NDAY) -- Default: 0   !    NDAY =  0  !
        Number of exceedances allowed
                       (NCOUNT) -- Default: 1   !  NCOUNT =  1  !


5) Selected day table(s)

   Echo Option -- Many records are written each averaging period
   selected and output is grouped by day
   [List file or Plot file]
                        (LECHO) -- Default: F   !  LECHO = F  !

   Timeseries Option -- Averages at all selected receptors for
   each selected averaging period are written to timeseries files.
   Each file contains one averaging period, and all receptors are
   written to a single record each averaging time.
   [TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT files]
```

(LTIME) -- Default: F ! LTIME = F !

Peak Value Option -- Averages at all selected receptors for each selected averaging period are screened and the peak value each period is written to timeseries files.
Each file contains one averaging period.
[PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT files]
(LPEAK) -- Default: F ! LPEAK = F !

-- Days selected for output
(IECHO(366)) -- Default: 366*0
! IECHO = 366*0 !
(366 values must be entered)

Plot output options

Plot files can be created for the Top-N, Exceedance, and Echo tables selected above. Two formats for these files are available, DATA and GRID. In the DATA format, results at all receptors are listed along with the receptor location [x,y,val1,val2,...]. In the GRID format, results at only gridded receptors are written, using a compact representation. The gridded values are written in rows (x varies), starting with the most southern row of the grid. The GRID format is given the .GRD extension, and includes headers compatible with the SURFER(R) plotting software.

A plotting and analysis file can also be created for the daily peak visibility summary output, in DATA format only.

Generate Plot file output in addition to writing tables to List file?
(LPLT) -- Default: F ! LPLT = F !

Use GRID format rather than DATA format, when available?
(LGRD) -- Default: F ! LGRD = F !

Auxiliary Output Files (for subsequent analyses)

visibility

A separate output file may be requested that contains the change in visibility at each selected receptor when ASPEC = VISIB. This file can be processed to construct visibility measures that are not available in CALPOST.

Output file with the visibility change at each receptor?
(MDVIS) -- Default: 0 ! MDVIS = 0 !

0 = Do Not create file
1 = Create file of DAILY (24 hour) Delta-Deciview
2 = Create file of DAILY (24 hour) Extinction Change (%)
3 = Create file of HOURLY Delta-Deciview
4 = Create file of HOURLY Extinction Change (%)

Additional Debug Output

```
   Output selected information to List file
    for debugging?
                                (LDEBUG) -- Default: F   ! LDEBUG  = F !

   Output hourly extinction information to REPORT.HRV?
    (Visibility Method 7)
                                (LVEXTHR) -- Default: F   ! LVEXTHR = F !

!END!
```

Appendix E

Example of CALPOST List File Output using the Existing and New IMPROVE Algorithm for Calculating Visibility Impairment at Class I Areas within 300km of Chemical Products Corporation

CALPOST Recalculation with New IMPROVE Algorithm

---------- INPUT from CALPOST (based on old IMPROVE algorithm) ----------

1. At cell A7, import "Ranked Daily Visibility Change" (bext) table, including column headings, from CALPOST (22 days, max)

YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	BEXT(Model)	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF	Rank

5. Check calculated valu below against CALPOST "Ranked Daily Visibility

dv(total)	dv(bkg)
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!
#NUM!	#NUM!

3. Enter value of site-specific Rayleigh scattering coefficient, from "Rayleigh & Sea Salt" worksheet

4. (Optional) Insert annual average sea salt concentration, from "Rayleigh & Sea Salt" worksheet. Leave blank if not used, i.e. default is 0.

6. Enter desired NO2/N ratio (default is 0)

---------- OUTPUT (based on new IMPROVE algorithm) ----------

YEAR	DAY	HR	RECEPTOR	COORDINATES (km)		TYPE	BEXT(Source	BEXT(BKG	BEXT(Total)	%CHANGE	RH(%)	bsSO4	bsNO3	bsOC	bsEC	bsPMC	bsPMF	baNO2	New Rank	dv(total)	dv(bkg)
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A
0	0	0	0	0	0	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0	0	0	0	1	#N/A	#N/A