REFINED CALPUFF BART APPLICABILITY MODELING ANALYSIS
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1. INTRODUCTION

INVISTA S.A. R.L. (INVISTA) owns and operates a synthetic organic chemical manufacturing plant (INVISTA Orange) located in Orange, Orange County, Texas. The Texas Commission on Environmental Quality (TCEQ) Customer Number (CN) for INVISTA is CN602582231. The Regulated Entity Number (RN) for the Orange Plant is RN104392626. INVISTA Orange is considered eligible to be regulated under the U.S. Environmental Protection Agency's (EPA) Best Available Retrofit Technology (BART) provisions of the Regional Haze Rule

The results of the initial BART Screening performed by TCEQ's contractor determined that the INVISTA Orange Plant could not be screened out of further analyses as part of a larger collection of sources grouped geographically and by source category. Preliminary analyses showing impacts from the modeled group that included the Orange Plant were above the threshold for contributing to visibility impairment at nine Class I areas. Therefore, a site-specific BART Applicability Analysis was required to be conducted for the Orange Plant to determine whether the facility is subject to or exempt from BART.

This report summarizes INVISTA's BART Applicability Analysis and resulting determination that the Orange Plant is exempt from BART since the refined air quality modeling analyses described in this report demonstrate that the plant does not contribute to visibility impairment at federally-protected Class I areas. Accordingly, no BART Determination is required for the Orange Plant.

INVISTA's site-specific evaluation of BART-eligibility and the modeling methods used to determine applicability of BART as described in this report are based on the following documents:

- TCEQ, "Final Report, Screening Analysis of Potential BART-Eligible Sources in Texas," Work Order No. 582-04-65563-06-10, September 27, 2006 and "Addendum I, BART Exemption Screening Analysis," December 6, 2006.
- TCEQ, "Best Available Retrofit Technology (BART) Modeling Protocol to Determine Sources Subject to BART in the State of Texas," January 22, 2007.
- Central Region Air Planning Association, *CENRAP BART Modeling Protocol,* December 15, 2005.
- U.S. EPA, *Guidance for Tracking Progress under the Regional Haze Rule* (EPA-454/B-03-004), September 2003.
- U.S. EPA, *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule* (EPA-454/B-03-005), October 2003.

The *TCEQ BART Modeling Protocol* is incorporated by reference for INVISTA's source-specific modeling analyses. The *TCEQ BART Modeling Protocol* and related information available at the TCEQ BART website established common technical approaches for quantifying emissions from BART-eligible emission units and conducting screening and refined modeling analyses using the

CALPUFF modeling system and common data resources.[1] INVISTA's analyses generally adhere to the recommendations made in the *TCEQ BART Modeling Protocol* as described in this report and adapted to the source-specific analysis of visibility impacts attributable to the Orange Plant. INVISTA has also submitted a BART Modeling Protocol to TCEQ for review.[2] Appendix A contains a copy of the submitted protocol for documentation purposes.

1.1 ASSESSMENT OF CONTRIBUTION TO VISIBILITY IMPAIRMENT AND BART APPLICABILITY

The *TCEQ BART Modeling Protocol* was issued in January 2007 and prescribes modeling techniques and data resources to conduct screening and refined analyses to assess whether a BART-eligible source is subject to BART. Causation is defined as a single-source impact of 1.0 deciviews (dv) or more and contribution is defined as a single-source impact of 0.5 dv or more, each evaluated on a 24-hour average basis. The deciview is a metric used to represent normalized light extinction attributable to visibility-affecting pollutants. To determine whether a BART-eligible plant causes or contributes to visibility impairment, U.S. EPA guidance requires the use of an air quality model, specifically recommending the CALPUFF modeling system, to quantify the impacts attributable to a single BART-eligible source. Because contribution to visibility impairment is sufficient cause to require a BART determination, 0.5 dv is the critical threshold for assessment of BART applicability.

The change in deciviews based on the source and background light extinction is based on the following equation:

$$\Delta \mathrm{dv} = 10 * \ln\left[\frac{\mathrm{b}_{\text{ext, background}} + \mathrm{b}_{\text{ext, source}}}{\mathrm{b}_{\text{ext, background}}}\right]$$

The background extinction coefficient $b_{\text{ext, background}}$ is affected by various chemical species and the Rayleigh scattering phenomenon and can be calculated as shown in the following equation:

$$b_{ext,background}\left(\mathrm{Mm}^{-1}\right) = b_{SO_4} + b_{NO_3} + b_{OC} + b_{Soil} + b_{Coarse} + b_{ap} + b_{Ray}$$

[1] http://www.tceq.state.tx.us/implementation/air/sip/bart/haze.html

[2] The protocol document was submitted to Mr. Daniel Jamieson of TCEQ via email on April 30, 2007.

where,

$b_{SO_4} = 3[(NH_4)_2SO_4]f(RH)$	$[(NH_4)_2SO_4]$ denotes the ammonium sulfate concentration
$b_{NO_3} = 3[NH_4NO_3]f(RH)$	$[NH_4NO_3]$ denotes the ammonium nitrate concentration
$b_{OC} = 4[OC]$	$[OC]$ denotes the concentration of organic carbon
$b_{Soil} = 1[Soil]$	$[Soil]$ denotes the concentration of fine soils
$b_{Coarse} = 0.6[\text{Coarse Mass}]$	$[\text{Coarse Mass}]$ denotes the concentration of coarse dusts
$b_{ap} = 10[EC]$	$[EC]$ denotes the concentration of elemental carbon
$b_{Ray} = \text{Rayleigh Scattering}\ (10\ \text{Mm}^{-1}\ \text{by default})$	Rayleigh Scattering is scattering due to air molecules
$f(RH) = \text{Relative Humidity Function}$	
$[\ ] = \text{Concentration in } \mu g/m^3$	

Values for the parameters listed above specific to the natural background conditions at the Class I areas considered in this analysis are provided on an annual average basis in the U.S. EPA's *Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule*.[3]

The extinction coefficient due to emissions of visibility-affecting pollutants from a BART-eligible source $b_{\text{ext,source}}$ is calculated using an air quality model. The extinction due to the BART-eligible source is calculated as shown in the following equation.

$$b_{ext,source}(\text{Mm}^{-1}) = b_{SO_4} + b_{NO_3} + b_{PMC} + b_{PMF} + b_{SOA} + b_{EC}$$

where,

$b_{SO_4} = 3[(NH_4)_2SO_4]f(RH)$	$[(NH_4)_2SO_4]$ denotes the ammonium sulfate concentration
$b_{NO_3} = 3[NH_4NO_3]f(RH)$	$[NH_4NO_3]$ denotes the ammonium nitrate concentration
$b_{SOA} = 4[SOA]$	$[SOA]$ denotes the concentration of secondary organic aerosols
$b_{PMF} = 1[PMF]$	$[PMF]$ denotes the concentration of fine PM
$b_{PMC} = 0.6[PMC]$	$[PMC]$ denotes the concentration of coarse PM
$b_{EC} = 10[EC]$	$[EC]$ denotes the concentration of elemental carbon
$f(RH) = \text{Relative Humidity Function}$	
$[\ ] = \text{Concentration in } \mu g/m^3$	

1.2 POTENTIALLY AFFECTED CLASS I AREAS

INVISTA used the refined modeling technique described in the *TCEQ BART Modeling Protocol* to determine whether BART-eligible operations at the Orange Plant contribute to visibility impairment at any Class I areas. The December 2006 addendum to the *TCEQ BART Screening Analysis Report* noted that the preliminary screening analysis only resulted in impacts above 0.5 dv for nine Class I areas for the source group or model plant that included the Orange Plant. Therefore, only those nine

[3] U.S. EPA, *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule*, Table 2-1, Attachment A, September 2003, EPA-454/B-03-005.

Class I areas are required to be included in INVISTA's analysis to determine whether the source contributes to visibility impairment.

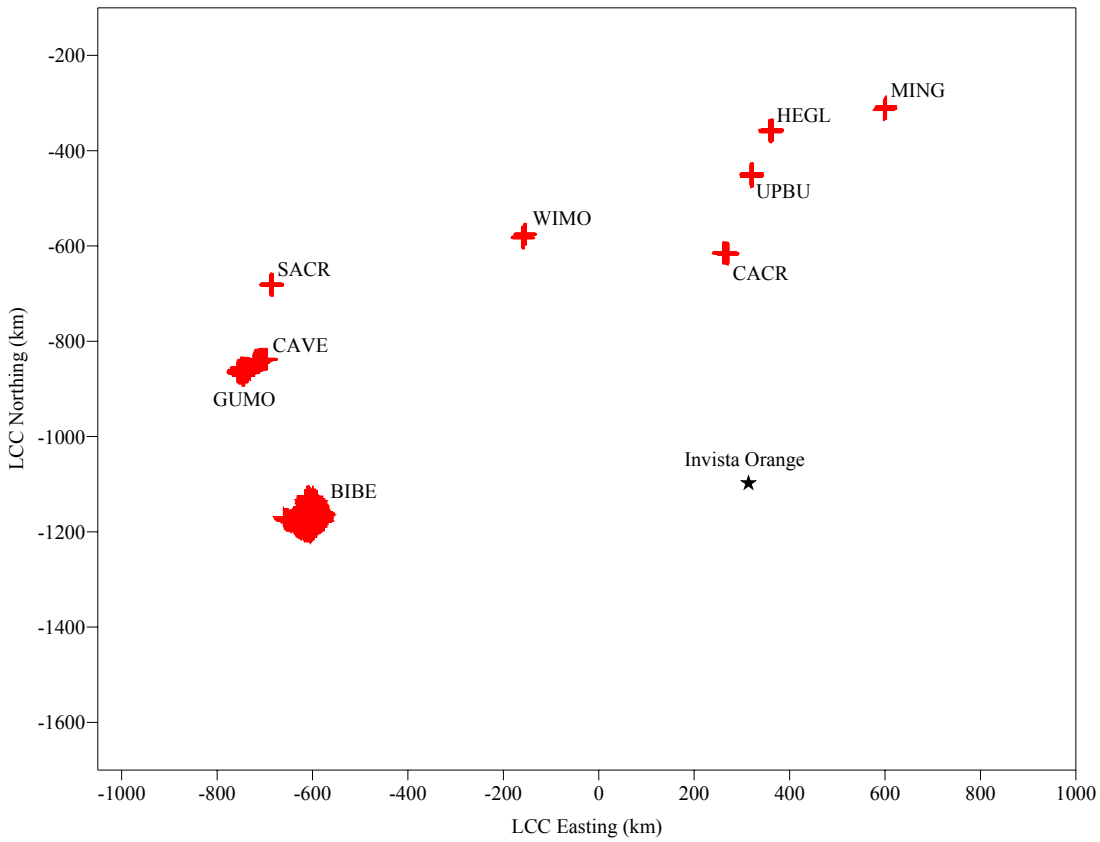
The required Class I areas for the INVISTA Orange Plant and the distance to these areas from the plant are provided in Table 1-1. Note that the distances listed in Table 1-1 are the distances between the plant and the closest border of the Class I areas.

TABLE 1-1. DISTANCE FROM VICTORIA PLANT TO SURROUNDING CLASS I AREAS

Class I Area	Symbol	Distance (km)
Big Bend National Park (TX)	BIBE	910
Caney Creek Wilderness Area (AR)	CACR	430
Carlsbad Caverns National Park (NM)	CAVE	1,075
Guadalupe Mountains National Park (TX)	GUMO	1,100
Hercules-Glades Wilderness Area (MO)	HEGL	660
Mingo Wilderness Area (MO)	MING	775
Salt Creek Wildlife Refuge (NM)	SACR	1,100
Upper Buffalo Wilderness Area (MO)	UPBU	575
Wichita Mountains Wilderness Area (OK)	WIMO	675

A plot of the Class I areas with respect to the Orange Plant is provided in Figure 1-1.

FIGURE 1-1. PLOT OF CLASS I AREAS REQUIRED BY TCEQ TO BE EVALUATED IN THE BART ANALYSIS



1.3 CALPUFF MODELING ANALYSES

As recommended by the U.S. EPA BART guidelines, the CALPUFF modeling system was used to compute the 24-hour average visibility impairment attributable to INVISTA's Orange Plant to assess whether the 0.5 dv contribution threshold is exceeded, and if so, the frequency, duration, and magnitude of any exceedance events. CALPUFF is a refined air quality modeling system that is capable of simulating the dispersion, chemical transformation, and long-range transport of multiple visibility-affecting pollutant emissions from a single source and is therefore preferred for BART applicability and determination analyses.

2. EMISSION SOURCE INFORMATION

This section of the report describes the emission units that comprise the BART-eligible sources at the INVISTA Orange Plant. Emissions of SO_2, NO_x, and PM from the 14 BART-eligible sources at INVISTA's Orange Plant are described in the following sections.

2.1 MODELED STACK PARAMETERS AND EMISSIONS

INVISTA reviewed the criteria for BART-eligibility and determined that the emission units described in Appendix B comprise the BART-eligible sources at the Orange Plant based on the source category and date-in-existence eligibility criteria. Actual stack parameters were input into the CALPUFF model to represent the point of visibility-affecting pollutant emissions. The location of each point source was represented consistently in the Lambert Conformal Coordinate system. Each exhaust discharges vertically without obstruction. Since the nearest modeled Class I area is located more than 400 km from the plant, pursuant to the TCEQ BART modeling protocol, effects of building downwash were not considered.

Emissions of SO_2, NO_x, and PM_{10} from the 14 BART-eligible sources at INVISTA's Orange Plant were included in the BART Modeling. In lieu of actual maximum 24-hour average pound per hour (lb/hr) emission rates of NO_x, SO_2, and PM from the period of 2002 through 2005, INVISTA Orange has conservatively used the permit allowable emission rates in the BART determination refined modeling. Appendix B summarizes the stack parameters and emission rates for BART-eligible emission units at INVISTA's Victoria Plant.

3. AIR QUALITY MODELING ANALYSES

The BART Modeling Protocol submitted by INVISTA in April 2007 describes the modeling methods, data resources, and technical options used to conduct the refined analysis for the Orange Plant. The air quality modeling was conducted following the methods described in the *TCEQ BART Modeling Protocol* and the INVISTA Refined BART modeling protocol submitted in April 2007 (refer to Appendix A for details).

4. REFINED ANALYSIS RESULTS

Refined analyses of visibility impacts attributable to INVISTA's Orange Plant were conducted to determine whether the plant is subject to BART using a conservative assessment.

4.1 REFINED ANALYSIS IMPACTS AT BIG BEND NP

Table 4-1 summarizes the modeled 98th percentile daily visibility impacts at Big Bend National Park (NP) attributable to INVISTA's Orange Plant. This table summarizes the results calculated by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred.

TABLE 4-1. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT BIG BEND NP

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.079	300
2002	0.038	303
2003	0.033	148

The results presented in Table 4-1 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Big Bend NP since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.2 REFINED ANALYSIS IMPACTS AT CANEY CREEK WA

Table 4-2 summarizes the modeled 98th percentile daily visibility impacts at Caney Creek Wilderness Area (WA) attributable to INVISTA's Orange Plant. This table summarizes the results calculated by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred.

TABLE 4-2. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT CANEY CREEK WA

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.205	326
2002	0.209	40
2003	0.319	362

The results presented in Table 4-2 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Caney Creek WA since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.3 REFINED ANALYSIS IMPACTS AT CARLSBAD CAVERNS NP

Table 4-3 summarizes the modeled 98th percentile daily visibility impacts at Carlsbad Caverns NP attributable to INVISTA's Orange Plant. This table summarizes the results calculated by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred.

TABLE 4-3. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT CARLSBAD CAVERNS NP

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.007	60
2002	0.039	298
2003	0.004	66

The results presented in Table 4-3 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Carlsbad Caverns NP since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.4 REFINED ANALYSIS IMPACTS AT GUADALUPE MOUNTAINS NP

Table 4-4 summarizes the modeled 98th percentile daily visibility impacts at Guadalupe Mountains NP attributable to INVISTA's Orange Plant. This table summarizes the results calculated by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred.

TABLE 4-4. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT GUADALUPE MOUNTAINS NP

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.008	60
2002	0.045	297
2003	0.003	65

The results presented in Table 4-4 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Guadalupe Mountains since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.5 REFINED ANALYSIS IMPACTS AT HERCULES GLADES WA

Table 4-5 summarizes the modeled 98th percentile daily visibility impacts at Hercules Glades WA attributable to INVISTA's Orange Plant. This table summarizes the results calculated by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred.

TABLE 4-5. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT HERCULES GLADES WA

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.092	50
2002	0.095	148
2003	0.133	71

The results presented in Table 4-5 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Hercules Glades WA since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.6 REFINED ANALYSIS IMPACTS AT MINGO WA

Table 4-6 summarizes the modeled 98th percentile daily visibility impacts at Mingo WA attributable to INVISTA's Orange Plant. This table summarizes the results calculated by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred.

TABLE 4-6. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT MINGO WA

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.072	95
2002	0.119	363
2003	0.103	29

The results presented in Table 4-6 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Mingo WA since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.7 REFINED ANALYSIS IMPACTS AT SALT CREEK WR

Table 4-7 summarizes the modeled 98th percentile daily visibility impacts at Salt Creek Wildlife Refuge (WR) attributable to INVISTA's Orange Plant. This table summarizes the results calculated

by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred..

TABLE 4-7. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT SALT CREEK WR

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.004	300
2002	0.017	299
2003	0.003	67

The results presented in Table 4-7 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Salt Creek WR since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.8 REFINED ANALYSIS IMPACTS AT UPPER BUFFALO WA

Table 4-8 summarizes the modeled 98th percentile daily visibility impacts at Upper Buffalo WA attributable to INVISTA's Orange Plant. This table summarizes the results calculated by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred.

TABLE 4-8. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT UPPER BUFFALO WA

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.093	327
2002	0.111	148
2003	0.125	356

The results presented in Table 4-8 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Upper Buffalo WA since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.9 REFINED ANALYSIS IMPACTS AT WICHITA MOUNTAINS WR

Table 4-9 summarizes the modeled 98th percentile daily visibility impacts at Wichita Mountains WR attributable to INVISTA's Orange Plant. This table summarizes the results calculated by using the methods described in the Modeling Protocol for representing annual average natural background conditions. Results are presented in terms of the 98th percentile daily visibility impact and the day at which the 98th percentile visibility impact occurred.

TABLE 4-9. 98TH PERCENTILE DAILY VISIBILITY IMPACTS AT WICHITA MOUNTAINS WR

Year	98th Percentile Modeled Impact (Δdv)	Julian Day For 98th Percentile Impact
2001	0.154	319
2002	0.046	276
2003	0.079	28

The results presented in Table 4-9 indicate that INVISTA's Orange Plant does not contributes to visibility impairment at Wichita Mountains WR since the refined analysis impacts, based on annual average natural background conditions, are below the impact contribution threshold of 0.5 dv.

4.10 SUMMARY OF REFINED ANALYSES

Because refined analyses of visibility impacts to INVISTA's Orange Plant indicated 98th percentile daily impacts impacts are below the 0.5 dv contribution threshold at all Class I areas evaluated, no further BART analysis was required.

5. CONCLUSIONS

Using analysis methods prescribed by the U.S. EPA, CENRAP, and TCEQ, INVISTA conducted BART Applicability Analyses of emissions of visibility-affecting pollutants from BART-eligible emission units at the Orange Plant. The results of this analysis indicate that the INVISTA Orange Plant is not subject to BART; hence, the site is not required to conduct a BART Determination, because the BART-eligible sources do not contributes to visibility impairment at Big Bend NP, Caney Creek WA, Carlsbad Caverns NP, Guadalupe Mountains NP, Hercules Glades WA, Mingo WR, Salt Creek WR, Upper Buffalo WA, and Wichita Mountains WR, as demonstrated by a refined modeling analysis that quantified the 98th percentile daily visibility impact as being less than the 0.5 dv contribution threshold. Upon review of this BART Applicability Analysis, TCEQ is expected to confirm INVISTA's determination that BART does not apply.

INVISTA reserves the right to revise the applicability analyses and determinations described in this report if new methods are approved for regulatory use by the U.S. EPA and TCEQ.

PROFESSIONAL ENGINEER SEAL

To the best of my knowledge, the representations made in this modeling demonstration document are true and accurate. The emission source data used in the analysis was provided by the client or determined from the client-provided data. By affixing my seal below, I submit that the engineering work and calculations performed in this application were either performed by myself or under my direct supervision, as defined in Section 131.81 of the Texas Engineering Practice Act.

Place P.E. Seal below this line

Signature *Date*

Weiping Dai, Managing Consultant, Trinity Consultants
Printed Name, Title, and Affiliation

APPENDIX A

BART REFINED MODELING PROTOCOL
Submitted to TCEQ on April 30, 2007

REFINED CALPUFF BART MODELING PROTOCOL

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1. INTRODUCTION

INVISTA S.A. R.L. (INVISTA) owns and operates a synthetic organic chemical manufacturing plant (INVISTA Orange) located in Orange, Orange County, Texas. The Texas Commission on Environmental Quality (TCEQ) Customer Number (CN) for INVISTA is CN602582231. The Regulated Entity Number (RN) for the Orange Plant is RN104392626. INVISTA Orange is considered eligible to be regulated under the U.S. Environmental Protection Agency's (EPA) Best Available Retrofit Technology (BART) provisions of the Regional Haze Rule. This protocol describes the proposed methodology for the Refined CALPUFF BART modeling analysis for INVISTA Orange.

1.1 BEST AVAILABLE RETROFIT TECHNOLOGY RULE BACKGROUND

On July 1, 1999, the U.S. Environmental EPA published the final Regional Haze Rule (RHR). The objective of the RHR is to improve visibility in 156 specific areas across with United States, known as Class I areas. The Clean Air Act defines Class I areas as certain national parks (over 6000 acres), wilderness areas (over 5000 acres), national memorial parks (over 5000 acres), and international parks that were in existence on August 7, 1977.

On July 6, 2005, the EPA published amendments to its 1999 RHR, often called the BART rule, which included guidance for making source-specific Best Available Retrofit Technology (BART) determinations. The BART rule defines BART-eligible sources as emission units that meet the following three criteria:

(1) Have potential emissions of at least 250 tons per year of a visibility-impairing pollutant,
(2) Began operation between August 7, 1962 and August 7, 1977, and
(3) Are listed as one of the 26 listed source categories in the guidance.

A BART-eligible source is not automatically subject to BART. Rather, BART-eligible sources are subject-to-BART if the sources are "reasonably anticipated to cause or contribute to visibility impairment in any federal mandatory Class I area." EPA has determined that sources are reasonably anticipated to cause or contribute to visibility impairment if the visibility impacts from a source are greater than 0.5 deciviews (dv) when compared against a natural background.

Air quality modeling is the tool that is used to determine a source's visibility impacts. States have the authority to exempt certain BART-eligible sources from installing BART controls if the results of the dispersion modeling demonstrate that the source cannot reasonably be anticipated to cause or contribute to visibility impairment in a Class I area. Further, states also have the authority to define the modeling procedures for conducting modeling related to making BART determinations.

1.2 MODELING PROTOCOL BACKGROUND

To promote consistency between sources in conducting modeling related to BART, TCEQ published a BART modeling protocol (January 2007). TCEQ has indicated that sources may use the protocol to

determine if BART-eligible units are subject to BART. The modeling methods prescribed by the TCEQ in the BART modeling protocol are based on the use of a CALMET meteorological data set developed by CENRAP. This data set incorporated only mesoscale meteorological data (mm5 data) and did not incorporate actual surface, upper air, precipitation or over water station observation data.

The FLMs commented that observations should be used in refined CALPUFF modeling. Thus, TCEQ indicated in their protocol that modeling using the CENRAP data set is considered screen modeling, and that sources may use observational data if they wish to conduct a more refined modeling analysis. It is INVISTA Orange's intent to conduct a refined CALPUFF modeling analysis to evaluate the applicability of BART to the Orange plant.

1.3 OBJECTIVE

The objective of this document is to provide a protocol summarizing the modeling methods and procedures that will be followed for a refined CALPUFF modeling for INVISTA Orange. The modeling methods and procedures will be used to determine if INVISTA Orange's BART-eligible sources can reasonably be anticipated to cause or contribute to visibility impairment in a Class I area and are thus subject to BART. It is INVISTA Orange's intent to show that the 98th percentile of the visibility impacts predicted by the model for all BART eligible sources are below EPA's recommended visibility contribution threshold of 0.5 Δdv.

1.4 LOCATION OF EMISSION UNITS AND RELEVANT CLASS I AREAS

The sources listed in Table 1-1 are the emission units that have been identified by INVISTA Orange as sources that meet the three criteria for BART-eligible sources.

TABLE 1-1. LIST OF ALL EMISSION UNITS IN BART-ELIGIBLE SOURCE GROUP

EPN	Source Description
05COM-001	Portable Compressors
11BLR-003	Power Boiler No. 5 Stack
11BLR-004	Power Boiler Nos. 7 & 8 Stack
FC-10	Fugitives
PA39	Incinerator
PC-9	Vent Stack
PF40	South ADN Boiler
PF41	North ADN Boiler
PH2	Start up flare
PH3	Operating Flare
PH63	HCN LOAD/UNLOAD FLARE
PH70	AMMONIA FLARE
PD-17A/PD17B[1]	FILTERS-FABRIC (BAGHOUSE)

[1] To be conservative, baghouse emissions from EPNs PD-17A and PD-17B were added to EPN PH-3 because it is the highest stack.

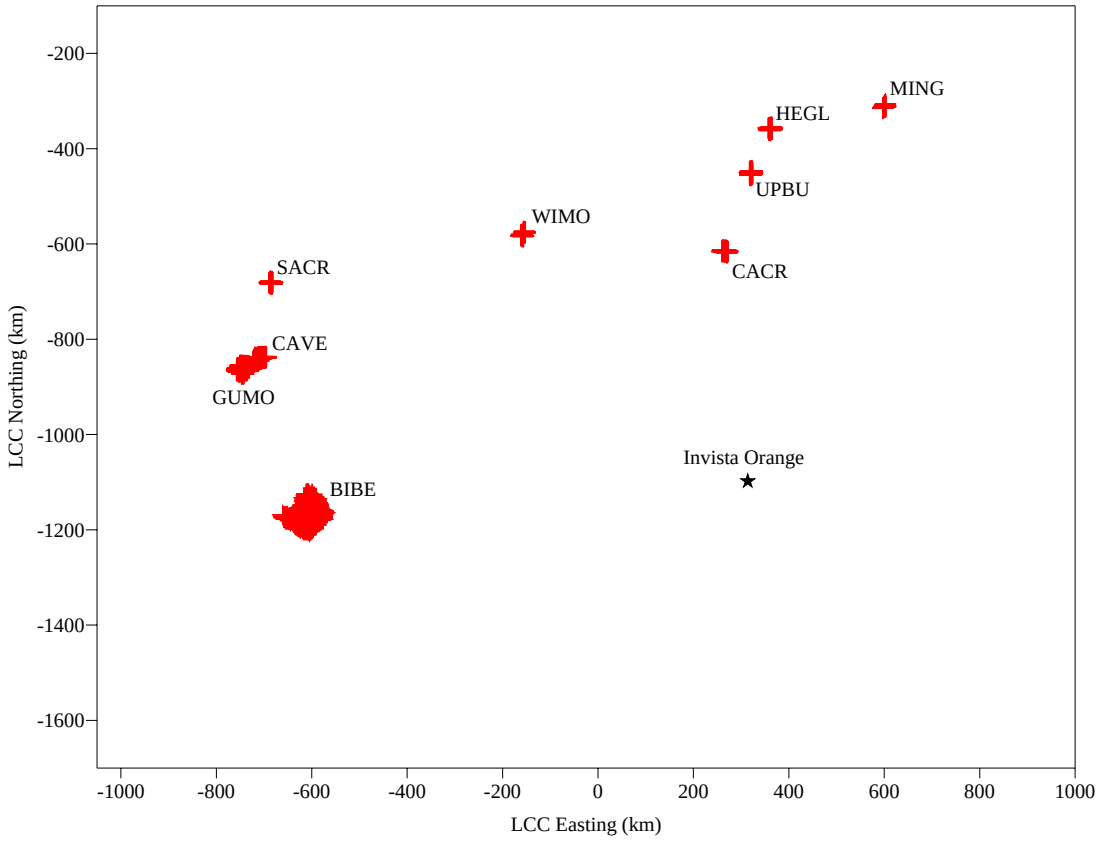
TCEQ provided a list of Class I areas that each source should include in their BART modeling analysis. The Class I areas listed for INVISTA Orange and the distance of these areas from the plant are provided in Table 1-2. Note that the distances listed in Table 1-2 are the distances of the plant to the closest border of the Class I areas.

TABLE 1-2. DISTANCE FROM ORANGE PLANT TO SURROUNDING CLASS I AREAS

Class I Area	Symbol	Distance (km)
Big Bend	BIBE	910
Caney Creek	CACR	430
Carlsbad Caverns	CAVE	1,075
Guadalupe Mountains	GUMO	1,100
Hercules-Glades Wilderness	HEGL	660
Mingo Wilderness Area	MING	775
Salt Creek Wildlife Refuge	SACR	1,100
Upper Buffalo Wilderness Area	UPBU	575
Wichita Mountains	WIMO	675

A plot of the Class I areas with respect to INVISTA Orange is provided in Figure 1-1.

FIGURE 1-1. PLOT OF CLASS I AREAS RECOMMENDED BY TCEQ TO BE EVALUATED IN THE BART ANALYSIS



The main components of the CALPUFF modeling system are CALMET, CALPUFF, and CALPOST. CALMET is the meteorological model that generates hourly three-dimensional meteorological fields such as wind and temperature. CALPUFF simulates the non-steady state transport, dispersion, and chemical transformation of air pollutants emitted from a source in "puffs". CALPUFF calculates hourly concentrations of visibility affecting pollutants at each specified receptor in a modeling domain. CALPOST is the post-processor for CALPUFF that computes visibility impacts from a source based on the visibility affecting pollutant concentrations that were output by CALPUFF.

2.1 MODEL VERSIONS

The versions of the CALPUFF modeling system programs that Trinity is proposing for modeling INVISTA Orange are listed in Table 2-1.

TABLE 2-1. CALPUFF MODELING SYSTEM VERSIONS

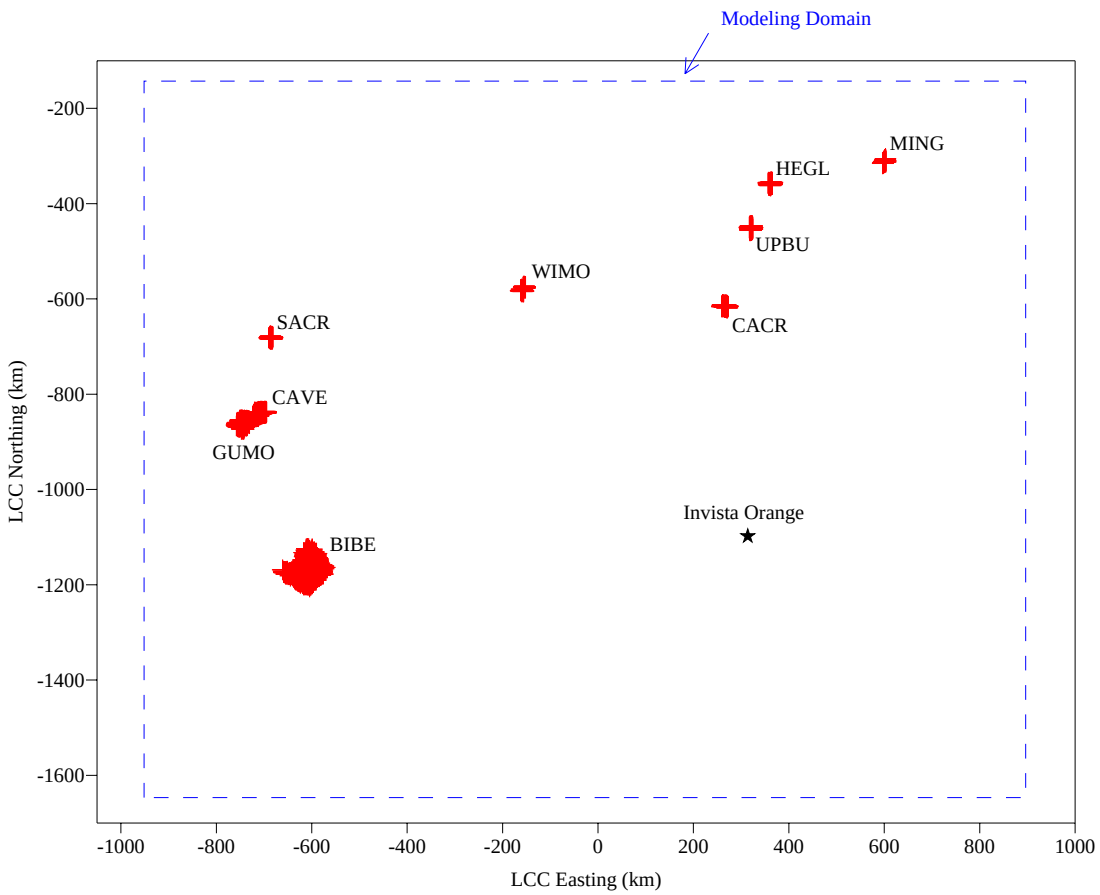
Processor	Version	Level
TERREL	3.3	030402
CTGPROC	2.63	050128
MAKEGEO	2.2	030402
CALMET	5.53a	040716
CALPUFF	5.711a	040716
POSTUTIL	1.3	030402
CALPOST	5.51	030709

2.2 MODELING DOMAIN

INVISTA Orange is proposing to use the modeling domain summarized as follows. Note that the map projection for the modeling domain will be Lambert Conformal Conic (LCC) and the datum will be World Geodetic System 84 (WGS-84). The reference point for the modeling domain is Latitude 40ºN, Longitude 97ºW. The southwest corner will be set to -951.547 km LCC, -1646.637 km LCC corresponding to Latitude 24.813 and Longitude 87.778. The meteorological grid spacing will be 4 km, resulting in 462 grid points in the X direction and 376 grid points in the Y direction.

A plot of the proposed modeling domain with respect to the Class I areas being modeled is also provided in Figure 2-1. Note that the modeling domain extends at least 50 km in all directions beyond INVISTA Orange and the Class I areas of interest.

FIGURE 2-1. REFINED CALPUFF MODELING DOMAIN



3. CALMET

The EPA Approved Version X CALMET meteorological processor will be used to generate the meteorological data for CALPUFF. CALMET is the meteorological processor that compiles meteorological data from raw observations of surface and upper air conditions, precipitation measurements, mesoscale model output, and geophysical parameters into a single hourly, gridded data set for input to CALPUFF. CALMET will be used to assimilate data for 2001- 2003 using National Weather Service (NWS) surface station observations, upper air station observations, precipitation station observations, buoy station observations, and mesoscale model output to develop the meteorological field.

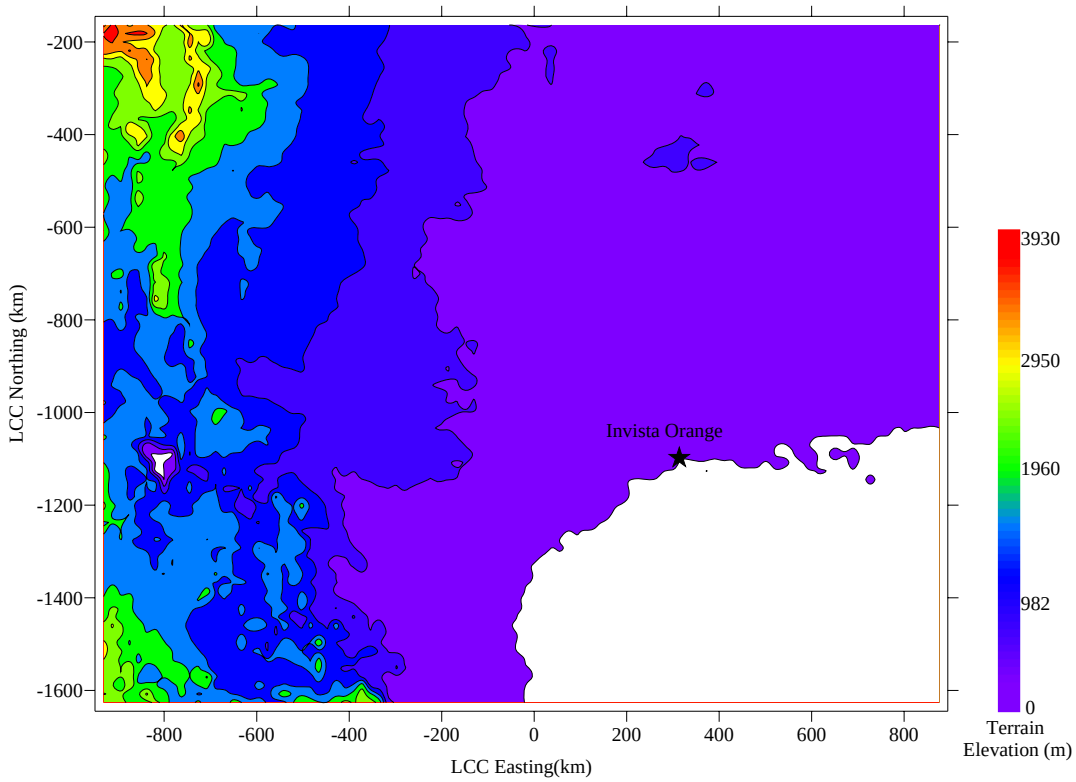
3.1 GEOPHYSICAL DATA

CALMET requires geophysical data to characterize the terrain and land use parameters that potentially affect dispersion. Terrain features affect flows and create turbulence in the atmosphere and are potentially subjected to higher concentrations of elevated puffs. Different land uses exhibit variable characteristics such as surface roughness, albedo, Bowen ratio, and leaf-area index that also effect turbulence and dispersion.

3.1.1 TERRAIN DATA

Terrain data will be obtained from the United States Geological Survey (USGS) in 1-degree (1:250,000 scale or approximately 90 meter resolution) digital format. The USGS terrain data will then be processed by the TERREL program to generate grid-cell elevation averages across the modeling domain. A plot of the land elevations based on the USGS data for the modeling domain is provided in Figure 3-1.

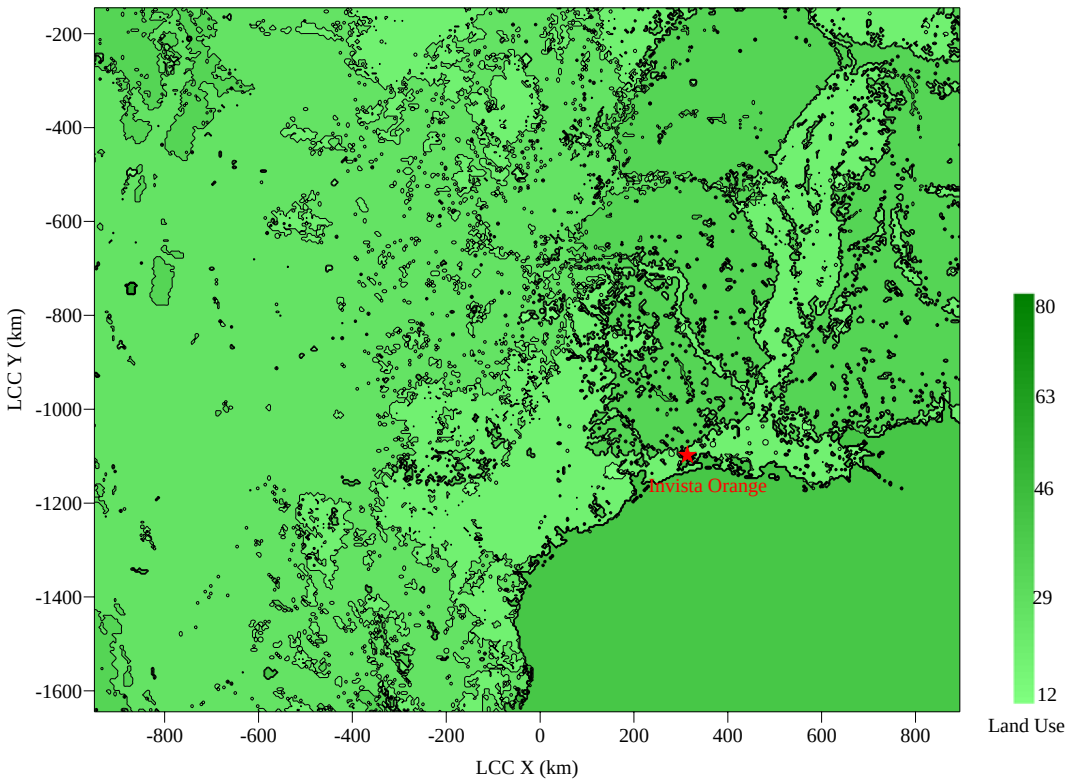
FIGURE 3-1. PLOT OF LAND ELEVATION USING USGS TERRAIN DATA



3.1.2 LAND USE DATA

The land use land cover (LULC) data from the USGS North American land cover characteristics data base in the Lambert Azimuthal equal area map projection will be used in order to determine the land usage within the modeling domain. The LULC data will be processed by the CTGPROC program which will generate land use for each grid cell across the modeling domain. A plot of the land use based on the USGS data for the modeling domain is provided in Figure 3-2.

FIGURE 3-2. PLOT OF LAND USE USING USGS LULC DATA



3.1.3 COMPILING TERRAIN AND LAND USE DATA

The terrain data files output by the TERELL program and the LULC files output by the CTGPROC program will uploaded into the MAKEGEO program to create a geophysical data file that will be input to CALMET.

3.2 METEOROLOGICAL DATA

CALMET will be used to assimilate data for 2001, 2002, and 2003 using mesoscale model output and National Weather Service (NWS) surface station observations, upper air station observations, precipitation station observations, and National Oceanic and Atmosphere Administrations (NOAA) buoy station observations to develop the meteorological field.

3.2.1 MESOSCALE MODEL METEOROLOGICAL DATA

Hourly mesoscale data will be used to supplement the hourly surface, upper air, precipitation, and buoy observation data. The mesoscale data will be used to define the initial guess field for the CALMET simulations. It is INVISTA Orange's intent to use the following 5th generation mesoscale model meteorological data (or MM5 data):

- 2001 MM5 data at 12 km resolution processed for EPA by Alpine Geophysics
- 2002 MM5 data at 36 km resolution processed by Iowa DNR
- 2003 MM5 data set at 36 km resolution processed by the Midwest RPO

The specific MM5 data that Trinity will use are subsets of the data listed above. Alpine Geophysics extracted three subsets of MM5 data for each year from 2001 to 2003 from the data sets listed above using the CALMM5 extraction program. The three subsets covered the northern, central, and southern portions of CENRAP. Trinity is proposing to use the southern set of the extracted MM5 data.

The 2001 southern subset of the extracted MM5 data includes 30 files that are broken into 10 to 11 day increments (3 files per month). The 2002 and 2003 southern subsets of extracted MM5 data include 12 files each of which are broken into 30 to 31 day increment files (1 file per month). Note that the 2001 to 2003 MM5 data extracted by Alpine Geophysics will not be used directly in the modeling analysis. To run the Alpine Geophysics extracted MM data in the EPA approved CALMET program, each of the MM5 files will need to be adjusted by appending an additional six (6) hours, at a minimum, to the end of each file to account for the shift in time zones from the GMT prepared Alpine Geophysics data to Time Zone 6 for this analysis. No change to the data will occur.

The time periods covered by the data in each of the MM5 files extracted by Alpine include a specific number of calendar days, where the data starts at Hour 0 in Greenwich Mean Time (GMT) for the first calendar day and ends at Hour 23 in GMT on the last calendar day. In order to run CALMET in the local standard time (LST), which is necessary since the surface meteorological observations are recorded in LST, there must be hours of MM5 data referenced in a CALMET run that match the LST observation hours. Since the LST hours in Central Standard Time (CST) are 6 hours behind GMT, it is necessary to adjust the data in each MM5 file so that the time periods covered in the files match CST.

An example that further clarifies the need to adjust the time periods covered in the MM5 data files follows. The MM5 files for January as extracted by Alpine Geophysics (referred to as CALMM5 files) cover the following times:

1) File 1: January 1, Hour 0 GMT through January 10, Hour 23 GMT
2) File 2: January 11, Hour 0 GMT through January 20, Hour 23 GMT
3) File 3: January 21, Hour 0 GMT through January 31, Hour 23 GMT

When the above CALMM5 files are incorporated into the EPA Approved CALMET software, CALMET is run in CST to match the surface observation data. As a result, the CALMET runs for January would need to be set up for the following run times:

1) January 1, Hour 0 CST through January 10, Hour 23 CST (equivalent to Jan 1, Hour 6 GMT through Jan 11, Hour 5 GMT)
2) January 11, Hour 0 CST through January 20, Hour 23 CST (equivalent to Jan 11, Hour 6 GMT through Jan 21, Hour 5 GMT)
3) January 21, Hour 0 CST through January 31, Hour 23 CST (equivalent to Jan 21, Hour 6 GMT through Feb 1, Hour 5 GMT)

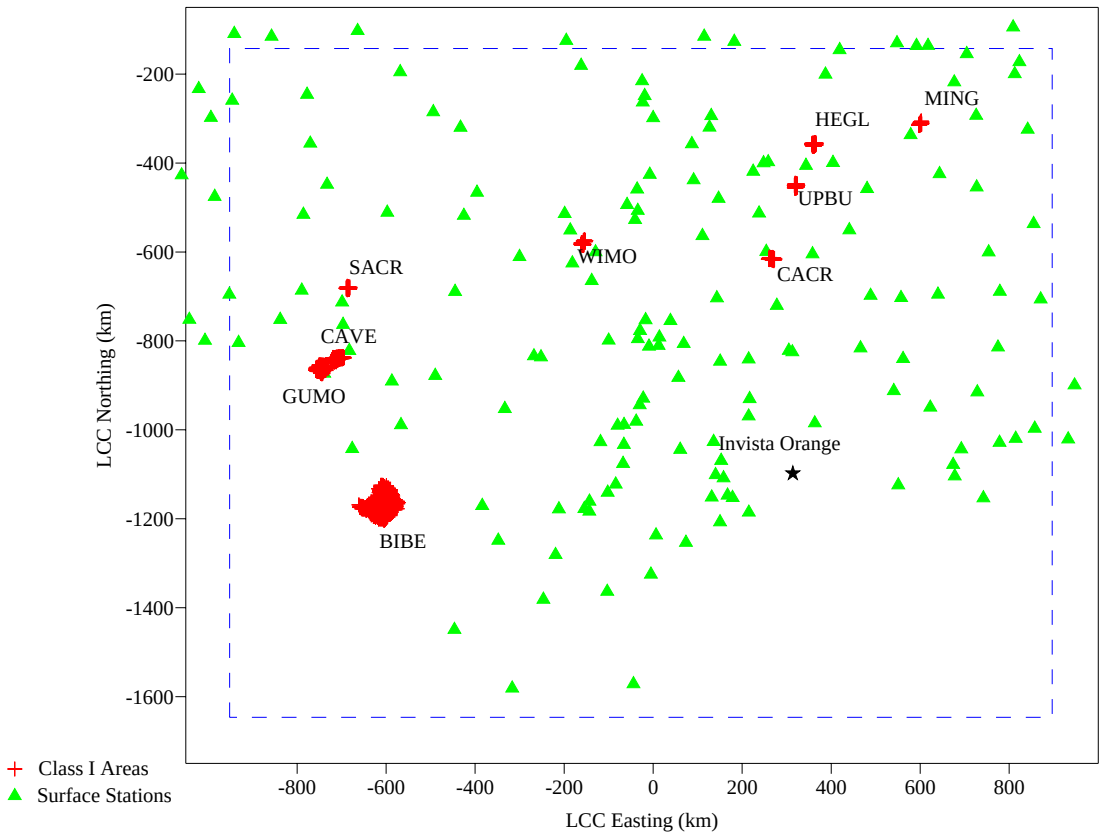
If the "equivalent to" hours for the MM5 data are compared to the CST hours for the observation data, it is clear that the time periods covered in the MM5 files do not match the time periods covered by the local observations. Thus, CALMET runs could not be simulated for the required times if the originally extracted Alpine Geophysic data was used. If CALMET is run starting at hour 0 CST, this would require data from the MM5 files starting at Hour 6 (since the GMT hours are six hours ahead of the local hour). This run would need to continue until Day 10, Hour 18 in CST. The CALMET run would run out of MM5 data 6 hours short when using the corresponding Alpine Geophysics MM5 file (as this is GMT Hour 23, which is the last hour in the MM5 file). Then a second CALMET run would need to be completed to generate data starting at Day 10, Hour 19. However, the CALMET program will only initialize a run between Hour 1 and Hour 6, thus, a run can not be initialized starting at Hour 19. Consequently, the Alpine MM5 files can not be used as is to generate a contiguous set of CALMET data.

Based on the above discussion, the Alpine MM5 data will not be used directly. Instead the data files will be modified to add 8 additional hours of data to the end of each file from the beginning of the subsequent file. CALMET will then be run using the appended MM5 data to generate a contiguous set of CALMET output files. This task will be completed using a fortran program. The converted MM5 data files occupy approximately 1.2 terabytes of hard drive space, thus the files are not have not been included as part of this submittal. This data can also be made available upon request.

3.2.2 SURFACE METEOROLOGICAL DATA

Parameters affecting turbulent dispersion that are observed hourly at surface stations include wind speed and direction, temperature, cloud cover and ceiling, relative humidity, and precipitation type. It is INVISTA Orange's intent to use the surface stations listed in Table A-1 of Appendix A. The locations of the surface stations with respect to the modeling domain are shown in Figure 3-3. The stations were selected from the available data inventory to optimize spatial coverage and representation of the domain. Data from the stations will be processed for use in CALMET using EPA's SMERGE program.

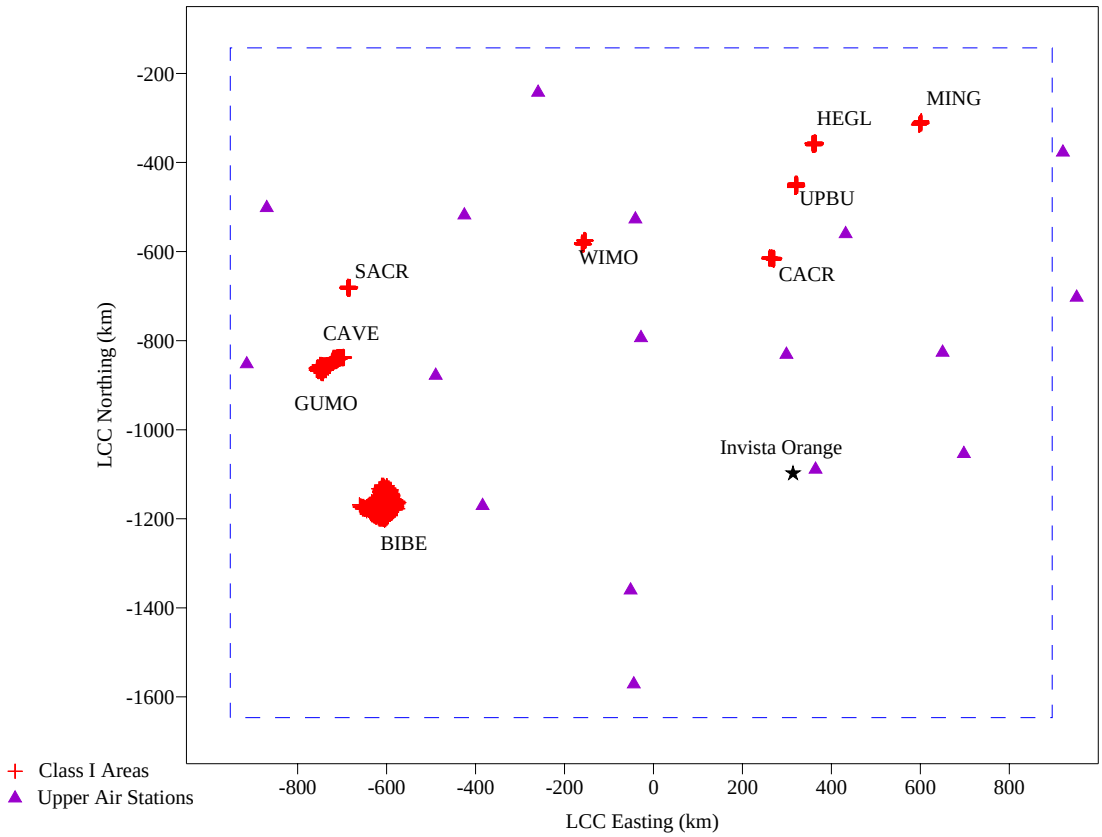
FIGURE 3-3. PLOT OF SURFACE STATION LOCATIONS



3.2.3 UPPER AIR METEOROLOGICAL DATA

Observations of meteorological conditions in the upper atmosphere provide a profile of turbulence from the surface through the depth of the boundary layer in which dispersion occurs. Upper air data are collected by balloons launched simultaneously across the observation network at 0000 Greenwich Mean Time (GMT) (6 o'clock PM in Texas) and 1200 GMT (6 o'clock AM in Texas). Sensors observe pressure, wind speed and direction, and temperature (among other parameters) as the balloon rises through the atmosphere. The upper air observation network is less dense than surface observation points since upper air conditions vary less and are generally not as affected by local effects (e.g., terrain or water bodies). The upper air stations from which Trinity will extract data are listed in Table A-2 of Appendix A. The locations of the upper air stations with respect to the modeling domain are shown in Figure 3-4. These stations were selected from the available data inventory to optimize spatial coverage and representation of the domain. Data from the stations will be processed for use in CALMET using EPA's READ62 program.

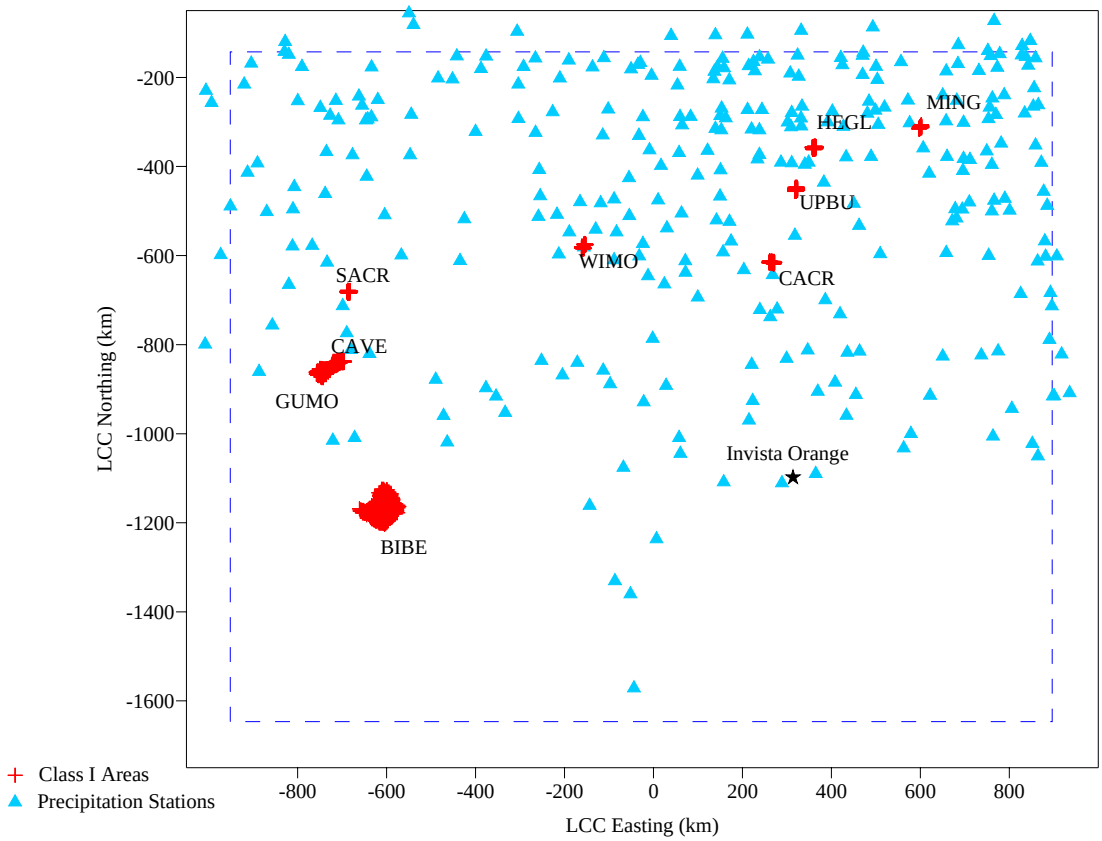
FIGURE 3-4. PLOT OF UPPER AIR STATIONS LOCATIONS



3.2.4 PRECIPITATION METEOROLOGICAL DATA

The effects of chemical transformation and deposition processes on ambient pollutant concentrations will be considered in this analysis. Therefore, it is necessary to include observations of precipitation in the CALMET analysis. The precipitation stations from which Trinity will extract data are listed in Table A-3 of Appendix A. The locations of the precipitation stations with respect to the modeling domain are shown in Figure 3-5. These stations were selected from the available data inventory to optimize spatial coverage and representation of the domain. Data from the stations will be processed for use in CALMET using EPA's PMERGE program.

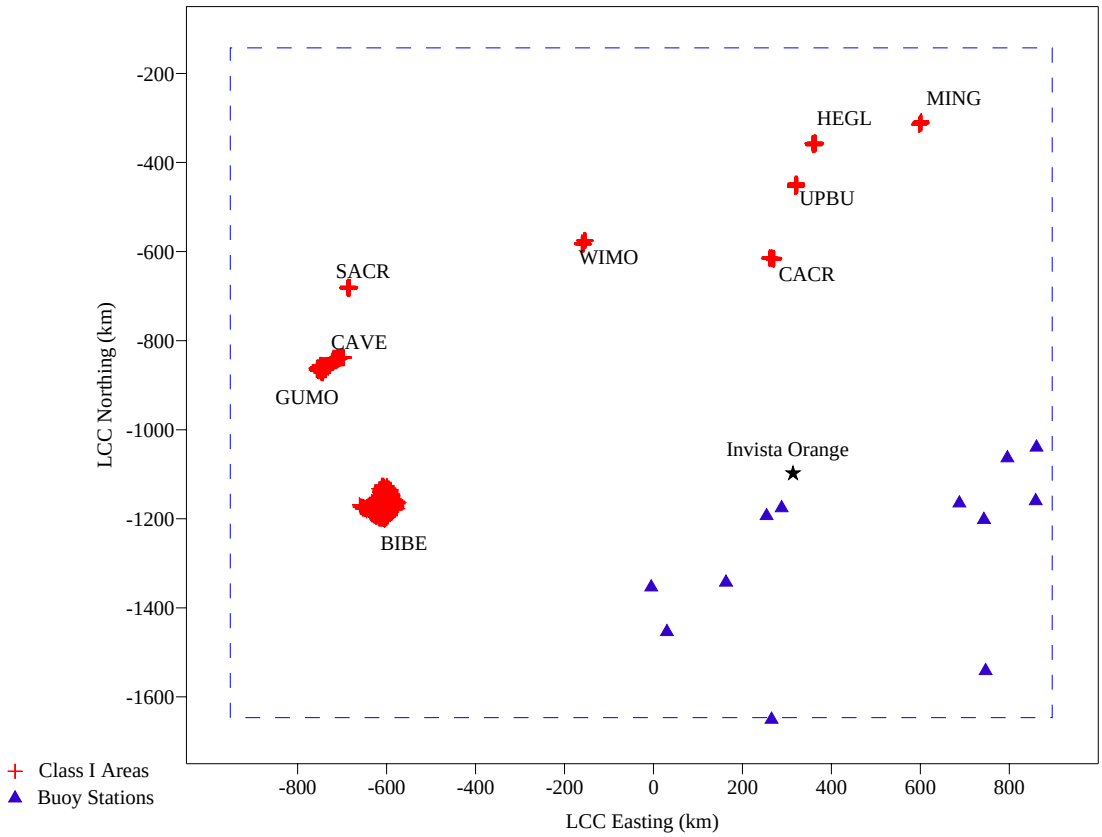
FIGURE 3-5. PLOT OF PRECIPITATION METEOROLOGICAL STATIONS



3.2.5 BUOY METEOROLOGICAL DATA

The effects of land/sea breeze on ambient pollutant concentrations will be considered in this analysis. Therefore, it is necessary to include observations of buoy stations in the CALMET analysis. The buoy stations from which Trinity will extract data are listed in Table A-4 of Appendix A. The locations of the buoy stations with respect to the modeling domain are shown in Figure 3-6. These stations were selected from the available data inventory to optimize spatial coverage and representation of the domain along the coastline. Data from the stations will be prepared by filling missing hour records with the CALMET missing parameter value (9999). No adjustments to the data will occur.

FIGURE 3-6. PLOT OF BUOY METEOROLOGICAL STATIONS



3.3 CALMET CONTROL PARAMETERS

Appendix B provides a sample CALMET input file used in INVISTA Orange's modeling analysis. A few details of the CALMET model setup for sensitive parameters are also discussed below.

3.3.1 VERTICAL METEOROLOGICAL PROFILE

The height of the top vertical layer will be set to 3,500 meters. This height corresponds to the top sounding pressure level for which upper air observation data will be relied upon. The vertical dimension of the domain will be divided into 12 layers with the maximum elevations for each layer shown in Table 3-1. The vertical dimensions are weighted towards the surface to resolve the mixing layer while using a somewhat coarser resolution for the layers aloft.

TABLE 3-1. VERTICAL LAYERS OF THE CALMET METEOROLOGICAL DOMAIN

Layer	Elevation (m)
1	20
2	40
3	60
4	80
5	100
6	150
7	200
8	250
9	500
10	1000
11	2000
12	3500

CALMET allows for a bias value to be applied to each of the vertical layers. The bias settings for each vertical layer determine the relative weight given to the vertically extrapolated surface and upper air wind and temperature observations. The initial guess fields are computed with an inverse distance weighting ($1/r^2$) of the surface and upper air data. The initial guess fields may be modified by a layer dependent bias factor. Values for the bias factor may range from -1 to +1. A bias of -1 eliminates upper-air observations in the $1/r^2$ interpolations used to initialize the vertical wind fields. Conversely, a bias of +1 eliminates the surface observations in the interpolations for this layer. Normally, bias is set to zero (0) for each vertical layer, such that the upper air and surface observations are given equal weight in the $1/r^2$ interpolations. The biases for each layer of the proposed modeling domain will be set to zero.

CALMET allows for vertical extrapolation of surface wind observations to layers aloft to be skipped if the surface station is close to the upper air station. Alternatively, CALMET allows data from all surface stations to be extrapolated. The CALMET parameter that controls this setting is IEXTRP. Setting IEXTRP to a value less than zero (0) means that layer 1 data from upper air soundings is ignored in any vertical extrapolations. IEXTRP is normally set to -4. When IEXTRP is set to -4, the similarity theory is used to extrapolate the surface winds into the layers aloft, which provides more information on observed local effects to the upper layers. Trinity will set IEXTRP to -4.

3.3.2 INFLUENCES OF OBSERVATIONS

Step 1 wind fields will be based on an initial guess using MM5 data and refined to reflect terrain affects. Step 2 wind fields will adjust the Step 1 wind field by incorporating the influence of local observations. An inverse distance method is used to determine the influence of observations to the Step 1 wind field. RMAX1 and RMAX2 define the radius of influence for data from surface stations to land in the surface layer and data from upper air stations to land in the layers aloft. In general, RMAX1 and RMAX2 are used to exclude observations from being inappropriately included in the development of the Step 2

wind field if the distance from an observation station to a grid point exceeds the maximum radius of influence.

If the distance from an observation station to a grid point is less than the value set for RMAX, the observation data will be used in the development of the Step 2 wind field. R1 represents the distance from a surface observation station at which the surface observation and the Step 1 wind field are weighted equally. R2 represents the comparable distance for winds aloft. R1 and R2 are used to weight the observation data with respect to the MM5 data that was used to generate the Step 1 wind field. Large values for R1 and R2 give more weight to the observations, where as small values give more weight to the MM5 data.

RMAX 1 will be set to 20 km, and R1 will be set to 10 km. This will limit the influence of the surface observation data from all surface stations to 20 km from each station, and will equally weight the MM5 and observation data at 10 km. RMAX2 will be set to 50 km, and R2 will be set to 25 km. This will limit the influence of the upper air observation data from all surface stations to 50 km from each station, and will equally weight the MM5 and observation data at 25 km. These radii of influence setting will allow for adequate weighting of the MM5 data and the observation data across the modeling domain due to the vast domain to be modeled. RAMX 3 will be set to 500 km.

4. CALPUFF

The CALPUFF model uses the output file from CALMET together with source, receptor, and chemical reaction information to predict hourly concentration impacts. Trinity will conduct a three-year CALPUFF analysis using data and model settings as described below.

4.1 EMISSIONS SOURCE DATA

Trinity will include emissions of SO_2, NO_x, and/or PM_{10} from the 14 BART-eligible emission units at INVISTA Orange. In lieu of actual maximum 24-hour average pound per hour (lb/hr) emission rates of NO_x, SO_2, and PM from the period of 2002 through 2005, INVISTA Orange has conservatively used the permit allowable emission rates in the BART determination refined modeling.

4.2 RECEPTOR LOCATIONS

The National Park Service (NPS) has electronic files available on their website that include the discrete locations and elevations of receptors to be evaluated in Class I area analyses. Trinity will incorporate this receptor information into the CALPUFF model.

4.3 BACKGROUND OZONE AND AMMONIA CONCENTRATIONS

Background ozone concentrations are required in order to model the photochemical conversion of SO_2 and NO_X to sulfates (SO_4) and nitrates (NO_3). CALPUFF can use either a single background value representative of an area or hourly ozone data from one or more ozone monitoring stations. Hourly ozone data files provided by the TCEQ will be used in the CALPUFF simulation. In addition, the monthly value will be set to 40 ppb. This value will only be used by the model if there are missing hourly ozone records. Background concentrations for ammonia will be assumed to be temporally and spatially invariant and will be set to 3 ppb. We do not have enough data on the origin of certain background concentration components (e.g., sea salt) to consider their overall effect on the modeling analysis and the Class I areas' background visibility.

4.4 CALPUFF MODEL CONTROL PARAMETERS

Appendix C provides a sample CALPUFF input file that Trinity will use in INVISTA Orange's modeling analysis.

Hourly concentration outputs from CALPUFF will be processed through POSTUTIL and CALPOST to determine visibility conditions. A three-year CALPOST analysis will be conducted to determine the visibility change in deciview (dv) caused by INVISTA Orange's BART-eligible sources when compared to a natural background.

5.1 POSTUTIL PROCESSING METHOD

In the postprocessing of CALPUFF-computed concentrations of visibility-affecting pollutants, the POSTUTIL postprocessing utility will be used to apply the ammonia limiting method (ALM) by re-partitioning the distribution of HNO_3 and NO_3 concentrations at each Class I area as a function of the temperature and relative humidity during each hour. A sample POSTUTIL input file is provided in Appendix D.

5.2 LIGHT EXTINCTION ALGORITHM

Trinity will utilize EPA's currently approved algorithm for reconstructing light extinction (as opposed to the new equation for reconstructing light extinction recommended by the IMPROVE Steering Committee). The light extinction equation is provided below.

$$b_{ext} = 3*f(RH)*[(NH_4)_2SO_4] + 3*f(RH)*[NH_4NO3] + 4*[OC] + 1*[PM_f] + 0.6*[PM_c] + 10*[EC] + b_{Ray}$$

The algorithm will be used to calculate the daily light extinction attributable to INVISTA Orange's BART-eligible sources and light extinction attributable to a natural background. The change in deciviews based on the source and background light extinctions will be evaluated using the equation below.

$$\Delta dv = 10*\ln\left[\frac{b_{ext,\ background} + b_{ext,\ source}}{b_{ext,\ background}}\right]$$

5.3 CALPOST PROCESSING METHOD

Trinity will use CALPOST Method 6, which calculates hourly light extinction impacts for the source and background using monthly average relative humidity adjustment factors. Trinity will use monthly Class I area-specific relative humidity adjustment factors based on the centroid of the Class I areas as included in Table A-3 of EPA's *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Program*. The factors for the Class I areas listed to be evaluated in the analysis are provided in Table 5-1.

TABLE 5-1. MONTHLY HUMIDITY FACTORS

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Big Bend	2.0	1.9	1.6	1.5	1.6	1.6	1.7	2.0	2.1	1.9	1.8	1.9
Caney Creek	3.4	3.1	2.9	3.0	3.6	3.6	3.4	3.4	3.6	3.5	3.4	3.5
Carlsbad Caverns	2.1	2.0	1.6	1.5	1.6	1.6	1.8	2.1	2.2	1.8	1.9	2.1
Guadalupe Mountains	2.0	2.0	1.6	1.5	1.6	1.5	1.9	2.2	2.2	1.8	1.9	2.2
Hercules-Glades	3.2	2.9	2.7	2.7	3.3	3.3	3.3	3.3	3.4	3.1	3.1	3.3
Mingo	3.3	3.0	2.8	2.6	3.0	3.2	3.3	3.5	3.5	3.1	3.1	3.3
Salt Creek	2.1	1.9	1.5	1.5	1.7	1.6	1.8	2.0	2.1	1.8	1.8	2.1
Upper Buffalo	3.3	3.0	2.7	2.8	3.4	3.4	3.4	3.4	3.6	3.3	3.2	3.3
Wichita Mountains	2.7	2.6	2.4	2.4	3.0	2.7	2.3	2.5	2.9	2.6	2.7	2.8

5.4 NATURAL BACKGROUND

Trinity will use EPA's default average annual aerosol concentrations for the U.S. that are included in Table 2-1 of EPA's *Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Program.* The annual average concentrations are provided in Table 5-2.

TABLE 5-2. DEFAULT AVERAGE ANNUAL NATURAL BACKGROUND LEVELS

Class I Area	Region	SO_4	NO_3	OC	EC	Soil	Coarse Mass
Big Bend	WEST	0.12	0.10	0.47	0.02	0.50	3.00
Caney Creek	EAST	0.23	0.10	1.40	0.02	0.50	3.00
Carlsbad Caverns	WEST	0.12	0.10	0.47	0.02	0.50	3.00
Guadalupe Mountains	WEST	0.12	0.10	0.47	0.02	0.50	3.00
Hercules-Glades	EAST	0.23	0.10	1.40	0.02	0.50	3.00
Mingo	EAST	0.23	0.10	1.40	0.02	0.50	3.00
Salt Creek	WEST	0.12	0.10	0.47	0.02	0.50	3.00
Upper Buffalo	EAST	0.23	0.10	1.40	0.02	0.50	3.00
Wichita Mountains	WEST	0.12	0.10	0.47	0.02	0.50	3.00

5.5 EVALUATING BART-EXEMPTION

Trinity will compare the 98th percentile of the 2001 through 2003 daily Δdv values output by CALPOST (22nd highest daily value) to a contribution threshold of 0.5 Δdv. If the 98th percentile daily Δdv values output by CALPOST is less 0.5 Δdv, it will be concluded that the source is exempt from BART and that no further analysis is necessary. If the 98th percentile of the daily Δdv values output by CALPOST is greater than 0.5 Δdv, it will be concluded that further analysis is necessary.

5.6 SUMMARY OF CALPOST CONTROL PARAMETERS

Appendix E provides a sample CALPOST input file that Trinity proposes to use in INVISTA Orange's modeling analysis.

APPENDIX A

METEOROLOGICAL STATIONS

TABLE A-1. LIST OF SURFACE METEOROLOGICAL STATIONS

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
1	KDYS	69019	-267.672	-834.095	96.9968	39.9925
2	KNPA	72222	932.565	-1020.909	97.0110	39.9908
3	KBFM	72223	857.471	-996.829	97.0101	39.9910
4	KGZH	72227	946.767	-899.515	97.0112	39.9919
5	KTCL	72228	870.843	-706.104	97.0103	39.9936
6	KNEW	53917	674.172	-1078.342	97.0080	39.9903
7	KNBG	12958	677.719	-1104.227	97.0080	39.9900
8	BVE	12884	741.996	-1153.463	97.0088	39.9896
9	KPTN	72232	550.88	-1124.295	97.0065	39.9898
10	KMEI	13865	774.911	-814.225	97.0092	39.9926
11	KPIB	72234	728.416	-915.165	97.0086	39.9917
12	KGLH	72235	557.072	-703.097	97.0066	39.9936
13	KHEZ	11111	540.777	-912.22	97.0064	39.9918
14	KMCB	11112	622.755	-949.618	97.0074	39.9914
15	KGWO	11113	640.102	-695.286	97.0076	39.9937
16	KASD	72236	692.381	-1043.261	97.0082	39.9906
17	KPOE	72239	363.294	-984.839	97.0043	39.9911
18	KBAZ	72241	-102.133	-1140.886	96.9988	39.9897
19	KGLS	72242	215.108	-1185.604	97.0025	39.9893
20	KDWH	11114	140.413	-1101.174	97.0017	39.9900
21	KIAH	12960	158.266	-1108.37	97.0019	39.9900
22	KHOU	72243	167.147	-1147.402	97.0020	39.9896
23	KEFD	12906	178.551	-1152.782	97.0021	39.9896
24	KCXO	72244	152.739	-1069.309	97.0018	39.9903
25	KCLL	11115	60.898	-1044.381	97.0007	39.9906
26	KLFK	93987	214.643	-969.355	97.0025	39.9912
27	KUTS	11116	136.056	-1026.773	97.0016	39.9907
28	KTYR	11117	150.451	-846.207	97.0018	39.9924
29	KCRS	72246	56.655	-882.642	97.0007	39.9920
30	KGGG	72247	214.572	-841.163	97.0025	39.9924
31	KGKY	11118	-9.365	-812.25	96.9999	39.9927
32	KDTN	72248	304.827	-821.713	97.0036	39.9926
33	KBAD	11119	312.743	-825.101	97.0037	39.9925
34	KMLU	11120	465.834	-816.211	97.0055	39.9926
35	KTVR	11121	561.446	-840.225	97.0066	39.9924
36	KTRL	11122	68.599	-806.417	97.0008	39.9927
37	KOCH	72249	216.81	-930.252	97.0026	39.9916
38	KBRO	12919	-44.167	-1571.387	96.9995	39.9858
39	KALI	72251	-103.012	-1363.74	96.9988	39.9877
40	KLRD	12920	-246.548	-1381.603	96.9971	39.9875
41	KSSF	72252	-143.386	-1183.35	96.9983	39.9893
42	KRKP	11123	-4.965	-1324.914	96.9999	39.9880

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
43	KCOT	11124	-219.097	-1280.964	96.9974	39.9884
44	KLBX	11125	150.245	-1207.466	97.0018	39.9891
45	KSAT	12921	-143.024	-1160.935	96.9983	39.9895
46	KHDO	12962	-211.702	-1178.172	96.9975	39.9894
47	KSKF	72253	-154.625	-1177.555	96.9982	39.9894
48	KHYI	11126	-84.156	-1122.487	96.9990	39.9899
49	KTKI	72254	38.788	-754.791	97.0005	39.9932
50	KBMQ	11127	-118.39	-1027.031	96.9986	39.9907
51	KATT	11128	-67.587	-1075.97	96.9992	39.9903
52	KSGR	11129	131.478	-1151.702	97.0016	39.9896
53	KGTU	11130	-65.624	-1033.173	96.9992	39.9907
54	KVCT	12912	6.587	-1236.788	97.0001	39.9888
55	KPSX	72255	73.878	-1253.33	97.0009	39.9887
56	KACT	13959	-22.12	-929.156	96.9997	39.9916
57	KPWG	72256	-30.147	-944.073	96.9996	39.9915
58	KILE	72257	-65.288	-988.507	96.9992	39.9911
59	KGRK	11131	-79.643	-990.173	96.9991	39.9911
60	KTPL	11132	-38.203	-981.19	96.9996	39.9911
61	KPRX	13960	143.317	-703.663	97.0017	39.9936
62	KDTO	72258	-17.018	-752.974	96.9998	39.9932
63	KAFW	11133	-29.564	-777.061	96.9997	39.9930
64	KFTW	72259	-34.302	-795.502	96.9996	39.9928
65	KMWL	11134	-99.769	-798.767	96.9988	39.9928
66	KRBD	11135	12.453	-810.467	97.0002	39.9927
67	KDRT	11136	-384.069	-1170.59	96.9955	39.9894
68	KFST	22010	-566.418	-988.838	96.9933	39.9911
69	KGDP	72261	-739.127	-873.302	96.9913	39.9921
70	KSJT	72262	-333.338	-952.54	96.9961	39.9914
71	KMRF	23034	-676.265	-1042.616	96.9920	39.9906
72	KMAF	72264	-489.668	-878.107	96.9942	39.9921
73	KINK	23023	-586.882	-890.654	96.9931	39.9920
74	KABI	72265	-252.044	-836.353	96.9970	39.9924
75	KLBB	13962	-445.006	-689.313	96.9948	39.9938
76	KATS	11137	-696.818	-763.258	96.9918	39.9931
77	KCQC	11138	-785.757	-515.724	96.9907	39.9953
78	KROW	23009	-698.822	-712.898	96.9918	39.9936
79	KSRR	72268	-789.593	-686.226	96.9907	39.9938
80	KCNM	11139	-682.79	-822.109	96.9919	39.9926
81	KALM	36870	-838.056	-752.338	96.9901	39.9932
82	KLRU	72269	-931.527	-804.112	96.9890	39.9927
83	KTCS	72271	-952.353	-695.469	96.9888	39.9937
84	KSVC	93063	-1042.03	-752.033	96.9877	39.9932
85	KDMN	72272	-1006.77	-799.231	96.9881	39.9928
86	KMSL	72323	854.846	-536.687	97.0101	39.9952
87	KPOF	72330	578.62	-336.733	97.0068	39.9970

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
88	KGTR	11140	779.065	-689.108	97.0092	39.9938
89	KTUP	93862	753.875	-600.337	97.0089	39.9946
90	KMKL	72334	727.051	-454.383	97.0086	39.9959
91	KLRF	72340	440.654	-550.661	97.0052	39.9950
92	KHKA	11141	643.365	-424.419	97.0076	39.9962
93	KHOT	72341	358.094	-604.603	97.0042	39.9945
94	KTXK	11142	278.022	-720.623	97.0033	39.9935
95	KLLQ	72342	488.655	-698.008	97.0058	39.9937
96	KMWT	72343	254.18	-599.224	97.0030	39.9946
97	KFSM	13964	237.97	-512.87	97.0028	39.9954
98	KSLG	72344	224.881	-419.064	97.0027	39.9962
99	KVBT	11143	248.074	-399.892	97.0029	39.9964
100	KHRO	11144	343.525	-405.601	97.0041	39.9963
101	KFLP	11145	404.239	-399.142	97.0048	39.9964
102	KBVX	11146	480.712	-457.853	97.0057	39.9959
103	KROG	11147	258.44	-397.685	97.0031	39.9964
104	KSPS	13966	-138.053	-664.886	96.9984	39.9940
105	KHBR	72352	-186.121	-551.123	96.9978	39.9950
106	KCSM	11148	-198.844	-513.911	96.9977	39.9954
107	KFDR	11149	-181.653	-625.205	96.9979	39.9944
108	KGOK	72353	-35.905	-458.97	96.9996	39.9959
109	KTIK	72354	-34.581	-506.938	96.9996	39.9954
110	KPWA	11150	-58.596	-493.951	96.9993	39.9955
111	KSWO	11151	-7.42	-425.828	96.9999	39.9962
112	KMKO	72355	146.972	-479.879	97.0017	39.9957
113	KRVS	72356	91.059	-438.276	97.0011	39.9960
114	KBVO	11152	87.136	-357.069	97.0010	39.9968
115	KMLC	11153	110.647	-563.566	97.0013	39.9949
116	KOUN	72357	-40.731	-527.298	96.9995	39.9952
117	KLAW	11154	-129.405	-600.222	96.9985	39.9946
118	KCDS	72360	-300.297	-610.668	96.9965	39.9945
119	KGNT	72362	-985.117	-475.563	96.9884	39.9957
120	KGUP	11155	-1059.48	-427.151	96.9875	39.9961
121	KAMA	23047	-425.319	-518.171	96.9950	39.9953
122	KBGD	72363	-395.603	-466.083	96.9953	39.9958
123	KFMN	72365	-993.449	-297.944	96.9883	39.9973
124	KSKX	72366	-770.464	-355.855	96.9909	39.9968
125	KTCC	23048	-597.271	-511.241	96.9930	39.9954
126	KLVS	23054	-732.565	-448.329	96.9914	39.9960
127	KEHR	72423	812.573	-199.695	97.0096	39.9982
128	KEVV	93817	822.929	-172.715	97.0097	39.9984
129	KMVN	72433	704.666	-154.54	97.0083	39.9986
130	KMDH	11156	676.745	-218.041	97.0080	39.9980
131	KBLV	11157	617.659	-136.018	97.0073	39.9988
132	KSUS	3966	547.898	-130.122	97.0065	39.9988

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
133	KPAH	3816	725.985	-293.319	97.0086	39.9974
134	KJEF	72445	419.01	-145.496	97.0050	39.9987
135	KAIZ	11158	387.096	-200.609	97.0046	39.9982
136	KIXD	72447	182.322	-126.913	97.0022	39.9989
137	KWLD	72450	0	-298.57	97.0000	39.9973
138	KAAO	11159	-18.976	-248.773	96.9998	39.9978
139	KIAB	11160	-23.392	-263.471	96.9997	39.9976
140	KEWK	11161	-24.645	-215.58	96.9997	39.9981
141	KGBD	72451	-161.892	-180.781	96.9981	39.9984
142	KHYS	11162	-195.191	-124.723	96.9977	39.9989
143	KCFV	11163	126.442	-319.698	97.0015	39.9971
144	KFOE	72456	114.618	-115.26	97.0014	39.9990
145	KEHA	72460	-432.761	-320.089	96.9949	39.9971
146	KALS	72462	-777.592	-245.892	96.9908	39.9978
147	KDRO	11164	-945.713	-259.163	96.9888	39.9977
148	KLHX	72463	-568.426	-195.178	96.9933	39.9982
149	KSPD	2128	-494.076	-285.176	96.9942	39.9974
150	KCOS	93037	-664.022	-102.596	96.9922	39.9991
151	KGUC	72467	-857.452	-115.301	96.9899	39.9990
152	KMTJ	93013	-940.981	-109.358	96.9889	39.9990
153	KCEZ	72476	-1020.87	-233.14	96.9880	39.9979
154	KCPS	72531	591.652	-136.14	97.0070	39.9988
155	KLWV	72534	808.939	-94.46	97.0096	39.9992
156	KPPF	74543	130.433	-293.855	97.0015	39.9973
157	KHOP	74671	841.751	-324.569	97.0099	39.9971
158	KBIX	74768	778.252	-1028.514	97.0092	39.9907
159	KPQL	11165	814.599	-1019.583	97.0096	39.9908
160	MMPG	76243	-348.007	-1248.779	96.9959	39.9887
161	MMMV	76342	-446.576	-1449.334	96.9947	39.9869
162	MMMY	76394	-316.664	-1581.176	96.9963	39.9857

TABLE A-2. LIST OF UPPER AIR METEOROLOGICAL STATIONS

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
1	KABQ	23050	-869.46	-501.713	96.9897	39.9955
2	KAMA	23047	-425.319	-518.171	96.9950	39.9953
3	KBMX	53823	951.609	-702.935	97.0112	39.9936
4	KBNA	13897	920.739	-377.164	97.0109	39.9966
5	KBRO	12919	-44.167	-1571.39	96.9995	39.9858
6	KCRP	12924	-51.535	-1360.35	96.9994	39.9877
7	KDDC	13985	-259.352	-242.681	96.9969	39.9978
8	KDRT	22010	-384.069	-1170.59	96.9955	39.9894
9	KEPZ	3020	-914.558	-852.552	96.9892	39.9923
10	KFWD	3990	-28.034	-793.745	96.9997	39.9928
11	KJAN	3940	650.105	-826.452	97.0077	39.9925
12	KLCH	3937	364.461	-1089.15	97.0043	39.9902
13	KLZK	3952	432.063	-560.441	97.0051	39.9949
14	KMAF	23023	-489.668	-878.107	96.9942	39.9921
15	KOUN	3948	-40.731	-527.298	96.9995	39.9952
16	KSHV	13957	298.869	-831.166	97.0035	39.9925
17	KSIL	53813	698.079	-1054.03	97.0082	39.9905

TABLE A-3. LIST OF PRECIPITATION METEOROLOGICAL STATIONS

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
1	ADDI	10063	906.825	-601.428	97.0107	39.9946
2	ALBE	10140	917.606	-821.64	97.0108	39.9926
3	BERR	10748	892.454	-683.388	97.0105	39.9938
4	HALE	13620	881.928	-601.878	97.0104	39.9946
5	HAMT	13645	863.663	-612.725	97.0102	39.9945
6	JACK	14193	898.014	-915.623	97.0106	39.9917
7	MBLE	15478	851.953	-1022.41	97.0101	39.9908
8	MUSC	15749	880.113	-567.484	97.0104	39.9949
9	PETE	16370	935.558	-908.259	97.0110	39.9918
10	THOM	18178	900.858	-915.326	97.0106	39.9917
11	TUSC	18385	895.631	-713.223	97.0106	39.9936
12	VERN	18517	825.585	-685.773	97.0098	39.9938
13	BEEB	30530	462.394	-532.485	97.0055	39.9952
14	BRIG	30900	318.015	-554.857	97.0038	39.9950
15	CALI	31140	419.619	-731.44	97.0050	39.9934
16	CAMD	31152	386.546	-699.659	97.0046	39.9937
17	DIER	32020	268.114	-643.184	97.0032	39.9942
18	EURE	32356	286.738	-390.862	97.0034	39.9965
19	GILB	32794	383.362	-435.625	97.0045	39.9961
20	GREE	32978	450.594	-483.201	97.0053	39.9956
21	STUT	36920	509.943	-596.328	97.0060	39.9946
22	TEXA	37048	278.022	-720.623	97.0033	39.9935
23	ALAM	50130	-749.044	-267.856	96.9912	39.9976
24	ARAP	50304	-441.903	-152.324	96.9948	39.9986
25	COCH	51713	-819.794	-148.582	96.9903	39.9987
26	CRES	51959	-828.107	-119.911	96.9902	39.9989
27	GRAN	53477	-451.781	-203.82	96.9947	39.9982
28	GUNN	53662	-829.573	-141.995	96.9902	39.9987
29	HUGO	54172	-539.364	-81.948	96.9936	39.9993
30	JOHN	54388	-483.95	-201.915	96.9943	39.9982
31	KIM	54538	-544.501	-283.337	96.9936	39.9974
32	MESA	55531	-993.391	-256.696	96.9883	39.9977
33	ORDW	56136	-549.552	-55.741	96.9935	39.9995
34	OURA	56203	-904.197	-168.246	96.9893	39.9985
35	PLEA	56591	-1005.94	-229.472	96.9881	39.9979
36	PUEB	56740	-633.961	-176.872	96.9925	39.9984
37	TYE	57320	-662.095	-242.254	96.9922	39.9978
38	SAGU	57337	-790.269	-176.061	96.9907	39.9984

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
39	SANL	57428	-726.777	-285.47	96.9914	39.9974
40	SHEP	57572	-714.046	-252.189	96.9916	39.9977
41	TELL	58204	-920.205	-215.382	96.9891	39.9981
42	TERC	58220	-708.229	-296.023	96.9916	39.9973
43	TRIN	58429	-642.489	-293.805	96.9924	39.9973
44	TRLK	58436	-646.185	-295.727	96.9924	39.9973
45	WALS	58781	-654.989	-262.821	96.9923	39.9976
46	WHIT	58997	-619.615	-250.12	96.9927	39.9977
47	ASHL	110281	684.787	-169.285	97.0081	39.9985
48	CAIR	111166	697.177	-301.436	97.0082	39.9973
49	CARM	111302	772.938	-177.782	97.0091	39.9984
50	CISN	111664	758.146	-151.446	97.0090	39.9986
51	FLOR	113109	751.801	-139.837	97.0089	39.9987
52	HARR	113879	762.044	-246.62	97.0090	39.9978
53	KASK	114629	650.464	-239.886	97.0077	39.9978
54	LAWR	114957	829.038	-128.708	97.0098	39.9988
55	MTCA	115888	827.797	-149.966	97.0098	39.9986
56	MURP	115983	682.261	-251.649	97.0081	39.9977
57	NEWT	116159	766.098	-72.902	97.0090	39.9993
58	REND	117187	731.633	-185.058	97.0086	39.9983
59	SMIT	118020	770.027	-283.638	97.0091	39.9974
60	SPAR	118147	658.275	-185.973	97.0078	39.9983
61	VAND	118781	685.449	-127.048	97.0081	39.9989
62	WEST	119193	778.655	-147.215	97.0092	39.9987
63	EVAN	122738	842.476	-172.871	97.0100	39.9984
64	NEWB	126151	855.854	-223.713	97.0101	39.9980
65	PRIN	127125	836.901	-153.449	97.0099	39.9986
66	STEN	128442	859.099	-156.613	97.0101	39.9986
67	JTML	128967	788.703	-239.572	97.0093	39.9978
68	ARLI	140326	-101.734	-271.373	96.9988	39.9976
69	BAZI	140620	-210.423	-201.758	96.9975	39.9982
70	BEAU	140637	59.762	-288.39	97.0007	39.9974
71	BONN	140957	211.236	-103.29	97.0025	39.9991
72	CALD	141233	-32.689	-330.586	96.9996	39.9970
73	CASS	141351	54.006	-217.645	97.0006	39.9980
74	CENT	141404	170.503	-206.038	97.0020	39.9981
75	CHAN	141427	150.257	-286.094	97.0018	39.9974
76	CLIN	141612	155.623	-157.682	97.0018	39.9986
77	COLL	141730	-265.465	-156.95	96.9969	39.9986
78	COLU	141740	220.541	-316.555	97.0026	39.9971

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
79	CONC	141867	58.918	-175.589	97.0007	39.9984
80	DODG	142164	-226.497	-277.655	96.9973	39.9975
81	ELKH	142432	-400.112	-321.784	96.9953	39.9971
82	ENGL	142560	-264.927	-324.066	96.9969	39.9971
83	ERIE	142582	162.669	-291.383	97.0019	39.9974
84	FALL	142686	83.491	-288.177	97.0010	39.9974
85	GALA	142938	-136.931	-176.83	96.9984	39.9984
86	GARD	142980	-304.059	-215.308	96.9964	39.9981
87	GREN	143248	64.308	-307.161	97.0008	39.9972
88	HAYS	143527	-190.307	-161.342	96.9978	39.9985
89	HEAL	143554	-292.133	-175.921	96.9966	39.9984
90	HILL	143686	214.018	-174.006	97.0025	39.9984
91	INDE	143954	139.335	-315.058	97.0016	39.9972
92	IOLA	143984	153.451	-269.438	97.0018	39.9976
93	JOHR	144104	134.784	-203.41	97.0016	39.9982
94	KANO	144178	-50.289	-181.177	96.9994	39.9984
95	KIOW	144341	-113.967	-329.843	96.9987	39.9970
96	MARI	145039	-4.343	-195.712	97.0000	39.9982
97	MELV	145210	137.104	-186.781	97.0016	39.9983
98	MILF	145306	39.504	-106.05	97.0005	39.9990
99	MOUD	145536	152.624	-318.136	97.0018	39.9971
100	OAKL	145888	-306.378	-96.814	96.9964	39.9991
101	OTTA	146128	158.639	-178.635	97.0019	39.9984
102	POMO	146498	143.864	-176.707	97.0017	39.9984
103	SALI	147160	-29.426	-166.908	96.9997	39.9985
104	SMOL	147551	-34.639	-171.31	96.9996	39.9985
105	STAN	147756	225.026	-164.85	97.0027	39.9985
106	SUBL	147922	-303.514	-292.808	96.9964	39.9974
107	TOPE	148167	139.116	-104.91	97.0016	39.9991
108	TRIB	148235	-387.855	-180.643	96.9954	39.9984
109	UNIO	148293	211.43	-272.537	97.0025	39.9975
110	WALL	148535	-376.076	-152.432	96.9956	39.9986
111	WICH	148830	-23.729	-288.579	96.9997	39.9974
112	WILS	148946	-111.502	-156.22	96.9987	39.9986
113	BENT	150611	781.608	-348.109	97.0092	39.9969
114	CALH	151227	865.268	-261.635	97.0102	39.9976
115	CLTN	151631	749.287	-365.634	97.0088	39.9967
116	HERN	153798	859.01	-352.458	97.0101	39.9968
117	MADI	155067	854.116	-265.064	97.0101	39.9976
118	PADU	156110	753.185	-293.024	97.0089	39.9974

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
119	PCTN	156580	834.464	-280.496	97.0099	39.9975
120	ALEX	160103	433.824	-959.253	97.0051	39.9913
121	BATN	160549	562.794	-1032.4	97.0066	39.9907
122	CALH	161411	436.113	-817.451	97.0052	39.9926
123	CLNT	161899	578.969	-999.986	97.0068	39.9910
124	JENA	164696	455.225	-912.366	97.0054	39.9918
125	LACM	165078	364.784	-1089.92	97.0043	39.9901
126	MIND	166244	346.708	-812.651	97.0041	39.9927
127	MONR	166314	463.225	-814.905	97.0055	39.9926
128	NATC	166582	369.451	-905.316	97.0044	39.9918
129	SHRE	168440	299.526	-831.143	97.0035	39.9925
130	WINN	169803	408.309	-884.596	97.0048	39.9920
131	BROK	221094	621.827	-914.236	97.0073	39.9917
132	CONE	221900	737.007	-823.513	97.0087	39.9926
133	JAKS	224472	650.361	-826.097	97.0077	39.9925
134	LEAK	224966	805.886	-943.78	97.0095	39.9915
135	MERI	225776	774.942	-814.558	97.0092	39.9926
136	SARD	227815	658.33	-593.661	97.0078	39.9946
137	SAUC	227840	763.399	-1005.93	97.0090	39.9909
138	TUPE	229003	753.571	-600.03	97.0089	39.9946
139	ADVA	230022	657.892	-298.102	97.0078	39.9973
140	ALEY	230088	505.348	-305.864	97.0060	39.9972
141	BOLI	230789	331.651	-291.689	97.0039	39.9974
142	CASV	231383	310.855	-392.187	97.0037	39.9965
143	CLER	231674	575.868	-302.209	97.0068	39.9973
144	CLTT	231711	307.465	-190.83	97.0036	39.9983
145	COLU	231791	421.287	-155.672	97.0050	39.9986
146	DREX	232331	228.23	-185.776	97.0027	39.9983
147	ELM	232568	257.758	-159.419	97.0030	39.9986
148	FULT	233079	470.408	-150.668	97.0056	39.9986
149	HOME	233999	619.93	-415.469	97.0073	39.9962
150	JEFF	234271	424.774	-172.095	97.0050	39.9984
151	JOPL	234315	238.245	-318.262	97.0028	39.9971
152	LEBA	234825	402.239	-276.263	97.0048	39.9975
153	LICK	234919	480.849	-280.775	97.0057	39.9975
154	LOCK	235027	302.048	-300.612	97.0036	39.9973
155	MALD	235207	659.982	-377.876	97.0078	39.9966
156	MARS	235298	332.062	-94.655	97.0039	39.9991
157	MAFD	235307	391.968	-300.033	97.0046	39.9973
158	MCES	235415	471.737	-143.942	97.0056	39.9987

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
159	MILL	235594	309.516	-311.398	97.0037	39.9972
160	MTGV	235834	426.937	-310.43	97.0050	39.9972
161	NVAD	235987	243.915	-272.715	97.0029	39.9975
162	OZRK	236460	349.133	-390.626	97.0041	39.9965
163	PDTD	236777	334.055	-265.018	97.0039	39.9976
164	POTO	236826	572.215	-251.455	97.0068	39.9977
165	ROLL	237263	484.503	-253.958	97.0057	39.9977
166	ROSE	237300	500.59	-175.393	97.0059	39.9984
167	SALE	237506	498.94	-274.122	97.0059	39.9975
168	SENE	237656	233.959	-383.703	97.0028	39.9965
169	SPRC	237967	238.112	-373.616	97.0028	39.9966
170	SPVL	237976	332.385	-309.374	97.0039	39.9972
171	STEE	238043	503.354	-205.135	97.0059	39.9981
172	STOK	238082	310.911	-279.239	97.0037	39.9975
173	SWSP	238223	324.053	-150.325	97.0038	39.9986
174	TRKD	238252	340.418	-395.428	97.0040	39.9964
175	TRUM	238466	326.883	-197.796	97.0039	39.9982
176	UNIT	238524	238.567	-154.494	97.0028	39.9986
177	VIBU	238609	519.633	-267.258	97.0061	39.9976
178	VIEN	238620	470.383	-193.872	97.0056	39.9983
179	WAPP	238700	606.68	-358.746	97.0072	39.9968
180	WASG	238746	556.425	-164.993	97.0066	39.9985
181	WEST	238880	489.373	-377.809	97.0058	39.9966
182	ALBU	290234	-869.46	-501.713	96.9897	39.9955
183	ARTE	290600	-689.529	-773.897	96.9919	39.9930
184	AUGU	290640	-973.07	-598.391	96.9885	39.9946
185	CARL	291469	-680.335	-811.474	96.9920	39.9927
186	CARR	291515	-819.836	-665.132	96.9903	39.9940
187	CLAY	291887	-547.124	-374.102	96.9935	39.9966
188	CLOV	291939	-566.973	-599.296	96.9933	39.9946
189	CUBA	292241	-890.304	-392.495	96.9895	39.9965
190	CUBE	292250	-951.142	-489.293	96.9888	39.9956
191	DEMI	292436	-1007.99	-799.087	96.9881	39.9928
192	DURA	292665	-767.148	-577.618	96.9909	39.9948
193	EANT	292700	-735.089	-366.94	96.9913	39.9967
194	LAVG	294862	-738.245	-461.163	96.9913	39.9958
195	PROG	297094	-811.39	-578.971	96.9904	39.9948
196	RAMO	297254	-733.737	-615.175	96.9913	39.9944
197	ROSW	297610	-698.544	-712.921	96.9918	39.9936
198	ROY	297638	-644.735	-422.422	96.9924	39.9962

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
199	SANT	298085	-807.375	-445.708	96.9905	39.9960
200	SPRI	298501	-676.681	-374.272	96.9920	39.9966
201	STAY	298518	-810.491	-495.501	96.9904	39.9955
202	TNMN	299031	-912.488	-413.425	96.9892	39.9963
203	TUCU	299156	-604.359	-508.834	96.9929	39.9954
204	WAST	299569	-638.605	-820.288	96.9925	39.9926
205	WISD	299686	-856.967	-756.366	96.9899	39.9932
206	AIRS	340179	-212.731	-597.062	96.9975	39.9946
207	ARDM	340292	-12.242	-645.633	96.9999	39.9942
208	BENG	340670	174.368	-568.011	97.0021	39.9949
209	CANE	341437	71.857	-637.935	97.0009	39.9942
210	CHRT	341544	203.233	-632.067	97.0024	39.9943
211	CHAN	341684	10.494	-475.655	97.0001	39.9957
212	CHIK	341750	-83.175	-547.26	96.9990	39.9951
213	CCTY	342334	-165	-479.536	96.9981	39.9957
214	DUNC	342654	-88.38	-610.04	96.9990	39.9945
215	ELKC	342849	-216.769	-507.879	96.9974	39.9954
216	FORT	343281	-129.964	-541.113	96.9985	39.9951
217	GEAR	343497	-118.53	-482.187	96.9986	39.9956
218	HENN	344052	-31.964	-601.206	96.9996	39.9946
219	HOBA	344202	-189.062	-547.36	96.9978	39.9951
220	KING	344865	24.538	-664.103	97.0003	39.9940
221	LKEU	344975	141.702	-520.6	97.0017	39.9953
222	LEHI	345108	71.634	-612.05	97.0009	39.9945
223	MACI	345463	-254.63	-466.154	96.9970	39.9958
224	MALL	345589	-55.127	-425.644	96.9994	39.9962
225	MAYF	345648	-258.49	-512.583	96.9970	39.9954
226	MUSK	346130	149.764	-466.905	97.0018	39.9958
227	NOWA	346485	121.551	-364.038	97.0014	39.9967
228	OKAR	346620	-88.424	-473.338	96.9990	39.9957
229	OKEM	346638	63.188	-504.958	97.0008	39.9954
230	OKLA	346661	-54.198	-510.562	96.9994	39.9954
231	PAOL	346859	-23.665	-573.142	96.9997	39.9948
232	PAWH	346935	57.704	-369.174	97.0007	39.9967
233	PAWN	346944	16.927	-398.139	97.0002	39.9964
234	PONC	347196	-8.871	-363.068	96.9999	39.9967
235	PRYO	347309	150.763	-407.824	97.0018	39.9963
236	SHAT	348101	-256.963	-407.368	96.9970	39.9963
237	STIG	348497	171.02	-523.736	97.0020	39.9953
238	TULS	348992	99.361	-419.873	97.0012	39.9962

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
239	TUSK	349023	156.629	-592.395	97.0019	39.9946
240	WMWR	349629	-156.42	-581.308	96.9982	39.9947
241	WOLF	349748	30.212	-538.388	97.0004	39.9951
242	BOLI	400876	760.886	-500.256	97.0090	39.9955
243	BROW	401150	710.048	-480.346	97.0084	39.9957
244	CETR	401587	877.35	-456.294	97.0104	39.9959
245	DICS	402489	872.14	-391.132	97.0103	39.9965
246	DYER	402680	695.792	-409.316	97.0082	39.9963
247	GRNF	403697	760.795	-395.69	97.0090	39.9964
248	JSNN	404561	765.932	-476.414	97.0090	39.9957
249	LWER	405089	885.291	-487.757	97.0105	39.9956
250	LEXI	405210	790.003	-471.897	97.0093	39.9957
251	MASO	405720	694.163	-496.166	97.0082	39.9955
252	MEMP	405954	671.8	-522.492	97.0079	39.9953
253	MWFO	405956	681.292	-516.15	97.0080	39.9953
254	MUNF	406358	678.65	-495.241	97.0080	39.9955
255	SAMB	408065	697.077	-382.536	97.0082	39.9965
256	SAVA	408108	800.788	-498.682	97.0095	39.9955
257	UNCY	409219	711.595	-384.605	97.0084	39.9965
258	ABIL	410016	-251.753	-836.027	96.9970	39.9924
259	AMAR	410211	-425.302	-517.839	96.9950	39.9953
260	AUST	410428	-67.587	-1075.97	96.9992	39.9903
261	BRWN	411136	-43.861	-1571.39	96.9995	39.9858
262	COST	411889	60.611	-1044.72	97.0007	39.9906
263	COCR	412015	-51.832	-1360.01	96.9994	39.9877
264	CROS	412131	-204.599	-868.469	96.9976	39.9922
265	DFWT	412242	-1.867	-786.341	97.0000	39.9929
266	EAST	412715	-171.024	-840.253	96.9980	39.9924
267	ELPA	412797	-886.583	-860.763	96.9895	39.9922
268	HICO	414137	-97.323	-888.181	96.9989	39.9920
269	HUST	414300	157.976	-1108.38	97.0019	39.9900
270	KRES	414880	-434.746	-611.717	96.9949	39.9945
271	LKCK	414975	99.734	-693.521	97.0012	39.9937
272	LNGV	415348	220.962	-844.674	97.0026	39.9924
273	LUFK	415424	214.652	-969.69	97.0025	39.9912
274	MATH	415661	-86.438	-1330.47	96.9990	39.9880
275	MIDR	415890	-489.385	-878.123	96.9942	39.9921
276	MTLK	416104	-672.024	-1008.98	96.9921	39.9909
277	NACO	416177	223.065	-925.966	97.0026	39.9916
278	NAVA	416210	28.358	-892.028	97.0003	39.9919

Number	Station Acronym	Station ID	LCC East (km)	LCC North (km)	Long	Lat
279	NEWB	416270	239.111	-721.818	97.0028	39.9935
280	BPAT	417174	288.962	-1110.65	97.0034	39.9900
281	RANK	417431	-472.048	-959.488	96.9944	39.9913
282	SAAG	417943	-333.338	-952.54	96.9961	39.9914
283	SAAT	417945	-143.322	-1161.27	96.9983	39.9895
284	SHEF	418252	-463.759	-1019.19	96.9945	39.9908
285	STEP	418623	-112.988	-857.918	96.9987	39.9922
286	STER	418630	-376.683	-897.195	96.9956	39.9919
287	VALE	419270	-720.749	-1015.17	96.9915	39.9908
288	VICT	419364	6.882	-1236.45	97.0001	39.9888
289	WACO	419419	-21.834	-928.823	96.9997	39.9916
290	WATR	419499	-353.767	-916.015	96.9958	39.9917
291	WHEE	419665	57.489	-1008.99	97.0007	39.9909
292	WPDM	419916	262.792	-737.786	97.0031	39.9933
293	DORA	232302	433.256	-378.797	97.0051	39.9966
294	DIXN	112353	756.057	-267.193	97.0089	39.9976
295	DAUP	12172	864.408	-1050.41	97.0102	39.9905
296	FREV	123104	847.031	-117.884	97.0100	39.9989
297	WARR	18673	890.447	-788.703	97.0105	39.9929
298	MDTN	235562	493.264	-87.222	97.0058	39.9992

TABLE A-4. LIST OF OVER WATER METEOROLOGICAL STATIONS

Number	Station ID	Input file Name	LCC East (km)	LCC North (km)	Long	Lat
1	42001	42001	746.874	-1541.35	89.67	25.9
2	42002	42002	265.486	-1650.616	94.42	25.19
3	42007	42007	795.674	-1063.667	88.77	30.09
4	42019	42019	163.178	-1342.917	95.36	27.91
5	42020	42020	30.212	-1453.738	96.7	26.94
6	42035	42035	254.465	-1193.539	94.41	29.25
7	42040	42040	859.497	-1160.066	88.21	29.18
8	BURL1	42045	743.116	-1202.117	89.43	28.9
9	DPIA1	42046	861.385	-1039.466	88.07	30.25
10	GDIL1	42047	687.984	-1164.910	89.96	29.27
11	PTAT2	42048	-4.980	-1353.398	97.05	27.83
12	SRST2	42049	288.163	-1175.682	94.05	29.67

APPENDIX B

SAMPLE CALMET CONTROL FILE

```
2001 - Refined
January 1 - January 10


---------------- Run title (3 lines)
-----------------------------------------

                    CALMET MODEL CONTROL FILE
                    -------------------------

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


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT=GEO.DAT       !
SURF.DAT      input    ! SRFDAT=SURF2001.DAT      !
CLOUD.DAT     input    * CLDDAT=            *
PRECIP.DAT    input    ! PRCDAT=precip01.DAT    !
MM4.DAT       input    ! MM4DAT=W:\01CENRAPMM\extracted_2001_01a_epa_
12km.unx     !
WT.DAT        input    * WTDAT=             *

CALMET.LST    output   ! METLST=01Met01a.LST     !
CALMET.DAT    output   ! METDAT=01MET01a.MET    !
PACOUT.DAT    output   * PACDAT=            *

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

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  17
!
    Number of overwater met stations
                                 (NOWSTA) No default     ! NOWSTA = 12
!

                       !END!
-----------------------------------------------------------------------
--------
Subgroup (b)
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type       File Name
------------  ----       ---------
UP1.DAT       input     1  ! UPDAT=UPABQ01.DAT!    !END!
UP2.DAT       input     2  ! UPDAT=UPAMA01.DAT!    !END!
UP3.DAT       input     3  ! UPDAT=UPBMX01.DAT!    !END!
UP4.DAT       input     4  ! UPDAT=UPBNA01.DAT!    !END!
UP5.DAT       input     5  ! UPDAT=UPBRO01.DAT!    !END!
UP6.DAT       input     6  ! UPDAT=UPCRP01.DAT!    !END!
```

```
UP7.DAT       input     7  ! UPDAT=UPDDC01.DAT!    !END!
UP8.DAT       input     8  ! UPDAT=UPDRT01.DAT!    !END!
UP9.DAT       input     9  ! UPDAT=UPEPZ01.DAT!    !END!
UP10.DAT      input     10 ! UPDAT=UPFWD01.DAT!    !END!
UP11.DAT      input     11 ! UPDAT=UPJAN01.DAT!    !END!
UP12.DAT      input     12 ! UPDAT=UPLCH01.DAT!    !END!
UP13.DAT      input     13 ! UPDAT=UPLZK01.DAT!    !END!
UP14.DAT      input     14 ! UPDAT=UPMAF01.DAT!    !END!
UP15.DAT      input     15 ! UPDAT=UPOUN01.DAT!    !END!
UP16.DAT      input     16 ! UPDAT=UPSHV01.DAT!    !END!
UP17.DAT      input     17 ! UPDAT=UPSIL01.DAT!    !END!

---------------------------------------------------------------------------
--------
Subgroup (c)
-----------------------------------------
Overwater station files (one per station)
-----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
OW1.DAT       input     1  ! SEADAT=42001_01_sea.dat!  !END!
OW2.DAT       input     2  ! SEADAT=42002_01_sea.dat!  !END!
OW3.DAT       input     3  ! SEADAT=42007_01_sea.dat!  !END!
OW4.DAT       input     4  ! SEADAT=42019_01_sea.dat!  !END!
OW5.DAT       input     5  ! SEADAT=42020_01_sea.dat!  !END!
OW6.DAT       input     6  ! SEADAT=42035_01_sea.dat!  !END!
OW7.DAT       input     7  ! SEADAT=42040_01_sea.dat!  !END!
OW8.DAT       input     8  ! SEADAT=42045_01_sea.dat!  !END!
OW9.DAT       input     9  ! SEADAT=42046_01_sea.dat!  !END!
OW10.DAT      input     10 ! SEADAT=42047_01_sea.dat!  !END!
OW11.DAT      input     11 ! SEADAT=42048_01_sea.dat!  !END!
OW12.DAT      input     12 ! SEADAT=42049_01_sea.dat!  !END!

---------------------------------------------------------------------------
--------
Subgroup (d)
----------------
Other file names
----------------

Default Name  Type       File Name
------------  ----       ---------
DIAG.DAT      input      * DIADAT=                  *
PROG.DAT      input      * PRGDAT=                  *

TEST.PRT      output     * TSTPRT=                  *
TEST.OUT      output     * TSTOUT=                  *
TEST.KIN      output     * TSTKIN=                  *
TEST.FRD      output     * TSTFRD=                  *
TEST.SLP      output     * TSTSLP=                  *

---------------------------------------------------------------------------
--------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (d) must have ONE 'END' (surround by
           delimiters) at the end of the group
       (3) Subgroups (b) and (c) must have an 'END' (surround by
           delimiters) at the end of EACH LINE

                          !END!
```

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

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

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

     Base time zone        (IBTZ) -- No default       ! IBTZ=  6  !
        PST = 08, MST = 07
        CST = 06, EST = 05

     Length of run (hours) (IRLG) -- No default       ! IRLG=   240 !

     Run type            (IRTYPE) -- Default: 1       ! IRTYPE=  1  !

        0 = Computes wind fields only
        1 = Computes wind fields and micrometeorological variables
            (u*, w*, L, zi, etc.)
        (IRTYPE must be 1 to run CALPUFF or CALGRID)

     Compute special data fields required
     by CALGRID (i.e., 3-D fields of W wind
     components and temperature)
     in additional to regular            Default: T    ! LCALGRD = T !
     fields ? (LCALGRD)
     (LCALGRD must be T to run CALGRID)

      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
                  COMPUTATIONAL phase after SETUP

!END!

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

INPUT GROUP: 2 -- 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  = 0.000  !
     (FNORTH)                   Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN =  0   !

     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 XLAT1
and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 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-G ).  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-G     WGS-84 GRS 80 Spheroid, Global coverage (WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS
(NAD27)
     NWS-27    NWS 6370KM Radius, Sphere
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

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


     Horizontal grid definition:
     ---------------------------

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

            No. X grid cells (NX)      No default     ! NX =   462  !
            No. Y grid cells (NY)      No default     ! NY =   376  !

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

     Reference grid coordinate of
     SOUTHWEST corner of grid cell (1,1)

        X coordinate (XORIGKM)         No default     ! XORIGKM = -
951.547 !
        Y coordinate (YORIGKM)         No default     ! YORIGKM = -
1646.637 !
                                       Units: km


     Vertical grid definition:
     -------------------------

        No. of vertical layers (NZ)    No default     ! NZ =  12  !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))    No defaults
                                       Units: m
        ! ZFACE =
0.,20.,40.,60.,80.,100.,150.,200.,250.,500.,1000.,2000.,3500. !
```

```
!END!

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

INPUT GROUP: 3 -- Output Options
--------------


    DISK OUTPUT OPTION

       Save met. fields in an unformatted
       output file ?              (LSAVE)  Default: T     ! LSAVE = T !
       (F = Do not save, T = Save)

       Type of unformatted output file:
       (IFORMO)                            Default: 1    ! IFORMO =  1
!

            1 = CALPUFF/CALGRID type file (CALMET.DAT)
            2 = MESOPUFF-II type file     (PACOUT.DAT)


    LINE PRINTER OUTPUT OPTIONS:

       Print met. fields ?  (LPRINT)       Default: F     ! LPRINT = T !
       (F = Do not print, T = Print)
       (NOTE: parameters below control which
              met. variables are printed)

       Print interval
       (IPRINF) in hours                   Default: 1     ! IPRINF =  1
!
       (Meteorological fields are printed
        every  1  hours)


       Specify which layers of U, V wind component
       to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T)        Defaults: NZ*0
       ! IUVOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,
0  !
       -----------------------


       Specify which levels of the W wind component to print
       (NOTE: W defined at TOP cell face --  12  values)
       (IWOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T & LCALGRD=T)
       -----------------------------------
                                           Defaults: NZ*0
        ! IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,
0  !


       Specify which levels of the 3-D temperature field to print
       (ITOUT(NZ)) -- NOTE: NZ values must be entered
```

```
       (0=Do not print, 1=Print)
       (used only if LPRINT=T & LCALGRD=T)
       -----------------------------------
                                          Defaults: NZ*0
        ! ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,
0  !

       Specify which meteorological fields
       to print
       (used only if LPRINT=T)            Defaults: 0 (all variables)
       -----------------------


         Variable           Print ?
                         (0 = do not print,
                          1 = print)
         --------        ------------------

      !  STABILITY  =          0           ! - PGT stability class
      !  USTAR      =          0           ! - Friction velocity
      !  MONIN      =          0           ! - Monin-Obukhov length
      !  MIXHT      =          0           ! - Mixing height
      !  WSTAR      =          0           ! - Convective velocity
scale
      !  PRECIP     =          0           ! - Precipitation rate
      !  SENSHEAT   =          0           ! - Sensible heat flux
      !  CONVZI     =          0           ! - Convective mixing ht.


       Testing and debug print options for micrometeorological module

          Print input meteorological data and
          internal variables (LDB)        Default: F       ! LDB = F !
          (F = Do not print, T = print)
          (NOTE: this option produces large amounts of output)

          First time step for which debug data
          are printed (NN1)               Default: 1       ! NN1 =  1
!

          Last time step for which debug data
          are printed (NN2)               Default: 1       ! NN2 =  1
!


       Testing and debug print options for wind field module
       (all of the following print options control output to
        wind field module's output files: TEST.PRT, TEST.OUT,
        TEST.KIN, TEST.FRD, and TEST.SLP)

          Control variable for writing the test/debug
          wind fields to disk files (IOUTD)
          (0=Do not write, 1=write)       Default: 0       ! IOUTD =  0
!

          Number of levels, starting at the surface,
          to print (NZPRN2)               Default: 1       ! NZPRN2 =
0  !

          Print the INTERPOLATED wind components ?
```

```
          (IPR0) (0=no, 1=yes)             Default: 0       !  IPR0 =  0
!

          Print the TERRAIN ADJUSTED surface wind
          components ?
          (IPR1) (0=no, 1=yes)             Default: 0       !  IPR1 =  0
!

          Print the SMOOTHED wind components and
          the INITIAL DIVERGENCE fields ?
          (IPR2) (0=no, 1=yes)             Default: 0       !  IPR2 =  0
!

          Print the FINAL wind speed and direction
          fields ?
          (IPR3) (0=no, 1=yes)             Default: 0       !  IPR3 =  0
!

          Print the FINAL DIVERGENCE fields ?
          (IPR4) (0=no, 1=yes)             Default: 0       !  IPR4 =  0
!

          Print the winds after KINEMATIC effects
          are added ?
          (IPR5) (0=no, 1=yes)             Default: 0       !  IPR5 =  0
!

          Print the winds after the FROUDE NUMBER
          adjustment is made ?
          (IPR6) (0=no, 1=yes)             Default: 0       !  IPR6 =  0
!

          Print the winds after SLOPE FLOWS
          are added ?
          (IPR7) (0=no, 1=yes)             Default: 0       !  IPR7 =  0
!

          Print the FINAL wind field components ?
          (IPR8) (0=no, 1=yes)             Default: 0       !  IPR8 =  0
!

!END!


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

INPUT GROUP: 4 -- Meteorological data options
--------------

    NO OBSERVATION MODE             (NOOBS)  Default: 0     ! NOOBS =  0
!
          0 = Use surface, overwater, and upper air stations
          1 = Use surface and overwater stations (no upper air
observations)
              Use MM5 for upper air data
          2 = No surface, overwater, or upper air observations
              Use MM5 for surface, overwater, and upper air data

    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS
```

```
       Number of surface stations   (NSSTA)  No default     ! NSSTA =
162  !

       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5 precip data)
                                     (NPSTA)  No default     ! NPSTA =
298  !

    CLOUD DATA OPTIONS
       Gridded cloud fields:
                                   (ICLOUD)  Default: 0     ! ICLOUD =
0  !
       ICLOUD = 0 - Gridded clouds not used
       ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
       ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT
       ICLOUD = 3 - Gridded cloud cover from Prognostic Rel. Humidity

    FILE FORMATS

       Surface meteorological data file format
                                   (IFORMS)  Default: 2     ! IFORMS =
2  !
       (1 = unformatted (e.g., SMERGE output))
       (2 = formatted   (free-formatted user input))

       Precipitation data file format
                                   (IFORMP)  Default: 2     ! IFORMP =
2  !
       (1 = unformatted (e.g., PMERGE output))
       (2 = formatted   (free-formatted user input))

       Cloud data file format
                                   (IFORMC)  Default: 2     ! IFORMC =
1  !
       (1 = unformatted - CALMET unformatted output)
       (2 = formatted   - free-formatted CALMET output or user input)

!END!


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

INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------


    WIND FIELD MODEL OPTIONS
       Model selection variable (IWFCOD)     Default: 1      ! IWFCOD =
1  !
          0 = Objective analysis only
          1 = Diagnostic wind module

       Compute Froude number adjustment
       effects ? (IFRADJ)                    Default: 1      ! IFRADJ =
1  !
       (0 = NO, 1 = YES)

       Compute kinematic effects ? (IKINE)   Default: 0      ! IKINE  =
```

```
0  !
       (0 = NO, 1 = YES)

       Use O'Brien procedure for adjustment
       of the vertical velocity ? (IOBR)     Default: 0      ! IOBR =  0
!
       (0 = NO, 1 = YES)

       Compute slope flow effects ? (ISLOPE) Default: 1      ! ISLOPE  =
1  !
       (0 = NO, 1 = YES)

       Extrapolate surface wind observations
       to upper layers ? (IEXTRP)            Default: -4     ! IEXTRP =
-4  !
       (1 = no extrapolation is done,
        2 = power law extrapolation used,
        3 = user input multiplicative factors
            for layers 2 - NZ used (see FEXTRP array)
        4 = similarity theory used
        -1, -2, -3, -4 = same as above except layer 1 data
            at upper air stations are ignored

       Extrapolate surface winds even
       if calm? (ICALM)                      Default: 0      ! ICALM  =
0  !
       (0 = NO, 1 = YES)

       Layer-dependent biases modifying the weights of
       surface and upper air stations (BIAS(NZ))
         -1<=BIAS<=1
       Negative BIAS reduces the weight of upper air stations
         (e.g. BIAS=-0.1 reduces the weight of upper air stations
       by 10%; BIAS= -1, reduces their weight by 100 %)
       Positive BIAS reduces the weight of surface stations
         (e.g. BIAS= 0.2 reduces the weight of surface stations
       by 20%; BIAS=1 reduces their weight by 100%)
       Zero BIAS leaves weights unchanged (1/R**2 interpolation)
       Default: NZ*0
                                ! BIAS =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0
,  0 ,  0 ,  0 ,  0 ,  0  !

       Minimum distance from nearest upper air station
       to surface station for which extrapolation
       of surface winds at surface station will be allowed
       (RMIN2: Set to -1 for IEXTRP = 4 or other situations
        where all surface stations should be extrapolated)
                                              Default: 4.    ! RMIN2 = -
1.0 !

       Use gridded prognostic wind field model
       output fields as input to the diagnostic
       wind field model (IPROG)              Default: 0      ! IPROG =
14  !
       (0 = No, [IWFCOD = 0 or 1]
        1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
        2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD =
1]
        3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD =
0]
```

```
        4 = Yes, use winds from MM4.DAT file as initial guess field
[IWFCOD = 1]
        5 = Yes, use winds from MM4.DAT file as observations [IWFCOD =
1]
        13 = Yes, use winds from MM5.DAT file as Step 1 field [IWFCOD =
0]
        14 = Yes, use winds from MM5.DAT file as initial guess field
[IWFCOD = 1]
        15 = Yes, use winds from MM5.DAT file as observations [IWFCOD =
1]

       Timestep (hours) of the prognostic
       model input data   (ISTEPPG)          Default: 1      ! ISTEPPG =
1   !

    RADIUS OF INFLUENCE PARAMETERS

       Use varying radius of influence       Default: F      ! LVARY =
T!
       (if no stations are found within RMAX1,RMAX2,
        or RMAX3, then the closest station will be used)

       Maximum radius of influence over land
       in the surface layer (RMAX1)          No default      ! RMAX1 =
20. !
                                             Units: km
       Maximum radius of influence over land
       aloft (RMAX2)                         No default      ! RMAX2 =
50. !
                                             Units: km
       Maximum radius of influence over water
       (RMAX3)                               No default      ! RMAX3 =
500. !
                                             Units: km


    OTHER WIND FIELD INPUT PARAMETERS

       Minimum radius of influence used in
       the wind field interpolation (RMIN)   Default: 0.1    ! RMIN =
0.1 !
                                             Units: km
       Radius of influence of terrain
       features (TERRAD)                     No default      ! TERRAD =
10. !

                                             Units: km
       Relative weighting of the first
       guess field and observations in the
       SURFACE layer (R1)                    No default      ! R1 = 10.
!
       (R1 is the distance from an           Units: km
       observational station at which the
       observation and first guess field are
       equally weighted)

       Relative weighting of the first
       guess field and observations in the
       layers ALOFT (R2)                     No default      ! R2 = 25.
!
```

```
       (R2 is applied in the upper layers    Units: km
       in the same manner as R1 is used in
       the surface layer).

       Relative weighting parameter of the
       prognostic wind field data (RPROG)    No default      ! RPROG =
54. !
       (Used only if IPROG = 1)              Units: km
       ------------------------

       Maximum acceptable divergence in the
       divergence minimization procedure
       (DIVLIM)                              Default: 5.E-6  ! DIVLIM=
5.0E-06 !

       Maximum number of iterations in the
       divergence min. procedure (NITER)     Default: 50     ! NITER =
50  !

       Number of passes in the smoothing
       procedure (NSMTH(NZ))
       NOTE: NZ values must be entered
            Default: 2,(mxnz-1)*4 ! NSMTH =
 2 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4  !

       Maximum number of stations used in
       each layer for the interpolation of
       data to a grid point (NINTR2(NZ))
       NOTE: NZ values must be entered       Default: 99.    ! NINTR2 =
 99 ,  99 ,  99 ,  99 ,  99 ,  99 ,  99 ,  99 ,  99 ,  99 ,  99 ,  99  !

       Critical Froude number (CRITFN)       Default: 1.0    ! CRITFN =
1. !

       Empirical factor controlling the
       influence of kinematic effects
       (ALPHA)                               Default: 0.1    ! ALPHA =
0.1 !

       Multiplicative scaling factor for
       extrapolation of surface observations
       to upper layers (FEXTR2(NZ))          Default: NZ*0.0
       ! FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0. !
       (Used only if IEXTRP = 3 or -3)


    BARRIER INFORMATION

       Number of barriers to interpolation
       of the wind fields (NBAR)             Default: 0      ! NBAR =  0
!

       THE FOLLOWING 4 VARIABLES ARE INCLUDED
       ONLY IF NBAR > 0
       NOTE: NBAR values must be entered     No defaults
             for each variable               Units: km

          X coordinate of BEGINNING
          of each barrier (XBBAR(NBAR))      ! XBBAR = 0. !
          Y coordinate of BEGINNING
```

```
          of each barrier (YBBAR(NBAR))      ! YBBAR = 0. !

          X coordinate of ENDING
          of each barrier (XEBAR(NBAR))      ! XEBAR = 0. !
          Y coordinate of ENDING
          of each barrier (YEBAR(NBAR))      ! YEBAR = 0. !


    DIAGNOSTIC MODULE DATA INPUT OPTIONS

       Surface temperature (IDIOPT1)         Default: 0      ! IDIOPT1 =
0  !
          0 = Compute internally from
              hourly surface observations
          1 = Read preprocessed values from
              a data file (DIAG.DAT)

          Surface met. station to use for
          the surface temperature (ISURFT)   No default     ! ISURFT =
64  !
          (Must be a value from 1 to NSSTA)
          (Used only if IDIOPT1 = 0)
          --------------------------

       Domain-averaged temperature lapse
       rate (IDIOPT2)                        Default: 0     ! IDIOPT2 =
0  !
          0 = Compute internally from
              twice-daily upper air observations
          1 = Read hourly preprocessed values
              from a data file (DIAG.DAT)

          Upper air station to use for
          the domain-scale lapse rate (IUPT) No default     ! IUPT   =
10  !
          (Must be a value from 1 to NUSTA)
          (Used only if IDIOPT2 = 0)
          --------------------------

          Depth through which the domain-scale
          lapse rate is computed (ZUPT)      Default: 200.  ! ZUPT =
200. !
          (Used only if IDIOPT2 = 0)         Units: meters
          --------------------------

       Domain-averaged wind components
       (IDIOPT3)                             Default: 0     ! IDIOPT3 =
0  !
          0 = Compute internally from
              twice-daily upper air observations
          1 = Read hourly preprocessed values
              a data file (DIAG.DAT)

          Upper air station to use for
          the domain-scale winds (IUPWND)    Default: -1    ! IUPWND = -
1  !
          (Must be a value from -1 to NUSTA)
          (Used only if IDIOPT3 = 0)
          --------------------------
```

```
          Bottom and top of layer through
          which the domain-scale winds
          are computed
          (ZUPWND(1), ZUPWND(2))        Defaults: 1., 1000. ! ZUPWND=
1., 2000. !
          (Used only if IDIOPT3 = 0)    Units: meters
          --------------------------

       Observed surface wind components
       for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 =  0  !
          0 = Read WS, WD from a surface
              data file (SURF.DAT)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       Observed upper air wind components
       for wind field module (IDIOPT5)  Default: 0     ! IDIOPT5 =  0  !
          0 = Read WS, WD from an upper
              air data file (UP1.DAT, UP2.DAT, etc.)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       LAKE BREEZE INFORMATION

          Use Lake Breeze Module  (LLBREZE)
                                          Default: F      ! LLBREZE = F
!

           Number of lake breeze regions (NBOX)            ! NBOX =  0
!

        X Grid line 1 defining the region of interest
                                                          ! XG1 = 0. !
        X Grid line 2 defining the region of interest
                                                          ! XG2 = 0. !
        Y Grid line 1 defining the region of interest
                                                          ! YG1 = 0. !
        Y Grid line 2 defining the region of interest
                                                          ! YG2 = 0. !

         X Point defining the coastline (Straight line)
                   (XBCST)  (KM)   Default: none    ! XBCST = 0. !

         Y Point defining the coastline (Straight line)
                   (YBCST)  (KM)   Default: none    ! YBCST = 0. !

         X Point defining the coastline (Straight line)
                   (XECST)  (KM)   Default: none    ! XECST = 0. !

         Y Point defining the coastline (Straight line)
                   (YECST)  (KM)   Default: none    ! YECST = 0. !


       Number of stations in the region     Default: none ! NLB =  0 !
       (Surface stations + upper air stations)

       Station ID's  in the region   (METBXID(NLB))
       (Surface stations first, then upper air stations)
         ! METBXID =  0 !
```

```
!END!

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

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation
Parameters
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                              Default: 1.41   ! CONSTB =
1.41 !
       Convective mixing ht. equation
       (CONSTE)                              Default: 0.15   ! CONSTE =
0.15 !
       Stable mixing ht. equation
       (CONSTN)                              Default: 2400.  ! CONSTN =
2400.!
       Overwater mixing ht. equation
       (CONSTW)                              Default: 0.16   ! CONSTW =
0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)                   Default: 1.E-4  ! FCORIOL =
1.0E-04!
                                             Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)               Default: 1      ! IAVEZI =
1  !

       Max. search radius in averaging
       process (MNMDAV)                      Default: 1      ! MNMDAV =
1  !
                                             Units: Grid
                                                    cells
       Half-angle of upwind looking cone
       for averaging (HAFANG)                Default: 30.    ! HAFANG =
30. !
                                             Units: deg.
       Layer of winds used in upwind
       averaging (ILEVZI)                    Default: 1      ! ILEVZI =
1  !
       (must be between 1 and NZ)

    OTHER MIXING HEIGHT VARIABLES

       Minimum potential temperature lapse
       rate in the stable layer above the
       current convective mixing ht.         Default: 0.001  ! DPTMIN =
0.001 !
       (DPTMIN)                              Units: deg. K/m
       Depth of layer above current conv.
       mixing height through which lapse     Default: 200.   ! DZZI =
200. !
       rate is computed (DZZI)               Units: meters
```

```
       Minimum overland mixing height        Default:  50.   ! ZIMIN =
20. !
       (ZIMIN)                               Units: meters
       Maximum overland mixing height        Default: 3000.  ! ZIMAX =
3500. !
       (ZIMAX)                               Units: meters
       Minimum overwater mixing height       Default:   50.  ! ZIMINW =
20. !
       (ZIMINW) -- (Not used if observed     Units: meters
       overwater mixing hts. are used)
       Maximum overwater mixing height       Default: 3000.  ! ZIMAXW =
3500. !
       (ZIMAXW) -- (Not used if observed     Units: meters
       overwater mixing hts. are used)


    TEMPERATURE PARAMETERS

       3D temperature from observations or
       from prognostic data? (ITPROG)        Default:0         !ITPROG =
0   !

          0 = Use Surface and upper air stations
              (only if NOOBS = 0)
          1 = Use Surface stations (no upper air observations)
              Use MM5 for upper air data
              (only if NOOBS = 0,1)
          2 = No surface or upper air observations
              Use MM5 for surface and upper air data
              (only if NOOBS = 0,1,2)

       Interpolation type
       (1 = 1/R ; 2 = 1/R**2)                Default:1         ! IRAD =
1  !

       Radius of influence for temperature
       interpolation (TRADKM)                Default: 500.     ! TRADKM
= 500. !
                                             Units: km

       Maximum Number of stations to include
       in temperature interpolation (NUMTS)  Default: 5        ! NUMTS =
5  !

       Conduct spatial averaging of temp-
       eratures (IAVET)  (0=no, 1=yes)         Default: 1     ! IAVET =
1  !
       (will use mixing ht MNMDAV,HAFANG
        so make sure they are correct)

       Default temperature gradient        Default: -.0098 ! TGDEFB = -
0.0098 !
       below the mixing height over
       water (K/m) (TGDEFB)

       Default temperature gradient        Default: -.0045 ! TGDEFA = -
0.0045 !
       above the mixing height over
       water (K/m) (TGDEFA)
```

```
       Beginning (JWAT1) and ending (JWAT2)
       land use categories for temperature                    ! JWAT1 =
55  !
       interpolation over water -- Make                       ! JWAT2 =
55  !
       bigger than largest land use to disable

   PRECIP INTERPOLATION PARAMETERS

       Method of interpolation (NFLAGP)      Default = 2    ! NFLAGP =
2  !
        (1=1/R,2=1/R**2,3=EXP/R**2)
       Radius of Influence (km) (SIGMAP)     Default = 100.0  ! SIGMAP =
100. !
        (0.0 => use half dist. btwn
         nearest stns w & w/out
         precip when NFLAGP = 3)
       Minimum Precip. Rate Cutoff (mm/hr)   Default = 0.01  ! CUTP =
0.01 !
        (values < CUTP = 0.0 mm/hr)
!END!


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

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------

     SURFACE STATION VARIABLES
     (One record per station --  15  records in all)


             1     2
         Name   ID            X coord.   Y coord.   Time   Anem.
                               (km)       (km)      zone   Ht.(m)
       ---------------------------------------------------------
! SS1  ='KDYS'   69019       -267.672    -834.095    7     4     !
! SS2  ='KNPA'   72222       932.565     -1020.909   6     10    !
! SS3  ='KBFM'   72223       857.471     -996.829    6     10    !
! SS4  ='KGZH'   72227       946.767     -899.515    6     10    !
! SS5  ='KTCL'   72228       870.843     -706.104    6     10    !
! SS6  ='KNEW'   53917       674.172     -1078.342   6     8     !
! SS7  ='KNBG'   12958       677.719     -1104.227   6     10    !
! SS8  ='BVE '   12884       741.996     -1153.463   6     10    !
! SS9  ='KPTN'   72232       550.88      -1124.295   6     10    !
! SS10 ='KMEI'   13865       774.911     -814.225    6     10    !
! SS11 ='KPIB'   72234       728.416     -915.165    6     10    !
! SS12 ='KGLH'   72235       557.072     -703.097    6     6     !
! SS13 ='KHEZ'   11111       540.777     -912.22     6     10    !
! SS14 ='KMCB'   11112       622.755     -949.618    6     10    !
! SS15 ='KGWO'   11113       640.102     -695.286    6     10    !
! SS16 ='KASD'   72236       692.381     -1043.261   6     10    !
! SS17 ='KPOE'   72239       363.294     -984.839    6     4     !
! SS18 ='KBAZ'   72241       -102.133    -1140.886   7     10    !
! SS19 ='KGLS'   72242       215.108     -1185.604   6     8     !
! SS20 ='KDWH'   11114       140.413     -1101.174   6     10    !
! SS21 ='KIAH'   12960       158.266     -1108.37    6     10    !
! SS22 ='KHOU'   72243       167.147     -1147.402   6     10    !
```

```
! SS23 ='KEFD'   12906       178.551     -1152.782   6     4     !
! SS24 ='KCXO'   72244       152.739     -1069.309   6     10    !
! SS25 ='KCLL'   11115       60.898      -1044.381   6     8     !
! SS26 ='KLFK'   93987       214.643     -969.355    6     8     !
! SS27 ='KUTS'   11116       136.056     -1026.773   6     10    !
! SS28 ='KTYR'   11117       150.451     -846.207    6     10    !
! SS29 ='KCRS'   72246       56.655      -882.642    6     10    !
! SS30 ='KGGG'   72247       214.572     -841.163    6     10    !
! SS31 ='KGKY'   11118       -9.365      -812.25     6     10    !
! SS32 ='KDTN'   72248       304.827     -821.713    6     10    !
! SS33 ='KBAD'   11119       312.743     -825.101    6     4     !
! SS34 ='KMLU'   11120       465.834     -816.211    6     10    !
! SS35 ='KTVR'   11121       561.446     -840.225    6     10    !
! SS36 ='KTRL'   11122       68.599      -806.417    6     10    !
! SS37 ='KOCH'   72249       216.81      -930.252    6     10    !
! SS38 ='KBRO'   12919       -44.167     -1571.387   6     10    !
! SS39 ='KALI'   72251       -103.012    -1363.74    7     10    !
! SS40 ='KLRD'   12920       -246.548    -1381.603   7     5     !
! SS41 ='KSSF'   72252       -143.386    -1183.35    7     10    !
! SS42 ='KRKP'   11123       -4.965      -1324.914   6     10    !
! SS43 ='KCOT'   11124       -219.097    -1280.964   7     10    !
! SS44 ='KLBX'   11125       150.245     -1207.466   6     10    !
! SS45 ='KSAT'   12921       -143.024    -1160.935   7     10    !
! SS46 ='KHDO'   12962       -211.702    -1178.172   7     10    !
! SS47 ='KSKF'   72253       -154.625    -1177.555   7     4     !
! SS48 ='KHYI'   11126       -84.156     -1122.487   7     10    !
! SS49 ='KTKI'   72254       38.788      -754.791    6     10    !
! SS50 ='KBMQ'   11127       -118.39     -1027.031   7     10    !
! SS51 ='KATT'   11128       -67.587     -1075.97    7     10    !
! SS52 ='KSGR'   11129       131.478     -1151.702   6     10    !
! SS53 ='KGTU'   11130       -65.624     -1033.173   7     10    !
! SS54 ='KVCT'   12912       6.587       -1236.788   6     10    !
! SS55 ='KPSX'   72255       73.878      -1253.33    6     10    !
! SS56 ='KACT'   13959       -22.12      -929.156    6     10    !
! SS57 ='KPWG'   72256       -30.147     -944.073    6     10    !
! SS58 ='KILE'   72257       -65.288     -988.507    7     10    !
! SS59 ='KGRK'   11131       -79.643     -990.173    7     5     !
! SS60 ='KTPL'   11132       -38.203     -981.19     6     10    !
! SS61 ='KPRX'   13960       143.317     -703.663    6     10    !
! SS62 ='KDTO'   72258       -17.018     -752.974    6     10    !
! SS63 ='KAFW'   11133       -29.564     -777.061    6     10    !
! SS64 ='KFTW'   72259       -34.302     -795.502    6     8     !
! SS65 ='KMWL'   11134       -99.769     -798.767    7     10    !
! SS66 ='KRBD'   11135       12.453      -810.467    6     10    !
! SS67 ='KDRT'   11136       -384.069    -1170.59    7     7     !
! SS68 ='KFST'   22010       -566.418    -988.838    7     10    !
! SS69 ='KGDP'   72261       -739.127    -873.302    7     10    !
! SS70 ='KSJT'   72262       -333.338    -952.54     7     10    !
! SS71 ='KMRF'   23034       -676.265    -1042.616   7     10    !
! SS72 ='KMAF'   72264       -489.668    -878.107    7     8     !
! SS73 ='KINK'   23023       -586.882    -890.654    7     10    !
! SS74 ='KABI'   72265       -252.044    -836.353    7     10    !
! SS75 ='KLBB'   13962       -445.006    -689.313    7     10    !
! SS76 ='KATS'   11137       -696.818    -763.258    7     21    !
! SS77 ='KCQC'   11138       -785.757    -515.724    7     10    !
! SS78 ='KROW'   23009       -698.822    -712.898    7     8     !
! SS79 ='KSRR'   72268       -789.593    -686.226    7     11    !
! SS80 ='KCNM'   11139       -682.79     -822.109    7     10    !
! SS81 ='KALM'   36870       -838.056    -752.338    7     7     !
! SS82 ='KLRU'   72269       -931.527    -804.112    7     8     !
```

```
! SS83 ='KTCS'   72271       -952.353    -695.469    7     10    !
! SS84 ='KSVC'   93063       -1042.029   -752.033    7     10    !
! SS85 ='KDMN'   72272       -1006.77    -799.231    7     10    !
! SS86 ='KMSL'   72323       854.846     -536.687    6     10    !
! SS87 ='KPOF'   72330       578.62      -336.733    6     8     !
! SS88 ='KGTR'   11140       779.065     -689.108    6     10    !
! SS89 ='KTUP'   93862       753.875     -600.337    6     10    !
! SS90 ='KMKL'   72334       727.051     -454.383    6     10    !
! SS91 ='KLRF'   72340       440.654     -550.661    6     10    !
! SS92 ='KHKA'   11141       643.365     -424.419    6     10    !
! SS93 ='KHOT'   72341       358.094     -604.603    6     8     !
! SS94 ='KTXK'   11142       278.022     -720.623    6     8     !
! SS95 ='KLLQ'   72342       488.655     -698.008    6     10    !
! SS96 ='KMWT'   72343       254.18      -599.224    6     10    !
! SS97 ='KFSM'   13964       237.97      -512.87     6     10    !
! SS98 ='KSLG'   72344       224.881     -419.064    6     10    !
! SS99 ='KVBT'   11143       248.074     -399.892    6     10    !
! SS100='KHRO'   11144       343.525     -405.601    6     8     !
! SS101='KFLP'   11145       404.239     -399.142    6     10    !
! SS102='KBVX'   11146       480.712     -457.853    6     10    !
! SS103='KROG'   11147       258.44      -397.685    6     10    !
! SS104='KSPS'   13966       -138.053    -664.886    7     10    !
! SS105='KHBR'   72352       -186.121    -551.123    7     10    !
! SS106='KCSM'   11148       -198.844    -513.911    7     10    !
! SS107='KFDR'   11149       -181.653    -625.205    7     10    !
! SS108='KGOK'   72353       -35.905     -458.97     6     10    !
! SS109='KTIK'   72354       -34.581     -506.938    6     5     !
! SS110='KPWA'   11150       -58.596     -493.951    7     8     !
! SS111='KSWO'   11151       -7.42       -425.828    6     10    !
! SS112='KMKO'   72355       146.972     -479.879    6     10    !
! SS113='KRVS'   72356       91.059      -438.276    6     10    !
! SS114='KBVO'   11152       87.136      -357.069    6     9     !
! SS115='KMLC'   11153       110.647     -563.566    6     10    !
! SS116='KOUN'   72357       -40.731     -527.298    6     10    !
! SS117='KLAW'   11154       -129.405    -600.222    7     10    !
! SS118='KCDS'   72360       -300.297    -610.668    7     10    !
! SS119='KGNT'   72362       -985.117    -475.563    7     10    !
! SS120='KGUP'   11155       -1059.475   -427.151    7     10    !
! SS121='KAMA'   23047       -425.319    -518.171    7     10    !
! SS122='KBGD'   72363       -395.603    -466.083    7     10    !
! SS123='KFMN'   72365       -993.449    -297.944    7     10    !
! SS124='KSKX'   72366       -770.464    -355.855    7     10    !
! SS125='KTCC'   23048       -597.271    -511.241    7     10    !
! SS126='KLVS'   23054       -732.565    -448.329    7     10    !
! SS127='KEHR'   72423       812.573     -199.695    6     10    !
! SS128='KEVV'   93817       822.929     -172.715    6     10    !
! SS129='KMVN'   72433       704.666     -154.54     6     7     !
! SS130='KMDH'   11156       676.745     -218.041    6     11    !
! SS131='KBLV'   11157       617.659     -136.018    6     4     !
! SS132='KSUS'   3966        547.898     -130.122    6     10    !
! SS133='KPAH'   3816        725.985     -293.319    6     10    !
! SS134='KJEF'   72445       419.01      -145.496    6     10    !
! SS135='KAIZ'   11158       387.096     -200.609    6     10    !
! SS136='KIXD'   72447       182.322     -126.913    6     10    !
! SS137='KWLD'   72450       0           -298.57     6     10    !
! SS138='KAAO'   11159       -18.976     -248.773    6     10    !
! SS139='KIAB'   11160       -23.392     -263.471    6     10    !
! SS140='KEWK'   11161       -24.645     -215.58     6     10    !
! SS141='KGBD'   72451       -161.892    -180.781    7     11    !
! SS142='KHYS'   11162       -195.191    -124.723    7     10    !
```

```
! SS143='KCFV'   11163       126.442     -319.698    6     10    !
! SS144='KFOE'   72456       114.618     -115.26     6     10    !
! SS145='KEHA'   72460       -432.761    -320.089    7     10    !
! SS146='KALS'   72462       -777.592    -245.892    7     10    !
! SS147='KDRO'   11164       -945.713    -259.163    7     10    !
! SS148='KLHX'   72463       -568.426    -195.178    7     10    !
! SS149='KSPD'   2128        -494.076    -285.176    7     10    !
! SS150='KCOS'   93037       -664.022    -102.596    7     10    !
! SS151='KGUC'   72467       -857.452    -115.301    7     10    !
! SS152='KMTJ'   93013       -940.981    -109.358    7     10    !
! SS153='KCEZ'   72476       -1020.867   -233.14     7     10    !
! SS154='KCPS'   72531       591.652     -136.14     6     10    !
! SS155='KLWV'   72534       808.939     -94.46      6     10    !
! SS156='KPPF'   74543       130.433     -293.855    6     10    !
! SS157='KHOP'   74671       841.751     -324.569    6     3     !
! SS158='KBIX'   74768       778.252     -1028.514   6     15    !
! SS159='KPQL'   11165       814.599     -1019.583   6     10    !
! SS160='MMPG'   76243       -348.007    -1248.779   7     10    !
! SS161='MMMV'   76342       -446.576    -1449.334   7     10    !
! SS162='MMMY'   76394       -316.664    -1581.176   7     10    !
! END !



-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!


-----------------------------------------------------------------------
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INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station --  2  records in all)

             1     2
         Name    ID      X coord.   Y coord.  Time zone
                           (km)       (km)
        ---------------------------------------------
! US1  ='KABQ'   23050       -869.46     -501.713    7     !
! US2  ='KAMA'   23047       -425.319    -518.171    7     !
! US3  ='KBMX'   53823       951.609     -702.935    6     !
! US4  ='KBNA'   13897       920.739     -377.164    6     !
! US5  ='KBRO'   12919       -44.167     -1571.387   6     !
! US6  ='KCRP'   12924       -51.535     -1360.349   7     !
! US7  ='KDDC'   13985       -259.352    -242.681    7     !
! US8  ='KDRT'   22010       -384.069    -1170.59    7     !
! US9  ='KEPZ'   3020        -914.558    -852.552    7     !
! US10 ='KFWD'   3990        -28.034     -793.745    6     !
! US11 ='KJAN'   3940        650.105     -826.452    6     !
! US12 ='KLCH'   3937        364.461     -1089.145   6     !
```

```
! US13 ='KLZK'   3952        432.063     -560.441    6     !
! US14 ='KMAF'   23023       -489.668    -878.107    7     !
! US15 ='KOUN'   3948        -40.731     -527.298    6     !
! US16 ='KSHV'   13957       298.869     -831.166    6     !
! US17 ='KSIL'   53813       698.079     -1054.027   6     !
! END !

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!


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INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station --  2  records in all)
     (NOT INCLUDED IF NPSTA = 0)

            1          2
         Name   Station    X coord.  Y coord.
                  Code       (km)      (km)
         ------------------------------------
! PS1  ='ADDI'   10063       906.825     -601.428    !
! PS2  ='ALBE'   10140       917.606     -821.64     !
! PS3  ='BERR'   10748       892.454     -683.388    !
! PS4  ='HALE'   13620       881.928     -601.878    !
! PS5  ='HAMT'   13645       863.663     -612.725    !
! PS6  ='JACK'   14193       898.014     -915.623    !
! PS7  ='MBLE'   15478       851.953     -1022.414   !
! PS8  ='MUSC'   15749       880.113     -567.484    !
! PS9  ='PETE'   16370       935.558     -908.259    !
! PS10 ='THOM'   18178       900.858     -915.326    !
! PS11 ='TUSC'   18385       895.631     -713.223    !
! PS12 ='VERN'   18517       825.585     -685.773    !
! PS13 ='BEEB'   30530       462.394     -532.485    !
! PS14 ='BRIG'   30900       318.015     -554.857    !
! PS15 ='CALI'   31140       419.619     -731.44     !
! PS16 ='CAMD'   31152       386.546     -699.659    !
! PS17 ='DIER'   32020       268.114     -643.184    !
! PS18 ='EURE'   32356       286.738     -390.862    !
! PS19 ='GILB'   32794       383.362     -435.625    !
! PS20 ='GREE'   32978       450.594     -483.201    !
! PS21 ='STUT'   36920       509.943     -596.328    !
! PS22 ='TEXA'   37048       278.022     -720.623    !
! PS23 ='ALAM'   50130       -749.044    -267.856    !
! PS24 ='ARAP'   50304       -441.903    -152.324    !
! PS25 ='COCH'   51713       -819.794    -148.582    !
! PS26 ='CRES'   51959       -828.107    -119.911    !
! PS27 ='GRAN'   53477       -451.781    -203.82     !
! PS28 ='GUNN'   53662       -829.573    -141.995    !
```

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! PS29 ='HUGO'   54172       -539.364    -81.948     !
! PS30 ='JOHN'   54388       -483.95     -201.915    !
! PS31 ='KIM '   54538       -544.501    -283.337    !
! PS32 ='MESA'   55531       -993.391    -256.696    !
! PS33 ='ORDW'   56136       -549.552    -55.741     !
! PS34 ='OURA'   56203       -904.197    -168.246    !
! PS35 ='PLEA'   56591       -1005.943   -229.472    !
! PS36 ='PUEB'   56740       -633.961    -176.872    !
! PS37 ='TYE '   57320       -662.095    -242.254    !
! PS38 ='SAGU'   57337       -790.269    -176.061    !
! PS39 ='SANL'   57428       -726.777    -285.47     !
! PS40 ='SHEP'   57572       -714.046    -252.189    !
! PS41 ='TELL'   58204       -920.205    -215.382    !
! PS42 ='TERC'   58220       -708.229    -296.023    !
! PS43 ='TRIN'   58429       -642.489    -293.805    !
! PS44 ='TRLK'   58436       -646.185    -295.727    !
! PS45 ='WALS'   58781       -654.989    -262.821    !
! PS46 ='WHIT'   58997       -619.615    -250.12     !
! PS47 ='ASHL'   110281      684.787     -169.285    !
! PS48 ='CAIR'   111166      697.177     -301.436    !
! PS49 ='CARM'   111302      772.938     -177.782    !
! PS50 ='CISN'   111664      758.146     -151.446    !
! PS51 ='FLOR'   113109      751.801     -139.837    !
! PS52 ='HARR'   113879      762.044     -246.62     !
! PS53 ='KASK'   114629      650.464     -239.886    !
! PS54 ='LAWR'   114957      829.038     -128.708    !
! PS55 ='MTCA'   115888      827.797     -149.966    !
! PS56 ='MURP'   115983      682.261     -251.649    !
! PS57 ='NEWT'   116159      766.098     -72.902     !
! PS58 ='REND'   117187      731.633     -185.058    !
! PS59 ='SMIT'   118020      770.027     -283.638    !
! PS60 ='SPAR'   118147      658.275     -185.973    !
! PS61 ='VAND'   118781      685.449     -127.048    !
! PS62 ='WEST'   119193      778.655     -147.215    !
! PS63 ='EVAN'   122738      842.476     -172.871    !
! PS64 ='NEWB'   126151      855.854     -223.713    !
! PS65 ='PRIN'   127125      836.901     -153.449    !
! PS66 ='STEN'   128442      859.099     -156.613    !
! PS67 ='JTML'   128967      788.703     -239.572    !
! PS68 ='ARLI'   140326      -101.734    -271.373    !
! PS69 ='BAZI'   140620      -210.423    -201.758    !
! PS70 ='BEAU'   140637      59.762      -288.39     !
! PS71 ='BONN'   140957      211.236     -103.29     !
! PS72 ='CALD'   141233      -32.689     -330.586    !
! PS73 ='CASS'   141351      54.006      -217.645    !
! PS74 ='CENT'   141404      170.503     -206.038    !
! PS75 ='CHAN'   141427      150.257     -286.094    !
! PS76 ='CLIN'   141612      155.623     -157.682    !
! PS77 ='COLL'   141730      -265.465    -156.95     !
! PS78 ='COLU'   141740      220.541     -316.555    !
! PS79 ='CONC'   141867      58.918      -175.589    !
! PS80 ='DODG'   142164      -226.497    -277.655    !
! PS81 ='ELKH'   142432      -400.112    -321.784    !
! PS82 ='ENGL'   142560      -264.927    -324.066    !
! PS83 ='ERIE'   142582      162.669     -291.383    !
! PS84 ='FALL'   142686      83.491      -288.177    !
! PS85 ='GALA'   142938      -136.931    -176.83     !
! PS86 ='GARD'   142980      -304.059    -215.308    !
! PS87 ='GREN'   143248      64.308      -307.161    !
! PS88 ='HAYS'   143527      -190.307    -161.342    !
```

```
! PS89 ='HEAL'   143554      -292.133    -175.921    !
! PS90 ='HILL'   143686      214.018     -174.006    !
! PS91 ='INDE'   143954      139.335     -315.058    !
! PS92 ='IOLA'   143984      153.451     -269.438    !
! PS93 ='JOHR'   144104      134.784     -203.41     !
! PS94 ='KANO'   144178      -50.289     -181.177    !
! PS95 ='KIOW'   144341      -113.967    -329.843    !
! PS96 ='MARI'   145039      -4.343      -195.712    !
! PS97 ='MELV'   145210      137.104     -186.781    !
! PS98 ='MILF'   145306      39.504      -106.05     !
! PS99 ='MOUD'   145536      152.624     -318.136    !
! PS100='OAKL'   145888      -306.378    -96.814     !
! PS101='OTTA'   146128      158.639     -178.635    !
! PS102='POMO'   146498      143.864     -176.707    !
! PS103='SALI'   147160      -29.426     -166.908    !
! PS104='SMOL'   147551      -34.639     -171.31     !
! PS105='STAN'   147756      225.026     -164.85     !
! PS106='SUBL'   147922      -303.514    -292.808    !
! PS107='TOPE'   148167      139.116     -104.91     !
! PS108='TRIB'   148235      -387.855    -180.643    !
! PS109='UNIO'   148293      211.43      -272.537    !
! PS110='WALL'   148535      -376.076    -152.432    !
! PS111='WICH'   148830      -23.729     -288.579    !
! PS112='WILS'   148946      -111.502    -156.22     !
! PS113='BENT'   150611      781.608     -348.109    !
! PS114='CALH'   151227      865.268     -261.635    !
! PS115='CLTN'   151631      749.287     -365.634    !
! PS116='HERN'   153798      859.01      -352.458    !
! PS117='MADI'   155067      854.116     -265.064    !
! PS118='PADU'   156110      753.185     -293.024    !
! PS119='PCTN'   156580      834.464     -280.496    !
! PS120='ALEX'   160103      433.824     -959.253    !
! PS121='BATN'   160549      562.794     -1032.396   !
! PS122='CALH'   161411      436.113     -817.451    !
! PS123='CLNT'   161899      578.969     -999.986    !
! PS124='JENA'   164696      455.225     -912.366    !
! PS125='LACM'   165078      364.784     -1089.915   !
! PS126='MIND'   166244      346.708     -812.651    !
! PS127='MONR'   166314      463.225     -814.905    !
! PS128='NATC'   166582      369.451     -905.316    !
! PS129='SHRE'   168440      299.526     -831.143    !
! PS130='WINN'   169803      408.309     -884.596    !
! PS131='BROK'   221094      621.827     -914.236    !
! PS132='CONE'   221900      737.007     -823.513    !
! PS133='JAKS'   224472      650.361     -826.097    !
! PS134='LEAK'   224966      805.886     -943.78     !
! PS135='MERI'   225776      774.942     -814.558    !
! PS136='SARD'   227815      658.33      -593.661    !
! PS137='SAUC'   227840      763.399     -1005.929   !
! PS138='TUPE'   229003      753.571     -600.03     !
! PS139='ADVA'   230022      657.892     -298.102    !
! PS140='ALEY'   230088      505.348     -305.864    !
! PS141='BOLI'   230789      331.651     -291.689    !
! PS142='CASV'   231383      310.855     -392.187    !
! PS143='CLER'   231674      575.868     -302.209    !
! PS144='CLTT'   231711      307.465     -190.83     !
! PS145='COLU'   231791      421.287     -155.672    !
! PS146='DREX'   232331      228.23      -185.776    !
! PS147='ELM '   232568      257.758     -159.419    !
! PS148='FULT'   233079      470.408     -150.668    !
```

```
! PS149='HOME'   233999      619.93      -415.469    !
! PS150='JEFF'   234271      424.774     -172.095    !
! PS151='JOPL'   234315      238.245     -318.262    !
! PS152='LEBA'   234825      402.239     -276.263    !
! PS153='LICK'   234919      480.849     -280.775    !
! PS154='LOCK'   235027      302.048     -300.612    !
! PS155='MALD'   235207      659.982     -377.876    !
! PS156='MARS'   235298      332.062     -94.655     !
! PS157='MAFD'   235307      391.968     -300.033    !
! PS158='MCES'   235415      471.737     -143.942    !
! PS159='MILL'   235594      309.516     -311.398    !
! PS160='MTGV'   235834      426.937     -310.43     !
! PS161='NVAD'   235987      243.915     -272.715    !
! PS162='OZRK'   236460      349.133     -390.626    !
! PS163='PDTD'   236777      334.055     -265.018    !
! PS164='POTO'   236826      572.215     -251.455    !
! PS165='ROLL'   237263      484.503     -253.958    !
! PS166='ROSE'   237300      500.59      -175.393    !
! PS167='SALE'   237506      498.94      -274.122    !
! PS168='SENE'   237656      233.959     -383.703    !
! PS169='SPRC'   237967      238.112     -373.616    !
! PS170='SPVL'   237976      332.385     -309.374    !
! PS171='STEE'   238043      503.354     -205.135    !
! PS172='STOK'   238082      310.911     -279.239    !
! PS173='SWSP'   238223      324.053     -150.325    !
! PS174='TRKD'   238252      340.418     -395.428    !
! PS175='TRUM'   238466      326.883     -197.796    !
! PS176='UNIT'   238524      238.567     -154.494    !
! PS177='VIBU'   238609      519.633     -267.258    !
! PS178='VIEN'   238620      470.383     -193.872    !
! PS179='WAPP'   238700      606.68      -358.746    !
! PS180='WASG'   238746      556.425     -164.993    !
! PS181='WEST'   238880      489.373     -377.809    !
! PS182='ALBU'   290234      -869.46     -501.713    !
! PS183='ARTE'   290600      -689.529    -773.897    !
! PS184='AUGU'   290640      -973.07     -598.391    !
! PS185='CARL'   291469      -680.335    -811.474    !
! PS186='CARR'   291515      -819.836    -665.132    !
! PS187='CLAY'   291887      -547.124    -374.102    !
! PS188='CLOV'   291939      -566.973    -599.296    !
! PS189='CUBA'   292241      -890.304    -392.495    !
! PS190='CUBE'   292250      -951.142    -489.293    !
! PS191='DEMI'   292436      -1007.985   -799.087    !
! PS192='DURA'   292665      -767.148    -577.618    !
! PS193='EANT'   292700      -735.089    -366.94     !
! PS194='LAVG'   294862      -738.245    -461.163    !
! PS195='PROG'   297094      -811.39     -578.971    !
! PS196='RAMO'   297254      -733.737    -615.175    !
! PS197='ROSW'   297610      -698.544    -712.921    !
! PS198='ROY '   297638      -644.735    -422.422    !
! PS199='SANT'   298085      -807.375    -445.708    !
! PS200='SPRI'   298501      -676.681    -374.272    !
! PS201='STAY'   298518      -810.491    -495.501    !
! PS202='TNMN'   299031      -912.488    -413.425    !
! PS203='TUCU'   299156      -604.359    -508.834    !
! PS204='WAST'   299569      -638.605    -820.288    !
! PS205='WISD'   299686      -856.967    -756.366    !
! PS206='AIRS'   340179      -212.731    -597.062    !
! PS207='ARDM'   340292      -12.242     -645.633    !
! PS208='BENG'   340670      174.368     -568.011    !
```

```
! PS209='CANE'   341437      71.857      -637.935    !
! PS210='CHRT'   341544      203.233     -632.067    !
! PS211='CHAN'   341684      10.494      -475.655    !
! PS212='CHIK'   341750      -83.175     -547.26     !
! PS213='CCTY'   342334      -165        -479.536    !
! PS214='DUNC'   342654      -88.38      -610.04     !
! PS215='ELKC'   342849      -216.769    -507.879    !
! PS216='FORT'   343281      -129.964    -541.113    !
! PS217='GEAR'   343497      -118.53     -482.187    !
! PS218='HENN'   344052      -31.964     -601.206    !
! PS219='HOBA'   344202      -189.062    -547.36     !
! PS220='KING'   344865      24.538      -664.103    !
! PS221='LKEU'   344975      141.702     -520.6      !
! PS222='LEHI'   345108      71.634      -612.05     !
! PS223='MACI'   345463      -254.63     -466.154    !
! PS224='MALL'   345589      -55.127     -425.644    !
! PS225='MAYF'   345648      -258.49     -512.583    !
! PS226='MUSK'   346130      149.764     -466.905    !
! PS227='NOWA'   346485      121.551     -364.038    !
! PS228='OKAR'   346620      -88.424     -473.338    !
! PS229='OKEM'   346638      63.188      -504.958    !
! PS230='OKLA'   346661      -54.198     -510.562    !
! PS231='PAOL'   346859      -23.665     -573.142    !
! PS232='PAWH'   346935      57.704      -369.174    !
! PS233='PAWN'   346944      16.927      -398.139    !
! PS234='PONC'   347196      -8.871      -363.068    !
! PS235='PRYO'   347309      150.763     -407.824    !
! PS236='SHAT'   348101      -256.963    -407.368    !
! PS237='STIG'   348497      171.02      -523.736    !
! PS238='TULS'   348992      99.361      -419.873    !
! PS239='TUSK'   349023      156.629     -592.395    !
! PS240='WMWR'   349629      -156.42     -581.308    !
! PS241='WOLF'   349748      30.212      -538.388    !
! PS242='BOLI'   400876      760.886     -500.256    !
! PS243='BROW'   401150      710.048     -480.346    !
! PS244='CETR'   401587      877.35      -456.294    !
! PS245='DICS'   402489      872.14      -391.132    !
! PS246='DYER'   402680      695.792     -409.316    !
! PS247='GRNF'   403697      760.795     -395.69     !
! PS248='JSNN'   404561      765.932     -476.414    !
! PS249='LWER'   405089      885.291     -487.757    !
! PS250='LEXI'   405210      790.003     -471.897    !
! PS251='MASO'   405720      694.163     -496.166    !
! PS252='MEMP'   405954      671.8       -522.492    !
! PS253='MWFO'   405956      681.292     -516.15     !
! PS254='MUNF'   406358      678.65      -495.241    !
! PS255='SAMB'   408065      697.077     -382.536    !
! PS256='SAVA'   408108      800.788     -498.682    !
! PS257='UNCY'   409219      711.595     -384.605    !
! PS258='ABIL'   410016      -251.753    -836.027    !
! PS259='AMAR'   410211      -425.302    -517.839    !
! PS260='AUST'   410428      -67.587     -1075.97    !
! PS261='BRWN'   411136      -43.861     -1571.389   !
! PS262='COST'   411889      60.611      -1044.719   !
! PS263='COCR'   412015      -51.832     -1360.009   !
! PS264='CROS'   412131      -204.599    -868.469    !
! PS265='DFWT'   412242      -1.867      -786.341    !
! PS266='EAST'   412715      -171.024    -840.253    !
! PS267='ELPA'   412797      -886.583    -860.763    !
! PS268='HICO'   414137      -97.323     -888.181    !
```

```
! PS269='HUST'   414300      157.976     -1108.375   !
! PS270='KRES'   414880      -434.746    -611.717    !
! PS271='LKCK'   414975      99.734      -693.521    !
! PS272='LNGV'   415348      220.962     -844.674    !
! PS273='LUFK'   415424      214.652     -969.69     !
! PS274='MATH'   415661      -86.438     -1330.466   !
! PS275='MIDR'   415890      -489.385    -878.123    !
! PS276='MTLK'   416104      -672.024    -1008.977   !
! PS277='NACO'   416177      223.065     -925.966    !
! PS278='NAVA'   416210      28.358      -892.028    !
! PS279='NEWB'   416270      239.111     -721.818    !
! PS280='BPAT'   417174      288.962     -1110.65    !
! PS281='RANK'   417431      -472.048    -959.488    !
! PS282='SAAG'   417943      -333.338    -952.54     !
! PS283='SAAT'   417945      -143.322    -1161.267   !
! PS284='SHEF'   418252      -463.759    -1019.194   !
! PS285='STEP'   418623      -112.988    -857.918    !
! PS286='STER'   418630      -376.683    -897.195    !
! PS287='VALE'   419270      -720.749    -1015.17    !
! PS288='VICT'   419364      6.882       -1236.451   !
! PS289='WACO'   419419      -21.834     -928.823    !
! PS290='WATR'   419499      -353.767    -916.015    !
! PS291='WHEE'   419665      57.489      -1008.992   !
! PS292='WPDM'   419916      262.792     -737.786    !
! PS293='DORA'   232302      433.256     -378.797    !
! PS294='DIXN'   112353      756.057     -267.193    !
! PS295='DAUP'   12172       864.408     -1050.408   !
! PS296='FREV'   123104      847.031     -117.884    !
! PS297='WARR'   18673       890.447     -788.703    !
! PS298='MDTN'   235562      493.264     -87.222     !
! END !

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```

APPENDIX C

SAMPLE CALPUFF CONTROL FILE

```
INVISTA Orange BART Refined Analysis
2001 (Ozone Files Included)

---------------- 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 =             *
    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 =01PFC1V.LST  !
CONC.DAT      output   ! CONDAT =01PFC1V.DAT     !
DFLX.DAT      output   * DFDAT  =             *
WFLX.DAT      output   * WFDAT  =             *

VISB.DAT      output   ! VISDAT =01PFC1V.VIS     !
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  =ozone_2001.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 =             *
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=W:\RefinedMetFiles2001\01Met01a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met01b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met01c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met02a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met02b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met02c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met03a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met03b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met03c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met04a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met04b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met04c.met
!  !END!
```

```
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met05a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met05b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met05c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met06a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met06b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met06c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met07a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met07b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met07c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met08a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met08b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met08c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met09a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met09b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met09c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met10a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met10b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met10c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met11a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met11b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met11c.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met12a.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met12b.met
!  !END!
 none         input    ! METDAT=W:\RefinedMetFiles2001\01Met12c.met
!  !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 =  0  !

Base time zone        (XBTZ) -- No default       ! XBTZ = 6.0  !
   PST = 8., MST = 7.
   CST = 6., EST = 5.

Length of run (hours) (IRLG) -- No default       ! IRLG =  8752  !

Number of chemical species (NSPEC)
                                Default: 5       ! NSPEC =  6   !

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

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)

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 0 (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)

     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)
        2 = use sigma-w measurements
            from PROFILE.DAT to compute sigma-z
            (valid for METFM = 1, 2, 3, 4)
        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)
        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.

     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


     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 =  1
!

        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


!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 =         PM10 !         !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   !
!         PM10  =         1,               1,           2,
0   !

!END!

-------------
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  = 0.000  !
     (FNORTH)                   Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN =  0   !

     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 XLAT1
```

```
and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 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-G ).  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-G     WGS-84 GRS 80 Spheroid, Global coverage (WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS
(NAD27)
     NWS-27    NWS 6370KM Radius, Sphere
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

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


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 =  462   !
            No. Y grid cells (NY)      No default     ! NY =  376   !
         No. vertical layers (NZ)      No default     ! NZ =  12   !

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

                Cell face heights
                    (ZFACE(nz+1))      No defaults
                                       Units: m
   ! ZFACE =
0.,20.,40.,60.,80.,100.,150.,200.,250.,500.,1000.,2000.,3500. !
```

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

            X coordinate (XORIGKM)     No default     ! XORIGKM = -
951.547 !
            Y coordinate (YORIGKM)     No default     ! YORIGKM = -
1646.637 !
                                      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 =  1
!
                  (1 <= IBCOMP <= NX)

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


        X index of UR corner (IECOMP)      No default     ! IECOMP =
462   !
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =
376   !
                  (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 =  1
!
         (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  1
!
         (JBCOMP <= JBSAMP <= JECOMP)


        X index of UR corner (IESAMP)      No default     ! IESAMP =
462   !
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =
376   !
         (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 =  0
!
   Wet Fluxes (IWET)                   1                   !  IWET =  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


    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported hourly?
```

```
       (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 hourly?
       (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 hours                Default: 1         ! ICFRQ =  1
!
       Dry flux print interval
       (IDFRQ) in hours                Default: 1         ! IDFRQ =  1
!
       Wet flux print interval
       (IWFRQ) in hours                Default: 1         ! IWFRQ =  1
!

       Units for Line Printer 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

       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

                  ---- CONCENTRATIONS ----   ------ DRY FLUXES ------
------ WET FLUXES ------   -- MASS FLUX --
   SPECIES
```

```
   /GROUP        PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?
PRINTED?  SAVED ON DISK?   SAVED ON DISK?
   -------       ------------------------   ------------------------
------------------------   ---------------
!          SO2 =     0,           1,           0,           0,
0,           0,           0   !
!          SO4 =     0,           1,           0,           0,
0,           0,           0   !
!          NOX =     0,           1,           0,           0,
0,           0,           0   !
!         HNO3 =     0,           1,           0,           0,
0,           0,           0   !
!          NO3 =     0,           1,           0,           0,
0,           0,           0   !
!         PM10 =     0,           1,           0,           0,
0,           0,           0   !

     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
=  1  !

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

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

!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         YRCT        ZRCT          XHH
                      (km)         (km)         (m)
                     ------        -----      ------         ----


-------------------
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     DIFFUSIVITY      ALPHA STAR      REACTIVITY
MESOPHYLL RESISTANCE     HENRY'S LAW COEFFICIENT
       NAME        (cm**2/s)
(s/cm)               (dimensionless)
      -------     -----------      ----------      ----------
--------------------     -----------------------

!          SO2 =     0.1509,         1000.,            8.,
0.,                  0.04 !
!          NOX =     0.1656,            1.,            8.,
5.,                   3.5 !
!         HNO3 =     0.1628,            1.,           18.,
0.,            0.00000008 !

!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      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                  DEVIATION
                        (microns)                 (microns)
      -------      -------------------        ------------------
!          SO4 =          0.48,                       2.   !
!          NO3 =          0.48,                       2.   !
!         PM10 =          0.48,                       2.   !
!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 =         3.0E-05,              0.0E00 !
!          SO4 =         1.0E-04,             3.0E-05 !
!         HNO3 =         6.0E-05,              0.0E00 !
!          NO3 =         1.0E-04,             3.0E-05 !
!         PM10 =         1.0E-04,             3.0E-05 !
!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 = 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00,
40.00, 40.00, 40.00, 40.00 !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
     !  BCKNH3 = 3.00, 3.00, 3.00, 3.00, 3.00, 3.00, 3.00, 3.00, 3.00,
3.00, 3.00, 3.00 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 =
.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	2	3	4	5	6	7	8	9	10	11	12
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	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   = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00,
50.00, 50.00, 50.00, 50.00 !


!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
= .01 !

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

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

        Roughness length (m) for modeling domain
        (Z0IN)                                  Default: 0.25   ! Z0IN =
.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 !

        Latitude (degrees) for met location
        (XLATIN)                                Default: -999.  ! XLATIN
= -999.0 !

        Longitude (degrees) for met location
        (XLONIN)                                Default: -999.  ! XLONIN
= -999.0 !

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

        Anemometer height (m) (Used only if METFM = 2,3)
        (ANEMHT)                                Default: 10.    ! ANEMHT
= 10.0 !

        Form of lateral turbulance data in PROFILE.DAT file
        (Used only if METFM = 4 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
= 1.0 !

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

     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
= 1.0  !

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

     Default minimum turbulence velocities
     sigma-v and sigma-w for each
     stability class (m/s)
     (SVMIN(6) and SWMIN(6))     Default SVMIN : .50,  .50,  .50,  .50,
.50,  .50
                                 Default SWMIN : .20,  .12,  .08,  .06,
.03,  .016

                               Stability Class :  A     B     C     D
E     F
                                                   ---   ---   ---   ---
---   ---
                                       ! SVMIN = 0.500, 0.500, 0.500,
0.500, 0.500, 0.500!
                                       ! SWMIN = 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, 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
= .5 !

     Maximum mixing height (m)
     (XMAXZI)                                   Default: 3000.  ! XMAXZI
= 4000.0 !

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

```
= 20.0 !

     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 =
10.0 !

     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 = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0 !

       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 (in BC segment lengths) about a receptor for
sampling
       nearest BC puff.  BC puffs are emitted with a spacing of one
segment
       length, so the search radius should be greater than 1.
       (RSAMPBC)                          Default:   4.      ! 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 =  12  !

     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)
---------------
                                        a
          POINT SOURCE: CONSTANT DATA
          ----------------------------

b          c
  Source       X         Y       Stack    Base     Stack    Exit  Exit
Bldg.  Emission
   No.     Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.
Dwash   Rates
              (km)      (km)       (m)      (m)       (m)  (m/s) (deg.
K)
  ------   ---------- ---------- ------  ------   -------- -----
-------- ----- --------
   1 ! SRCNAM = JQGM30SU ! 05COM001
   1 ! X =  314.455, -1097.73,     20,      0, 0.305,    0.305, 554,
.0,
           0,0,0.2,0,0,0!
   1 ! FMFAC = 1.0 !
   1 ! END !
   2 ! SRCNAM = JQGM30SX ! 11BLR003
   2 ! X =  314.209, -1097.849,    100,      1, 2.438,  6.096, 482.594,
.0,
           0.15,0,142.00,0,0,5.04!
   2 ! FMFAC = 1.0 !
   2 ! END !
   3 ! SRCNAM = JQGM30SY ! 11BLR004
   3 ! X =  314.189, -1097.862,    100,      0, 14.021,  6.096, 472.039,
.0,
           0.33,0,565.00,0,0,14.55!
   3 ! FMFAC = 1.0 !
   3 ! END !
   4 ! SRCNAM = JQGM30SZ ! FC10
   4 ! X =  314.745, -1097.64,     10,      1,  0.001,  0.001,    293,
.0,
           0,0,1.2,0,0,0!
   4 ! FMFAC = 1.0 !
   4 ! END !
   5 ! SRCNAM = JQGM30T0 ! PA39
   5 ! X =  313.841, -1098.232,    122,      1,      3,   44.2, 810.928,
```

```
.0,
           0,0,25,0,0,0!
   5 ! FMFAC = 1.0 !
   5 ! END !
   6 ! SRCNAM = JQGM30T1 ! PC9
   6 ! X =   314.76, -1097.595,    170,      1, 1.219, 28.651, 374.817,
.0,
           0,0,77,0,0,0!
   6 ! FMFAC = 1.0 !
   6 ! END !
   7 ! SRCNAM = JQGM30T2 ! PF40
   7 ! X =  313.952, -1098.026,     75,      1,     11,     72, 533.15,
.0,
           0,0,490,0,0,6.8!
   7 ! FMFAC = 1.0 !
   7 ! END !
   8 ! SRCNAM = JQGM30T3 ! PF41
   8 ! X =  313.944, -1098.014,     75,      1,     11,     61, 533.15,
.0,
           0,0,637,0,0,6.8!
   8 ! FMFAC = 1.0 !
   8 ! END !
   9 ! SRCNAM = JQGM30T4 ! PH2
   9 ! X =  313.864, -1098.02,    145,      1, 11.801, 65.617,   1273,
.0,
           0,0,119.84,0,0,0!
   9 ! FMFAC = 1.0 !
   9 ! END !
  10 ! SRCNAM = JQGM30T5 ! PH3
  10 ! X =  313.928, -1098.053,    180,      0, 11.447, 65.617,   1273,
.0,
           0.60,0,766.30,0,0,0.94!
  10 ! FMFAC = 1.0 !
  10 ! END !
  11 ! SRCNAM = JQGM30T6 ! PH63
  11 ! X =  313.744, -1098.188,    150,      1, 0.075, 65.617,   1273,
.0,
           0,0,0.74,0,0,0!
  11 ! FMFAC = 1.0 !
  11 ! END !
  12 ! SRCNAM = JQGM30T7 ! PH70
  12 ! X =  313.865, -1098.023,    145,      0, 7.425, 65.617,   1273,
.0,
           0,0,54.84,0,0,0!
  12 ! FMFAC = 1.0 !
  12 ! 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)

b
0. = No building downwash modeled, 1. = downwash modeled
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
a
No. Effective building height, width, length and X/Y offset (in meters)
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)
---------------
                                        a
          AREA SOURCE: CONSTANT DATA
          ----------------------------
                                                          b
Source           Effect.    Base      Initial    Emission
 No.             Height   Elevation   Sigma z     Rates
                   (m)       (m)        (m)
-------          ------    ------     --------   ---------


--------
    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)
---------------

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


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


---------------
Subgroup (14d)
---------------
                                              a
          AREA SOURCE: VARIABLE EMISSIONS DATA
          ------------------------------------

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

----

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 =   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 (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)
---------------
                                        a
           VOLUME SOURCE: CONSTANT DATA
           ------------------------------

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


--------
    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)
---------------
                                                  a
          VOLUME SOURCE: VARIABLE EMISSIONS DATA
          ----------------------------------------
```

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 =  1256
!

!END!
```

Subgroup (17b)

NON-GRIDDED (DISCRETE) RECEPTOR DATA[a]

```
                   X            Y          Ground        Height   b
Receptor       Coordinate   Coordinate    Elevation   Above Ground
  No.             (km)         (km)          (m)           (m)
--------       ----------   ----------    ---------   ------------
1            ! X =  -604.58, -1203.69,      631,        0 ! !END! BIBE
2            ! X =  -616.63, -1200.05,      623,        0 ! !END! BIBE
3            ! X =  -614.18, -1200.22,      640,        0 ! !END! BIBE
```

```
4            ! X =  -611.74, -1200.39,      623,        0 ! !END! BIBE
5            ! X =  -609.29, -1200.56,      612,        0 ! !END! BIBE
6            ! X =  -606.84, -1200.73,      626,        0 ! !END! BIBE
7            ! X =  -604.39, -1200.89,      676,        0 ! !END! BIBE
8            ! X =  -601.94, -1201.06,     1014,        0 ! !END! BIBE
9            ! X =  -623.78, -1196.74,      638,        0 ! !END! BIBE
10           ! X =  -618.89, -1197.09,      640,        0 ! !END! BIBE
11           ! X =  -616.44, -1197.26,      641,        0 ! !END! BIBE
12           ! X =  -613.99, -1197.42,      641,        0 ! !END! BIBE
13           ! X =  -611.54, -1197.59,      635,        0 ! !END! BIBE
14           ! X =  -609.10, -1197.76,      640,        0 ! !END! BIBE
15           ! X =  -606.65, -1197.93,      647,        0 ! !END! BIBE
16           ! X =  -604.20, -1198.10,      912,        0 ! !END! BIBE
17           ! X =  -601.75, -1198.26,      912,        0 ! !END! BIBE
18           ! X =  -599.31, -1198.43,      624,        0 ! !END! BIBE
19           ! X =  -628.48, -1193.60,      658,        0 ! !END! BIBE
20           ! X =  -626.03, -1193.77,      668,        0 ! !END! BIBE
21           ! X =  -623.58, -1193.95,      666,        0 ! !END! BIBE
22           ! X =  -621.14, -1194.12,      640,        0 ! !END! BIBE
23           ! X =  -618.69, -1194.29,      671,        0 ! !END! BIBE
24           ! X =  -616.24, -1194.46,      679,        0 ! !END! BIBE
25           ! X =  -613.80, -1194.63,      659,        0 ! !END! BIBE
26           ! X =  -611.35, -1194.79,      671,        0 ! !END! BIBE
27           ! X =  -608.91, -1194.96,      658,        0 ! !END! BIBE
28           ! X =  -606.46, -1195.13,      689,        0 ! !END! BIBE
29           ! X =  -604.01, -1195.30,      920,        0 ! !END! BIBE
30           ! X =  -601.57, -1195.46,      701,        0 ! !END! BIBE
31           ! X =  -599.12, -1195.63,      610,        0 ! !END! BIBE
32           ! X =  -596.67, -1195.79,      567,        0 ! !END! BIBE
33           ! X =  -633.17, -1190.46,      670,        0 ! !END! BIBE
34           ! X =  -630.72, -1190.63,      703,        0 ! !END! BIBE
35           ! X =  -628.28, -1190.80,      732,        0 ! !END! BIBE
36           ! X =  -625.83, -1190.98,      715,        0 ! !END! BIBE
37           ! X =  -623.39, -1191.15,      698,        0 ! !END! BIBE
38           ! X =  -620.94, -1191.32,      701,        0 ! !END! BIBE
39           ! X =  -618.50, -1191.49,      732,        0 ! !END! BIBE
40           ! X =  -616.05, -1191.66,      731,        0 ! !END! BIBE
41           ! X =  -613.60, -1191.83,      709,        0 ! !END! BIBE
42           ! X =  -611.16, -1192.00,      708,        0 ! !END! BIBE
43           ! X =  -608.71, -1192.16,      697,        0 ! !END! BIBE
44           ! X =  -606.27, -1192.33,      727,        0 ! !END! BIBE
45           ! X =  -603.82, -1192.50,      664,        0 ! !END! BIBE
46           ! X =  -601.38, -1192.66,      619,        0 ! !END! BIBE
47           ! X =  -598.93, -1192.83,      610,        0 ! !END! BIBE
48           ! X =  -596.48, -1192.99,      627,        0 ! !END! BIBE
49           ! X =  -635.41, -1187.48,      640,        0 ! !END! BIBE
50           ! X =  -632.97, -1187.66,      671,        0 ! !END! BIBE
51           ! X =  -630.52, -1187.83,      755,        0 ! !END! BIBE
52           ! X =  -628.08, -1188.00,      732,        0 ! !END! BIBE
53           ! X =  -625.64, -1188.18,      792,        0 ! !END! BIBE
54           ! X =  -623.19, -1188.35,      756,        0 ! !END! BIBE
55           ! X =  -620.75, -1188.52,     1150,        0 ! !END! BIBE
56           ! X =  -618.30, -1188.69,     1036,        0 ! !END! BIBE
57           ! X =  -615.86, -1188.86,      813,        0 ! !END! BIBE
58           ! X =  -613.41, -1189.03,      830,        0 ! !END! BIBE
59           ! X =  -610.97, -1189.20,      750,        0 ! !END! BIBE
60           ! X =  -608.52, -1189.37,      732,        0 ! !END! BIBE
61           ! X =  -606.08, -1189.53,      722,        0 ! !END! BIBE
62           ! X =  -603.63, -1189.70,      670,        0 ! !END! BIBE
63           ! X =  -601.19, -1189.86,      622,        0 ! !END! BIBE
```

```
64          ! X =  -598.74, -1190.03,      624,        0 ! !END! BIBE
65          ! X =  -596.30, -1190.19,      607,        0 ! !END! BIBE
66          ! X =  -593.85, -1190.36,      574,        0 ! !END! BIBE
67          ! X =  -591.41, -1190.52,      559,        0 ! !END! BIBE
68          ! X =  -637.66, -1184.51,      657,        0 ! !END! BIBE
69          ! X =  -635.21, -1184.69,      738,        0 ! !END! BIBE
70          ! X =  -632.77, -1184.86,      751,        0 ! !END! BIBE
71          ! X =  -630.33, -1185.03,      808,        0 ! !END! BIBE
72          ! X =  -627.88, -1185.21,      886,        0 ! !END! BIBE
73          ! X =  -625.44, -1185.38,      871,        0 ! !END! BIBE
74          ! X =  -622.99, -1185.55,      914,        0 ! !END! BIBE
75          ! X =  -620.55, -1185.72,     1219,        0 ! !END! BIBE
76          ! X =  -618.11, -1185.89,     1048,        0 ! !END! BIBE
77          ! X =  -615.66, -1186.06,     1148,        0 ! !END! BIBE
78          ! X =  -613.22, -1186.23,      880,        0 ! !END! BIBE
79          ! X =  -610.77, -1186.40,      823,        0 ! !END! BIBE
80          ! X =  -608.33, -1186.57,      787,        0 ! !END! BIBE
81          ! X =  -605.89, -1186.73,      889,        0 ! !END! BIBE
82          ! X =  -603.44, -1186.90,      961,        0 ! !END! BIBE
83          ! X =  -601.00, -1187.07,      666,        0 ! !END! BIBE
84          ! X =  -598.55, -1187.23,      642,        0 ! !END! BIBE
85          ! X =  -596.11, -1187.40,      623,        0 ! !END! BIBE
86          ! X =  -593.66, -1187.56,      606,        0 ! !END! BIBE
87          ! X =  -591.22, -1187.72,      575,        0 ! !END! BIBE
88          ! X =  -644.78, -1181.18,      671,        0 ! !END! BIBE
89          ! X =  -639.90, -1181.54,      683,        0 ! !END! BIBE
90          ! X =  -637.46, -1181.71,      691,        0 ! !END! BIBE
91          ! X =  -635.01, -1181.89,      732,        0 ! !END! BIBE
92          ! X =  -632.57, -1182.06,      786,        0 ! !END! BIBE
93          ! X =  -630.13, -1182.24,      830,        0 ! !END! BIBE
94          ! X =  -627.68, -1182.41,      884,        0 ! !END! BIBE
95          ! X =  -625.24, -1182.58,      910,        0 ! !END! BIBE
96          ! X =  -622.80, -1182.75,     1211,        0 ! !END! BIBE
97          ! X =  -620.36, -1182.92,     1470,        0 ! !END! BIBE
98          ! X =  -617.91, -1183.09,     1205,        0 ! !END! BIBE
99          ! X =  -615.47, -1183.26,     1218,        0 ! !END! BIBE
100         ! X =  -613.03, -1183.43,     1067,        0 ! !END! BIBE
101         ! X =  -610.58, -1183.60,      923,        0 ! !END! BIBE
102         ! X =  -608.14, -1183.77,      851,        0 ! !END! BIBE
103         ! X =  -605.70, -1183.94,      762,        0 ! !END! BIBE
104         ! X =  -603.25, -1184.10,      734,        0 ! !END! BIBE
105         ! X =  -600.81, -1184.27,      683,        0 ! !END! BIBE
106         ! X =  -598.36, -1184.43,      676,        0 ! !END! BIBE
107         ! X =  -595.92, -1184.60,      642,        0 ! !END! BIBE
108         ! X =  -593.48, -1184.76,      611,        0 ! !END! BIBE
109         ! X =  -591.03, -1184.92,      592,        0 ! !END! BIBE
110         ! X =  -588.59, -1185.09,      556,        0 ! !END! BIBE
111         ! X =  -654.35, -1177.67,      750,        0 ! !END! BIBE
112         ! X =  -651.91, -1177.85,      980,        0 ! !END! BIBE
113         ! X =  -649.47, -1178.03,     1046,        0 ! !END! BIBE
114         ! X =  -647.02, -1178.21,      690,        0 ! !END! BIBE
115         ! X =  -644.58, -1178.39,      692,        0 ! !END! BIBE
116         ! X =  -642.14, -1178.56,      710,        0 ! !END! BIBE
117         ! X =  -639.70, -1178.74,      699,        0 ! !END! BIBE
118         ! X =  -637.26, -1178.92,      722,        0 ! !END! BIBE
119         ! X =  -634.81, -1179.09,      851,        0 ! !END! BIBE
120         ! X =  -632.37, -1179.27,      799,        0 ! !END! BIBE
121         ! X =  -629.93, -1179.44,      850,        0 ! !END! BIBE
122         ! X =  -627.49, -1179.61,      999,        0 ! !END! BIBE
123         ! X =  -625.04, -1179.78,     1121,        0 ! !END! BIBE
```

```
124          ! X =  -622.60, -1179.96,     1154,        0 ! !END! BIBE
125          ! X =  -620.16, -1180.13,     1280,        0 ! !END! BIBE
126          ! X =  -617.72, -1180.30,     1617,        0 ! !END! BIBE
127          ! X =  -615.27, -1180.47,     1309,        0 ! !END! BIBE
128          ! X =  -612.83, -1180.64,     1229,        0 ! !END! BIBE
129          ! X =  -610.39, -1180.80,      994,        0 ! !END! BIBE
130          ! X =  -607.95, -1180.97,      914,        0 ! !END! BIBE
131          ! X =  -605.50, -1181.14,      859,        0 ! !END! BIBE
132          ! X =  -603.06, -1181.30,      824,        0 ! !END! BIBE
133          ! X =  -600.62, -1181.47,      764,        0 ! !END! BIBE
134          ! X =  -598.18, -1181.64,      671,        0 ! !END! BIBE
135          ! X =  -595.73, -1181.80,      640,        0 ! !END! BIBE
136          ! X =  -593.29, -1181.96,      639,        0 ! !END! BIBE
137          ! X =  -590.85, -1182.13,      610,        0 ! !END! BIBE
138          ! X =  -588.40, -1182.29,      573,        0 ! !END! BIBE
139          ! X =  -659.02, -1174.51,      716,        0 ! !END! BIBE
140          ! X =  -656.58, -1174.70,      991,        0 ! !END! BIBE
141          ! X =  -654.14, -1174.88,     1062,        0 ! !END! BIBE
142          ! X =  -651.70, -1175.06,      986,        0 ! !END! BIBE
143          ! X =  -649.26, -1175.23,      740,        0 ! !END! BIBE
144          ! X =  -646.82, -1175.41,      706,        0 ! !END! BIBE
145          ! X =  -644.38, -1175.59,      718,        0 ! !END! BIBE
146          ! X =  -641.94, -1175.77,      729,        0 ! !END! BIBE
147          ! X =  -639.50, -1175.94,      732,        0 ! !END! BIBE
148          ! X =  -637.05, -1176.12,      731,        0 ! !END! BIBE
149          ! X =  -634.61, -1176.29,      793,        0 ! !END! BIBE
150          ! X =  -632.17, -1176.47,      850,        0 ! !END! BIBE
151          ! X =  -629.73, -1176.64,      911,        0 ! !END! BIBE
152          ! X =  -627.29, -1176.81,     1008,        0 ! !END! BIBE
153          ! X =  -624.85, -1176.99,     1128,        0 ! !END! BIBE
154          ! X =  -622.41, -1177.16,     1260,        0 ! !END! BIBE
155          ! X =  -619.96, -1177.33,     1472,        0 ! !END! BIBE
156          ! X =  -617.52, -1177.50,     1713,        0 ! !END! BIBE
157          ! X =  -615.08, -1177.67,     1371,        0 ! !END! BIBE
158          ! X =  -612.64, -1177.84,     1280,        0 ! !END! BIBE
159          ! X =  -610.20, -1178.01,     1156,        0 ! !END! BIBE
160          ! X =  -607.76, -1178.17,     1030,        0 ! !END! BIBE
161          ! X =  -605.31, -1178.34,      942,        0 ! !END! BIBE
162          ! X =  -602.87, -1178.51,     1002,        0 ! !END! BIBE
163          ! X =  -600.43, -1178.67,      762,        0 ! !END! BIBE
164          ! X =  -597.99, -1178.84,      690,        0 ! !END! BIBE
165          ! X =  -595.55, -1179.00,      673,        0 ! !END! BIBE
166          ! X =  -593.10, -1179.17,      640,        0 ! !END! BIBE
167          ! X =  -590.66, -1179.33,      625,        0 ! !END! BIBE
168          ! X =  -588.22, -1179.49,      611,        0 ! !END! BIBE
169          ! X =  -585.78, -1179.65,      619,        0 ! !END! BIBE
170          ! X =  -583.33, -1179.81,      570,        0 ! !END! BIBE
171          ! X =  -580.89, -1179.97,      610,        0 ! !END! BIBE
172          ! X =  -658.82, -1171.72,      945,        0 ! !END! BIBE
173          ! X =  -656.38, -1171.90,     1086,        0 ! !END! BIBE
174          ! X =  -653.94, -1172.08,      975,        0 ! !END! BIBE
175          ! X =  -651.50, -1172.26,      796,        0 ! !END! BIBE
176          ! X =  -641.74, -1172.97,      729,        0 ! !END! BIBE
177          ! X =  -639.29, -1173.15,      759,        0 ! !END! BIBE
178          ! X =  -636.85, -1173.32,      746,        0 ! !END! BIBE
179          ! X =  -634.41, -1173.50,      800,        0 ! !END! BIBE
180          ! X =  -631.97, -1173.67,      850,        0 ! !END! BIBE
181          ! X =  -629.53, -1173.85,      909,        0 ! !END! BIBE
182          ! X =  -627.09, -1174.02,      979,        0 ! !END! BIBE
183          ! X =  -624.65, -1174.19,     1185,        0 ! !END! BIBE
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184          ! X =  -622.21, -1174.36,     1491,        0 ! !END! BIBE
185          ! X =  -619.77, -1174.53,     1656,        0 ! !END! BIBE
186          ! X =  -617.33, -1174.70,     1820,        0 ! !END! BIBE
187          ! X =  -614.89, -1174.87,     1821,        0 ! !END! BIBE
188          ! X =  -612.45, -1175.04,     1398,        0 ! !END! BIBE
189          ! X =  -610.01, -1175.21,     1216,        0 ! !END! BIBE
190          ! X =  -607.56, -1175.38,     1105,        0 ! !END! BIBE
191          ! X =  -605.12, -1175.54,      977,        0 ! !END! BIBE
192          ! X =  -602.68, -1175.71,      972,        0 ! !END! BIBE
193          ! X =  -600.24, -1175.88,      802,        0 ! !END! BIBE
194          ! X =  -597.80, -1176.04,      732,        0 ! !END! BIBE
195          ! X =  -595.36, -1176.20,      714,        0 ! !END! BIBE
196          ! X =  -592.92, -1176.37,      677,        0 ! !END! BIBE
197          ! X =  -590.48, -1176.53,      633,        0 ! !END! BIBE
198          ! X =  -588.03, -1176.69,      633,        0 ! !END! BIBE
199          ! X =  -585.59, -1176.85,      823,        0 ! !END! BIBE
200          ! X =  -583.15, -1177.01,      808,        0 ! !END! BIBE
201          ! X =  -580.71, -1177.17,      663,        0 ! !END! BIBE
202          ! X =  -578.27, -1177.33,      914,        0 ! !END! BIBE
203          ! X =  -575.83, -1177.49,      897,        0 ! !END! BIBE
204          ! X =  -661.05, -1168.74,      707,        0 ! !END! BIBE
205          ! X =  -639.09, -1170.35,      788,        0 ! !END! BIBE
206          ! X =  -636.65, -1170.53,      750,        0 ! !END! BIBE
207          ! X =  -634.21, -1170.70,      823,        0 ! !END! BIBE
208          ! X =  -631.77, -1170.88,      967,        0 ! !END! BIBE
209          ! X =  -629.33, -1171.05,      924,        0 ! !END! BIBE
210          ! X =  -626.89, -1171.22,     1199,        0 ! !END! BIBE
211          ! X =  -624.45, -1171.39,     1165,        0 ! !END! BIBE
212          ! X =  -622.01, -1171.56,     1202,        0 ! !END! BIBE
213          ! X =  -619.57, -1171.74,     1871,        0 ! !END! BIBE
214          ! X =  -617.13, -1171.91,     1959,        0 ! !END! BIBE
215          ! X =  -614.69, -1172.08,     2198,        0 ! !END! BIBE
216          ! X =  -612.25, -1172.24,     1609,        0 ! !END! BIBE
217          ! X =  -609.81, -1172.41,     1720,        0 ! !END! BIBE
218          ! X =  -607.37, -1172.58,     1310,        0 ! !END! BIBE
219          ! X =  -604.93, -1172.75,     1111,        0 ! !END! BIBE
220          ! X =  -602.49, -1172.91,      981,        0 ! !END! BIBE
221          ! X =  -600.05, -1173.08,      873,        0 ! !END! BIBE
222          ! X =  -597.61, -1173.24,      795,        0 ! !END! BIBE
223          ! X =  -595.17, -1173.41,      757,        0 ! !END! BIBE
224          ! X =  -592.73, -1173.57,      695,        0 ! !END! BIBE
225          ! X =  -590.29, -1173.73,      637,        0 ! !END! BIBE
226          ! X =  -587.85, -1173.89,      696,        0 ! !END! BIBE
227          ! X =  -585.41, -1174.06,      757,        0 ! !END! BIBE
228          ! X =  -582.97, -1174.22,      884,        0 ! !END! BIBE
229          ! X =  -580.53, -1174.38,      708,        0 ! !END! BIBE
230          ! X =  -578.09, -1174.54,      853,        0 ! !END! BIBE
231          ! X =  -638.89, -1167.55,      761,        0 ! !END! BIBE
232          ! X =  -636.45, -1167.73,      816,        0 ! !END! BIBE
233          ! X =  -634.01, -1167.90,      822,        0 ! !END! BIBE
234          ! X =  -631.57, -1168.08,      871,        0 ! !END! BIBE
235          ! X =  -629.14, -1168.25,     1047,        0 ! !END! BIBE
236          ! X =  -626.70, -1168.42,     1160,        0 ! !END! BIBE
237          ! X =  -624.26, -1168.60,     1192,        0 ! !END! BIBE
238          ! X =  -621.82, -1168.77,     1132,        0 ! !END! BIBE
239          ! X =  -619.38, -1168.94,     1270,        0 ! !END! BIBE
240          ! X =  -616.94, -1169.11,     1509,        0 ! !END! BIBE
241          ! X =  -614.50, -1169.28,     1841,        0 ! !END! BIBE
242          ! X =  -612.06, -1169.45,     1850,        0 ! !END! BIBE
243          ! X =  -609.62, -1169.62,     1590,        0 ! !END! BIBE
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244          ! X =  -607.18, -1169.78,     1703,        0 ! !END! BIBE
245          ! X =  -604.74, -1169.95,     1279,        0 ! !END! BIBE
246          ! X =  -602.30, -1170.12,      998,        0 ! !END! BIBE
247          ! X =  -599.86, -1170.28,      897,        0 ! !END! BIBE
248          ! X =  -597.42, -1170.45,      866,        0 ! !END! BIBE
249          ! X =  -594.98, -1170.61,      759,        0 ! !END! BIBE
250          ! X =  -592.54, -1170.77,      677,        0 ! !END! BIBE
251          ! X =  -590.10, -1170.94,      697,        0 ! !END! BIBE
252          ! X =  -587.66, -1171.10,      746,        0 ! !END! BIBE
253          ! X =  -585.22, -1171.26,      779,        0 ! !END! BIBE
254          ! X =  -582.78, -1171.42,     1191,        0 ! !END! BIBE
255          ! X =  -580.34, -1171.58,      945,        0 ! !END! BIBE
256          ! X =  -577.90, -1171.74,      760,        0 ! !END! BIBE
257          ! X =  -633.81, -1165.11,      823,        0 ! !END! BIBE
258          ! X =  -631.38, -1165.28,      860,        0 ! !END! BIBE
259          ! X =  -628.94, -1165.46,      915,        0 ! !END! BIBE
260          ! X =  -626.50, -1165.63,     1053,        0 ! !END! BIBE
261          ! X =  -624.06, -1165.80,     1060,        0 ! !END! BIBE
262          ! X =  -621.62, -1165.97,     1089,        0 ! !END! BIBE
263          ! X =  -619.18, -1166.14,     1170,        0 ! !END! BIBE
264          ! X =  -616.74, -1166.31,     1430,        0 ! !END! BIBE
265          ! X =  -614.31, -1166.48,     1648,        0 ! !END! BIBE
266          ! X =  -611.87, -1166.65,     1397,        0 ! !END! BIBE
267          ! X =  -609.43, -1166.82,     1514,        0 ! !END! BIBE
268          ! X =  -606.99, -1166.99,     1292,        0 ! !END! BIBE
269          ! X =  -604.55, -1167.15,     1071,        0 ! !END! BIBE
270          ! X =  -602.11, -1167.32,      983,        0 ! !END! BIBE
271          ! X =  -599.67, -1167.48,      909,        0 ! !END! BIBE
272          ! X =  -597.23, -1167.65,      877,        0 ! !END! BIBE
273          ! X =  -594.79, -1167.81,      760,        0 ! !END! BIBE
274          ! X =  -592.36, -1167.98,      697,        0 ! !END! BIBE
275          ! X =  -589.92, -1168.14,      772,        0 ! !END! BIBE
276          ! X =  -587.48, -1168.30,      821,        0 ! !END! BIBE
277          ! X =  -585.04, -1168.46,      943,        0 ! !END! BIBE
278          ! X =  -582.60, -1168.62,     1271,        0 ! !END! BIBE
279          ! X =  -580.16, -1168.78,     1067,        0 ! !END! BIBE
280          ! X =  -577.72, -1168.94,      792,        0 ! !END! BIBE
281          ! X =  -633.61, -1162.31,      823,        0 ! !END! BIBE
282          ! X =  -631.18, -1162.49,      895,        0 ! !END! BIBE
283          ! X =  -628.74, -1162.66,      886,        0 ! !END! BIBE
284          ! X =  -626.30, -1162.83,      977,        0 ! !END! BIBE
285          ! X =  -623.86, -1163.00,      985,        0 ! !END! BIBE
286          ! X =  -621.43, -1163.18,     1044,        0 ! !END! BIBE
287          ! X =  -618.99, -1163.35,     1064,        0 ! !END! BIBE
288          ! X =  -616.55, -1163.52,     1188,        0 ! !END! BIBE
289          ! X =  -614.11, -1163.69,     1218,        0 ! !END! BIBE
290          ! X =  -611.67, -1163.85,     1242,        0 ! !END! BIBE
291          ! X =  -609.24, -1164.02,     1185,        0 ! !END! BIBE
292          ! X =  -606.80, -1164.19,     1120,        0 ! !END! BIBE
293          ! X =  -604.36, -1164.36,     1048,        0 ! !END! BIBE
294          ! X =  -601.92, -1164.52,      974,        0 ! !END! BIBE
295          ! X =  -599.48, -1164.69,      944,        0 ! !END! BIBE
296          ! X =  -597.05, -1164.85,      853,        0 ! !END! BIBE
297          ! X =  -594.61, -1165.02,      764,        0 ! !END! BIBE
298          ! X =  -592.17, -1165.18,      877,        0 ! !END! BIBE
299          ! X =  -589.73, -1165.34,      914,        0 ! !END! BIBE
300          ! X =  -587.29, -1165.50,     1068,        0 ! !END! BIBE
301          ! X =  -584.85, -1165.66,     1113,        0 ! !END! BIBE
302          ! X =  -582.42, -1165.82,     1067,        0 ! !END! BIBE
303          ! X =  -579.98, -1165.98,     1035,        0 ! !END! BIBE
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304          ! X =  -577.54, -1166.14,      857,        0 ! !END! BIBE
305          ! X =  -575.10, -1166.30,      733,        0 ! !END! BIBE
306          ! X =  -628.54, -1159.86,      905,        0 ! !END! BIBE
307          ! X =  -626.10, -1160.04,      945,        0 ! !END! BIBE
308          ! X =  -623.67, -1160.21,      961,        0 ! !END! BIBE
309          ! X =  -621.23, -1160.38,     1031,        0 ! !END! BIBE
310          ! X =  -618.79, -1160.55,     1057,        0 ! !END! BIBE
311          ! X =  -616.36, -1160.72,     1107,        0 ! !END! BIBE
312          ! X =  -613.92, -1160.89,     1112,        0 ! !END! BIBE
313          ! X =  -611.48, -1161.06,     1128,        0 ! !END! BIBE
314          ! X =  -609.04, -1161.23,     1098,        0 ! !END! BIBE
315          ! X =  -606.61, -1161.39,     1039,        0 ! !END! BIBE
316          ! X =  -604.17, -1161.56,      997,        0 ! !END! BIBE
317          ! X =  -601.73, -1161.73,      975,        0 ! !END! BIBE
318          ! X =  -599.29, -1161.89,      916,        0 ! !END! BIBE
319          ! X =  -596.86, -1162.05,      853,        0 ! !END! BIBE
320          ! X =  -594.42, -1162.22,      767,        0 ! !END! BIBE
321          ! X =  -591.98, -1162.38,      898,        0 ! !END! BIBE
322          ! X =  -589.54, -1162.54,      876,        0 ! !END! BIBE
323          ! X =  -587.11, -1162.71,     1005,        0 ! !END! BIBE
324          ! X =  -584.67, -1162.87,     1278,        0 ! !END! BIBE
325          ! X =  -582.23, -1163.03,     1108,        0 ! !END! BIBE
326          ! X =  -579.79, -1163.19,     1208,        0 ! !END! BIBE
327          ! X =  -577.36, -1163.35,      780,        0 ! !END! BIBE
328          ! X =  -574.92, -1163.51,      711,        0 ! !END! BIBE
329          ! X =  -572.48, -1163.66,      519,        0 ! !END! BIBE
330          ! X =  -628.34, -1157.07,     1278,        0 ! !END! BIBE
331          ! X =  -625.91, -1157.24,      954,        0 ! !END! BIBE
332          ! X =  -623.47, -1157.41,     1080,        0 ! !END! BIBE
333          ! X =  -621.03, -1157.58,     1037,        0 ! !END! BIBE
334          ! X =  -618.60, -1157.75,     1193,        0 ! !END! BIBE
335          ! X =  -616.16, -1157.92,     1124,        0 ! !END! BIBE
336          ! X =  -613.72, -1158.09,     1055,        0 ! !END! BIBE
337          ! X =  -611.29, -1158.26,     1056,        0 ! !END! BIBE
338          ! X =  -608.85, -1158.43,     1032,        0 ! !END! BIBE
339          ! X =  -606.42, -1158.60,     1004,        0 ! !END! BIBE
340          ! X =  -603.98, -1158.76,      936,        0 ! !END! BIBE
341          ! X =  -601.54, -1158.93,      924,        0 ! !END! BIBE
342          ! X =  -599.11, -1159.09,      869,        0 ! !END! BIBE
343          ! X =  -596.67, -1159.26,      792,        0 ! !END! BIBE
344          ! X =  -594.23, -1159.42,      823,        0 ! !END! BIBE
345          ! X =  -591.80, -1159.59,      903,        0 ! !END! BIBE
346          ! X =  -589.36, -1159.75,      942,        0 ! !END! BIBE
347          ! X =  -586.92, -1159.91,     1281,        0 ! !END! BIBE
348          ! X =  -584.48, -1160.07,     1397,        0 ! !END! BIBE
349          ! X =  -582.05, -1160.23,     1208,        0 ! !END! BIBE
350          ! X =  -579.61, -1160.39,     1008,        0 ! !END! BIBE
351          ! X =  -577.17, -1160.55,      835,        0 ! !END! BIBE
352          ! X =  -574.74, -1160.71,      767,        0 ! !END! BIBE
353          ! X =  -625.71, -1154.44,     1104,        0 ! !END! BIBE
354          ! X =  -623.27, -1154.62,     1092,        0 ! !END! BIBE
355          ! X =  -620.84, -1154.79,     1006,        0 ! !END! BIBE
356          ! X =  -618.40, -1154.96,     1003,        0 ! !END! BIBE
357          ! X =  -615.97, -1155.13,     1014,        0 ! !END! BIBE
358          ! X =  -613.53, -1155.30,     1029,        0 ! !END! BIBE
359          ! X =  -611.10, -1155.47,     1003,        0 ! !END! BIBE
360          ! X =  -608.66, -1155.63,      989,        0 ! !END! BIBE
361          ! X =  -606.22, -1155.80,      968,        0 ! !END! BIBE
362          ! X =  -603.79, -1155.97,      914,        0 ! !END! BIBE
363          ! X =  -601.35, -1156.13,      882,        0 ! !END! BIBE
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364          ! X =  -598.92, -1156.30,      847,         0 ! !END! BIBE
365          ! X =  -596.48, -1156.46,      806,         0 ! !END! BIBE
366          ! X =  -594.04, -1156.63,      906,         0 ! !END! BIBE
367          ! X =  -591.61, -1156.79,     1027,         0 ! !END! BIBE
368          ! X =  -589.17, -1156.95,     1003,         0 ! !END! BIBE
369          ! X =  -586.74, -1157.11,     1532,         0 ! !END! BIBE
370          ! X =  -584.30, -1157.27,     1431,         0 ! !END! BIBE
371          ! X =  -581.86, -1157.43,     1205,         0 ! !END! BIBE
372          ! X =  -579.43, -1157.59,     1025,         0 ! !END! BIBE
373          ! X =  -613.34, -1152.50,      945,         0 ! !END! BIBE
374          ! X =  -610.90, -1152.67,      959,         0 ! !END! BIBE
375          ! X =  -608.47, -1152.84,      946,         0 ! !END! BIBE
376          ! X =  -606.03, -1153.00,      897,         0 ! !END! BIBE
377          ! X =  -603.60, -1153.17,      868,         0 ! !END! BIBE
378          ! X =  -601.16, -1153.34,      850,         0 ! !END! BIBE
379          ! X =  -598.73, -1153.50,      829,         0 ! !END! BIBE
380          ! X =  -596.29, -1153.67,      845,         0 ! !END! BIBE
381          ! X =  -593.86, -1153.83,      887,         0 ! !END! BIBE
382          ! X =  -591.42, -1153.99,      951,         0 ! !END! BIBE
383          ! X =  -588.99, -1154.16,     1032,         0 ! !END! BIBE
384          ! X =  -586.55, -1154.32,     1272,         0 ! !END! BIBE
385          ! X =  -584.12, -1154.48,     1574,         0 ! !END! BIBE
386          ! X =  -613.14, -1149.71,      980,         0 ! !END! BIBE
387          ! X =  -610.71, -1149.87,      981,         0 ! !END! BIBE
388          ! X =  -608.28, -1150.04,      997,         0 ! !END! BIBE
389          ! X =  -605.84, -1150.21,     1036,         0 ! !END! BIBE
390          ! X =  -603.41, -1150.38,      953,         0 ! !END! BIBE
391          ! X =  -600.97, -1150.54,      869,         0 ! !END! BIBE
392          ! X =  -598.54, -1150.71,      848,         0 ! !END! BIBE
393          ! X =  -596.10, -1150.87,      864,         0 ! !END! BIBE
394          ! X =  -593.67, -1151.03,      914,         0 ! !END! BIBE
395          ! X =  -591.23, -1151.20,      975,         0 ! !END! BIBE
396          ! X =  -588.80, -1151.36,     1072,         0 ! !END! BIBE
397          ! X =  -586.37, -1151.52,     1265,         0 ! !END! BIBE
398          ! X =  -608.08, -1147.25,     1111,         0 ! !END! BIBE
399          ! X =  -605.65, -1147.41,     1268,         0 ! !END! BIBE
400          ! X =  -603.22, -1147.58,      997,         0 ! !END! BIBE
401          ! X =  -600.78, -1147.75,      915,         0 ! !END! BIBE
402          ! X =  -598.35, -1147.91,      874,         0 ! !END! BIBE
403          ! X =  -595.92, -1148.07,      911,         0 ! !END! BIBE
404          ! X =  -593.48, -1148.24,      967,         0 ! !END! BIBE
405          ! X =  -591.05, -1148.40,      992,         0 ! !END! BIBE
406          ! X =  -588.61, -1148.56,     1093,         0 ! !END! BIBE
407          ! X =  -586.18, -1148.73,     1432,         0 ! !END! BIBE
408          ! X =  -607.89, -1144.45,     1334,         0 ! !END! BIBE
409          ! X =  -605.46, -1144.62,     1194,         0 ! !END! BIBE
410          ! X =  -603.03, -1144.78,     1061,         0 ! !END! BIBE
411          ! X =  -600.59, -1144.95,      908,         0 ! !END! BIBE
412          ! X =  -598.16, -1145.12,      875,         0 ! !END! BIBE
413          ! X =  -595.73, -1145.28,      907,         0 ! !END! BIBE
414          ! X =  -593.29, -1145.44,      975,         0 ! !END! BIBE
415          ! X =  -590.86, -1145.61,     1037,         0 ! !END! BIBE
416          ! X =  -588.43, -1145.77,     1129,         0 ! !END! BIBE
417          ! X =  -586.00, -1145.93,     1359,         0 ! !END! BIBE
418          ! X =  -614.99, -1141.15,      944,         0 ! !END! BIBE
419          ! X =  -612.56, -1141.32,     1067,         0 ! !END! BIBE
420          ! X =  -610.13, -1141.49,     1478,         0 ! !END! BIBE
421          ! X =  -607.70, -1141.66,     1526,         0 ! !END! BIBE
422          ! X =  -605.27, -1141.82,     1075,         0 ! !END! BIBE
423          ! X =  -602.83, -1141.99,      956,         0 ! !END! BIBE
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424          ! X =  -600.40, -1142.16,      874,        0 ! !END! BIBE
425          ! X =  -597.97, -1142.32,      854,        0 ! !END! BIBE
426          ! X =  -595.54, -1142.48,      904,        0 ! !END! BIBE
427          ! X =  -593.11, -1142.65,      975,        0 ! !END! BIBE
428          ! X =  -590.67, -1142.81,     1040,        0 ! !END! BIBE
429          ! X =  -588.24, -1142.97,     1097,        0 ! !END! BIBE
430          ! X =  -614.80, -1138.36,      912,        0 ! !END! BIBE
431          ! X =  -612.37, -1138.53,      941,        0 ! !END! BIBE
432          ! X =  -609.94, -1138.69,      938,        0 ! !END! BIBE
433          ! X =  -607.51, -1138.86,      976,        0 ! !END! BIBE
434          ! X =  -605.08, -1139.03,      913,        0 ! !END! BIBE
435          ! X =  -602.64, -1139.19,      854,        0 ! !END! BIBE
436          ! X =  -600.21, -1139.36,      834,        0 ! !END! BIBE
437          ! X =  -597.78, -1139.52,      835,        0 ! !END! BIBE
438          ! X =  -595.35, -1139.69,     1008,        0 ! !END! BIBE
439          ! X =  -592.92, -1139.85,     1006,        0 ! !END! BIBE
440          ! X =  -590.49, -1140.02,      946,        0 ! !END! BIBE
441          ! X =  -614.61, -1135.56,      929,        0 ! !END! BIBE
442          ! X =  -612.17, -1135.73,      879,        0 ! !END! BIBE
443          ! X =  -609.74, -1135.90,      852,        0 ! !END! BIBE
444          ! X =  -607.31, -1136.07,      846,        0 ! !END! BIBE
445          ! X =  -604.88, -1136.23,      823,        0 ! !END! BIBE
446          ! X =  -602.45, -1136.40,      810,        0 ! !END! BIBE
447          ! X =  -600.02, -1136.57,      800,        0 ! !END! BIBE
448          ! X =  -597.59, -1136.73,      814,        0 ! !END! BIBE
449          ! X =  -595.16, -1136.89,      965,        0 ! !END! BIBE
450          ! X =  -592.73, -1137.06,      957,        0 ! !END! BIBE
451          ! X =  -590.30, -1137.22,      916,        0 ! !END! BIBE
452          ! X =  -616.84, -1132.60,      966,        0 ! !END! BIBE
453          ! X =  -614.41, -1132.77,     1034,        0 ! !END! BIBE
454          ! X =  -611.98, -1132.94,     1007,        0 ! !END! BIBE
455          ! X =  -609.55, -1133.11,      864,        0 ! !END! BIBE
456          ! X =  -607.12, -1133.27,      846,        0 ! !END! BIBE
457          ! X =  -604.69, -1133.44,      835,        0 ! !END! BIBE
458          ! X =  -602.26, -1133.61,      826,        0 ! !END! BIBE
459          ! X =  -599.83, -1133.77,      808,        0 ! !END! BIBE
460          ! X =  -597.40, -1133.94,      777,        0 ! !END! BIBE
461          ! X =  -594.97, -1134.10,      867,        0 ! !END! BIBE
462          ! X =  -592.54, -1134.26,      851,        0 ! !END! BIBE
463          ! X =  -590.11, -1134.43,      805,        0 ! !END! BIBE
464          ! X =  -611.79, -1130.14,      914,        0 ! !END! BIBE
465          ! X =  -609.36, -1130.31,      877,        0 ! !END! BIBE
466          ! X =  -606.93, -1130.48,      860,        0 ! !END! BIBE
467          ! X =  -604.50, -1130.65,      854,        0 ! !END! BIBE
468          ! X =  -602.07, -1130.81,      853,        0 ! !END! BIBE
469          ! X =  -599.64, -1130.98,      803,        0 ! !END! BIBE
470          ! X =  -597.21, -1131.14,      792,        0 ! !END! BIBE
471          ! X =  -594.79, -1131.31,      884,        0 ! !END! BIBE
472          ! X =  -611.59, -1127.35,      907,        0 ! !END! BIBE
473          ! X =  -609.17, -1127.52,      889,        0 ! !END! BIBE
474          ! X =  -606.74, -1127.68,      884,        0 ! !END! BIBE
475          ! X =  -604.31, -1127.85,      858,        0 ! !END! BIBE
476          ! X =  -599.45, -1128.18,     1007,        0 ! !END! BIBE
477          ! X =  -611.40, -1124.56,      923,        0 ! !END! BIBE
478          ! X =  -608.97, -1124.72,      914,        0 ! !END! BIBE
479          ! X =  -606.55, -1124.89,      912,        0 ! !END! BIBE
480          ! X =  -599.26, -1125.39,      856,        0 ! !END! BIBE
481          ! X =  -724.13,  -850.79,     1557,        0 ! !END! CAVE
482          ! X =  -724.05,  -849.86,     1798,        0 ! !END! CAVE
483          ! X =  -723.26,  -849.93,     1526,        0 ! !END! CAVE
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484          ! X =  -723.97,  -848.94,     1818,        0 ! !END! CAVE
485          ! X =  -723.19,  -849.00,     1831,        0 ! !END! CAVE
486          ! X =  -723.89,  -848.01,     1792,        0 ! !END! CAVE
487          ! X =  -723.11,  -848.08,     1524,        0 ! !END! CAVE
488          ! X =  -722.32,  -848.15,     1584,        0 ! !END! CAVE
489          ! X =  -721.54,  -848.21,     1528,        0 ! !END! CAVE
490          ! X =  -720.76,  -848.28,     1455,        0 ! !END! CAVE
491          ! X =  -723.81,  -847.09,     1757,        0 ! !END! CAVE
492          ! X =  -723.03,  -847.15,     1825,        0 ! !END! CAVE
493          ! X =  -722.25,  -847.22,     1524,        0 ! !END! CAVE
494          ! X =  -721.46,  -847.29,     1714,        0 ! !END! CAVE
495          ! X =  -720.68,  -847.35,     1617,        0 ! !END! CAVE
496          ! X =  -723.73,  -846.16,     1734,        0 ! !END! CAVE
497          ! X =  -722.95,  -846.23,     1666,        0 ! !END! CAVE
498          ! X =  -722.17,  -846.30,     1768,        0 ! !END! CAVE
499          ! X =  -721.38,  -846.36,     1881,        0 ! !END! CAVE
500          ! X =  -720.60,  -846.43,     1829,        0 ! !END! CAVE
501          ! X =  -719.82,  -846.49,     1751,        0 ! !END! CAVE
502          ! X =  -719.03,  -846.56,     1622,        0 ! !END! CAVE
503          ! X =  -718.25,  -846.63,     1544,        0 ! !END! CAVE
504          ! X =  -717.47,  -846.69,     1455,        0 ! !END! CAVE
505          ! X =  -716.68,  -846.76,     1404,        0 ! !END! CAVE
506          ! X =  -715.90,  -846.82,     1350,        0 ! !END! CAVE
507          ! X =  -722.09,  -845.37,     1829,        0 ! !END! CAVE
508          ! X =  -721.31,  -845.44,     1723,        0 ! !END! CAVE
509          ! X =  -720.52,  -845.50,     1721,        0 ! !END! CAVE
510          ! X =  -719.74,  -845.57,     1825,        0 ! !END! CAVE
511          ! X =  -718.96,  -845.63,     1815,        0 ! !END! CAVE
512          ! X =  -718.17,  -845.70,     1739,        0 ! !END! CAVE
513          ! X =  -717.39,  -845.77,     1716,        0 ! !END! CAVE
514          ! X =  -716.60,  -845.83,     1721,        0 ! !END! CAVE
515          ! X =  -715.82,  -845.90,     1553,        0 ! !END! CAVE
516          ! X =  -715.04,  -845.96,     1376,        0 ! !END! CAVE
517          ! X =  -714.25,  -846.03,     1341,        0 ! !END! CAVE
518          ! X =  -713.47,  -846.09,     1301,        0 ! !END! CAVE
519          ! X =  -712.69,  -846.16,     1268,        0 ! !END! CAVE
520          ! X =  -711.90,  -846.23,     1249,        0 ! !END! CAVE
521          ! X =  -722.01,  -844.45,     1890,        0 ! !END! CAVE
522          ! X =  -721.23,  -844.51,     1797,        0 ! !END! CAVE
523          ! X =  -720.44,  -844.58,     1705,        0 ! !END! CAVE
524          ! X =  -719.66,  -844.64,     1682,        0 ! !END! CAVE
525          ! X =  -718.88,  -844.71,     1617,        0 ! !END! CAVE
526          ! X =  -718.09,  -844.78,     1737,        0 ! !END! CAVE
527          ! X =  -717.31,  -844.84,     1806,        0 ! !END! CAVE
528          ! X =  -716.53,  -844.91,     1809,        0 ! !END! CAVE
529          ! X =  -715.74,  -844.97,     1708,        0 ! !END! CAVE
530          ! X =  -714.96,  -845.04,     1587,        0 ! !END! CAVE
531          ! X =  -714.18,  -845.10,     1465,        0 ! !END! CAVE
532          ! X =  -713.39,  -845.17,     1339,        0 ! !END! CAVE
533          ! X =  -712.61,  -845.24,     1279,        0 ! !END! CAVE
534          ! X =  -711.83,  -845.30,     1263,        0 ! !END! CAVE
535          ! X =  -721.93,  -843.52,     1866,        0 ! !END! CAVE
536          ! X =  -721.15,  -843.59,     1805,        0 ! !END! CAVE
537          ! X =  -720.37,  -843.65,     1890,        0 ! !END! CAVE
538          ! X =  -719.58,  -843.72,     1685,        0 ! !END! CAVE
539          ! X =  -718.80,  -843.79,     1589,        0 ! !END! CAVE
540          ! X =  -718.02,  -843.85,     1524,        0 ! !END! CAVE
541          ! X =  -717.23,  -843.92,     1527,        0 ! !END! CAVE
542          ! X =  -716.45,  -843.98,     1589,        0 ! !END! CAVE
543          ! X =  -715.67,  -844.05,     1562,        0 ! !END! CAVE
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544          ! X =  -714.88,  -844.11,     1684,        0 ! !END! CAVE
545          ! X =  -714.10,  -844.18,     1545,        0 ! !END! CAVE
546          ! X =  -713.32,  -844.24,     1526,        0 ! !END! CAVE
547          ! X =  -712.53,  -844.31,     1335,        0 ! !END! CAVE
548          ! X =  -711.75,  -844.38,     1299,        0 ! !END! CAVE
549          ! X =  -721.85,  -842.60,     1847,        0 ! !END! CAVE
550          ! X =  -721.07,  -842.66,     1885,        0 ! !END! CAVE
551          ! X =  -720.29,  -842.73,     1755,        0 ! !END! CAVE
552          ! X =  -719.50,  -842.79,     1666,        0 ! !END! CAVE
553          ! X =  -718.72,  -842.86,     1707,        0 ! !END! CAVE
554          ! X =  -717.94,  -842.93,     1707,        0 ! !END! CAVE
555          ! X =  -717.16,  -842.99,     1554,        0 ! !END! CAVE
556          ! X =  -716.37,  -843.06,     1463,        0 ! !END! CAVE
557          ! X =  -715.59,  -843.12,     1668,        0 ! !END! CAVE
558          ! X =  -714.81,  -843.19,     1404,        0 ! !END! CAVE
559          ! X =  -714.02,  -843.25,     1459,        0 ! !END! CAVE
560          ! X =  -713.24,  -843.32,     1353,        0 ! !END! CAVE
561          ! X =  -712.46,  -843.39,     1393,        0 ! !END! CAVE
562          ! X =  -711.67,  -843.45,     1566,        0 ! !END! CAVE
563          ! X =  -710.89,  -843.52,     1367,        0 ! !END! CAVE
564          ! X =  -720.21,  -841.80,     1890,        0 ! !END! CAVE
565          ! X =  -719.43,  -841.87,     1832,        0 ! !END! CAVE
566          ! X =  -718.64,  -841.94,     1829,        0 ! !END! CAVE
567          ! X =  -717.86,  -842.00,     1753,        0 ! !END! CAVE
568          ! X =  -717.08,  -842.07,     1755,        0 ! !END! CAVE
569          ! X =  -716.29,  -842.13,     1653,        0 ! !END! CAVE
570          ! X =  -715.51,  -842.20,     1829,        0 ! !END! CAVE
571          ! X =  -714.73,  -842.26,     1648,        0 ! !END! CAVE
572          ! X =  -713.95,  -842.33,     1630,        0 ! !END! CAVE
573          ! X =  -713.16,  -842.40,     1400,        0 ! !END! CAVE
574          ! X =  -712.38,  -842.46,     1611,        0 ! !END! CAVE
575          ! X =  -711.60,  -842.53,     1671,        0 ! !END! CAVE
576          ! X =  -710.81,  -842.59,     1527,        0 ! !END! CAVE
577          ! X =  -710.03,  -842.66,     1405,        0 ! !END! CAVE
578          ! X =  -709.25,  -842.72,     1263,        0 ! !END! CAVE
579          ! X =  -708.46,  -842.79,     1220,        0 ! !END! CAVE
580          ! X =  -720.13,  -840.88,     1889,        0 ! !END! CAVE
581          ! X =  -719.35,  -840.95,     1788,        0 ! !END! CAVE
582          ! X =  -718.57,  -841.01,     1890,        0 ! !END! CAVE
583          ! X =  -717.78,  -841.08,     1864,        0 ! !END! CAVE
584          ! X =  -717.00,  -841.14,     1781,        0 ! !END! CAVE
585          ! X =  -716.22,  -841.21,     1823,        0 ! !END! CAVE
586          ! X =  -715.43,  -841.27,     1828,        0 ! !END! CAVE
587          ! X =  -714.65,  -841.34,     1627,        0 ! !END! CAVE
588          ! X =  -713.87,  -841.41,     1447,        0 ! !END! CAVE
589          ! X =  -713.08,  -841.47,     1405,        0 ! !END! CAVE
590          ! X =  -712.30,  -841.54,     1646,        0 ! !END! CAVE
591          ! X =  -711.52,  -841.60,     1584,        0 ! !END! CAVE
592          ! X =  -710.74,  -841.67,     1645,        0 ! !END! CAVE
593          ! X =  -709.95,  -841.73,     1433,        0 ! !END! CAVE
594          ! X =  -709.17,  -841.80,     1343,        0 ! !END! CAVE
595          ! X =  -708.39,  -841.86,     1258,        0 ! !END! CAVE
596          ! X =  -707.60,  -841.93,     1219,        0 ! !END! CAVE
597          ! X =  -720.05,  -839.95,     1776,        0 ! !END! CAVE
598          ! X =  -719.27,  -840.02,     1770,        0 ! !END! CAVE
599          ! X =  -718.49,  -840.09,     1809,        0 ! !END! CAVE
600          ! X =  -717.71,  -840.15,     1754,        0 ! !END! CAVE
601          ! X =  -716.92,  -840.22,     1825,        0 ! !END! CAVE
602          ! X =  -716.14,  -840.28,     1840,        0 ! !END! CAVE
603          ! X =  -715.36,  -840.35,     1739,        0 ! !END! CAVE
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604          ! X =  -714.57,  -840.41,     1708,        0 ! !END! CAVE
605          ! X =  -713.79,  -840.48,     1522,        0 ! !END! CAVE
606          ! X =  -713.01,  -840.55,     1675,        0 ! !END! CAVE
607          ! X =  -712.22,  -840.61,     1637,        0 ! !END! CAVE
608          ! X =  -711.44,  -840.68,     1624,        0 ! !END! CAVE
609          ! X =  -710.66,  -840.74,     1515,        0 ! !END! CAVE
610          ! X =  -709.88,  -840.81,     1583,        0 ! !END! CAVE
611          ! X =  -709.09,  -840.87,     1529,        0 ! !END! CAVE
612          ! X =  -708.31,  -840.94,     1455,        0 ! !END! CAVE
613          ! X =  -707.53,  -841.00,     1282,        0 ! !END! CAVE
614          ! X =  -706.74,  -841.07,     1213,        0 ! !END! CAVE
615          ! X =  -705.96,  -841.13,     1199,        0 ! !END! CAVE
616          ! X =  -705.18,  -841.20,     1204,        0 ! !END! CAVE
617          ! X =  -719.98,  -839.03,     1811,        0 ! !END! CAVE
618          ! X =  -719.19,  -839.10,     1805,        0 ! !END! CAVE
619          ! X =  -718.41,  -839.16,     1646,        0 ! !END! CAVE
620          ! X =  -717.63,  -839.23,     1704,        0 ! !END! CAVE
621          ! X =  -716.84,  -839.29,     1768,        0 ! !END! CAVE
622          ! X =  -716.06,  -839.36,     1827,        0 ! !END! CAVE
623          ! X =  -715.28,  -839.42,     1702,        0 ! !END! CAVE
624          ! X =  -714.50,  -839.49,     1623,        0 ! !END! CAVE
625          ! X =  -713.71,  -839.56,     1724,        0 ! !END! CAVE
626          ! X =  -712.93,  -839.62,     1768,        0 ! !END! CAVE
627          ! X =  -712.15,  -839.69,     1707,        0 ! !END! CAVE
628          ! X =  -711.36,  -839.75,     1647,        0 ! !END! CAVE
629          ! X =  -710.58,  -839.82,     1585,        0 ! !END! CAVE
630          ! X =  -709.80,  -839.88,     1485,        0 ! !END! CAVE
631          ! X =  -709.02,  -839.95,     1463,        0 ! !END! CAVE
632          ! X =  -708.23,  -840.01,     1521,        0 ! !END! CAVE
633          ! X =  -707.45,  -840.08,     1367,        0 ! !END! CAVE
634          ! X =  -706.67,  -840.14,     1334,        0 ! !END! CAVE
635          ! X =  -705.88,  -840.21,     1240,        0 ! !END! CAVE
636          ! X =  -705.10,  -840.27,     1217,        0 ! !END! CAVE
637          ! X =  -704.32,  -840.34,     1194,        0 ! !END! CAVE
638          ! X =  -703.53,  -840.40,     1159,        0 ! !END! CAVE
639          ! X =  -719.90,  -838.10,     1740,        0 ! !END! CAVE
640          ! X =  -719.12,  -838.17,     1655,        0 ! !END! CAVE
641          ! X =  -718.33,  -838.24,     1733,        0 ! !END! CAVE
642          ! X =  -717.55,  -838.30,     1684,        0 ! !END! CAVE
643          ! X =  -716.77,  -838.37,     1709,        0 ! !END! CAVE
644          ! X =  -715.98,  -838.43,     1590,        0 ! !END! CAVE
645          ! X =  -715.20,  -838.50,     1583,        0 ! !END! CAVE
646          ! X =  -714.42,  -838.57,     1704,        0 ! !END! CAVE
647          ! X =  -713.64,  -838.63,     1715,        0 ! !END! CAVE
648          ! X =  -712.85,  -838.70,     1661,        0 ! !END! CAVE
649          ! X =  -712.07,  -838.76,     1598,        0 ! !END! CAVE
650          ! X =  -711.29,  -838.83,     1535,        0 ! !END! CAVE
651          ! X =  -710.50,  -838.89,     1546,        0 ! !END! CAVE
652          ! X =  -709.72,  -838.96,     1440,        0 ! !END! CAVE
653          ! X =  -708.94,  -839.02,     1343,        0 ! !END! CAVE
654          ! X =  -708.16,  -839.09,     1320,        0 ! !END! CAVE
655          ! X =  -707.37,  -839.15,     1280,        0 ! !END! CAVE
656          ! X =  -706.59,  -839.22,     1402,        0 ! !END! CAVE
657          ! X =  -705.81,  -839.28,     1402,        0 ! !END! CAVE
658          ! X =  -705.02,  -839.35,     1378,        0 ! !END! CAVE
659          ! X =  -704.24,  -839.41,     1298,        0 ! !END! CAVE
660          ! X =  -703.46,  -839.48,     1219,        0 ! !END! CAVE
661          ! X =  -702.68,  -839.54,     1209,        0 ! !END! CAVE
662          ! X =  -701.89,  -839.60,     1173,        0 ! !END! CAVE
663          ! X =  -701.11,  -839.67,     1149,        0 ! !END! CAVE
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664          ! X =  -700.33,  -839.73,     1134,        0 ! !END! CAVE
665          ! X =  -699.54,  -839.80,     1128,        0 ! !END! CAVE
666          ! X =  -698.76,  -839.86,     1121,        0 ! !END! CAVE
667          ! X =  -697.98,  -839.93,     1111,        0 ! !END! CAVE
668          ! X =  -713.56,  -837.71,     1550,        0 ! !END! CAVE
669          ! X =  -712.78,  -837.77,     1598,        0 ! !END! CAVE
670          ! X =  -711.99,  -837.84,     1610,        0 ! !END! CAVE
671          ! X =  -711.21,  -837.90,     1567,        0 ! !END! CAVE
672          ! X =  -710.43,  -837.97,     1571,        0 ! !END! CAVE
673          ! X =  -709.64,  -838.03,     1461,        0 ! !END! CAVE
674          ! X =  -708.86,  -838.10,     1460,        0 ! !END! CAVE
675          ! X =  -708.08,  -838.16,     1341,        0 ! !END! CAVE
676          ! X =  -707.30,  -838.23,     1400,        0 ! !END! CAVE
677          ! X =  -706.51,  -838.29,     1373,        0 ! !END! CAVE
678          ! X =  -705.73,  -838.36,     1375,        0 ! !END! CAVE
679          ! X =  -704.95,  -838.42,     1402,        0 ! !END! CAVE
680          ! X =  -704.17,  -838.49,     1401,        0 ! !END! CAVE
681          ! X =  -703.38,  -838.55,     1376,        0 ! !END! CAVE
682          ! X =  -702.60,  -838.62,     1341,        0 ! !END! CAVE
683          ! X =  -701.82,  -838.68,     1341,        0 ! !END! CAVE
684          ! X =  -701.03,  -838.74,     1276,        0 ! !END! CAVE
685          ! X =  -700.25,  -838.81,     1250,        0 ! !END! CAVE
686          ! X =  -699.47,  -838.87,     1218,        0 ! !END! CAVE
687          ! X =  -698.69,  -838.94,     1156,        0 ! !END! CAVE
688          ! X =  -697.90,  -839.00,     1138,        0 ! !END! CAVE
689          ! X =  -697.12,  -839.06,     1133,        0 ! !END! CAVE
690          ! X =  -696.34,  -839.13,     1119,        0 ! !END! CAVE
691          ! X =  -695.55,  -839.19,     1118,        0 ! !END! CAVE
692          ! X =  -711.92,  -836.91,     1443,        0 ! !END! CAVE
693          ! X =  -711.13,  -836.98,     1524,        0 ! !END! CAVE
694          ! X =  -710.35,  -837.04,     1495,        0 ! !END! CAVE
695          ! X =  -709.57,  -837.11,     1463,        0 ! !END! CAVE
696          ! X =  -708.79,  -837.17,     1406,        0 ! !END! CAVE
697          ! X =  -708.00,  -837.24,     1402,        0 ! !END! CAVE
698          ! X =  -707.22,  -837.30,     1402,        0 ! !END! CAVE
699          ! X =  -706.44,  -837.37,     1402,        0 ! !END! CAVE
700          ! X =  -705.65,  -837.43,     1377,        0 ! !END! CAVE
701          ! X =  -704.87,  -837.50,     1341,        0 ! !END! CAVE
702          ! X =  -704.09,  -837.56,     1341,        0 ! !END! CAVE
703          ! X =  -703.31,  -837.63,     1341,        0 ! !END! CAVE
704          ! X =  -702.52,  -837.69,     1341,        0 ! !END! CAVE
705          ! X =  -701.74,  -837.75,     1339,        0 ! !END! CAVE
706          ! X =  -700.96,  -837.82,     1339,        0 ! !END! CAVE
707          ! X =  -700.18,  -837.88,     1285,        0 ! !END! CAVE
708          ! X =  -699.39,  -837.95,     1280,        0 ! !END! CAVE
709          ! X =  -698.61,  -838.01,     1280,        0 ! !END! CAVE
710          ! X =  -697.83,  -838.08,     1280,        0 ! !END! CAVE
711          ! X =  -697.04,  -838.14,     1219,        0 ! !END! CAVE
712          ! X =  -696.26,  -838.20,     1211,        0 ! !END! CAVE
713          ! X =  -695.48,  -838.27,     1158,        0 ! !END! CAVE
714          ! X =  -707.93,  -836.31,     1447,        0 ! !END! CAVE
715          ! X =  -707.14,  -836.38,     1442,        0 ! !END! CAVE
716          ! X =  -706.36,  -836.44,     1424,        0 ! !END! CAVE
717          ! X =  -705.58,  -836.51,     1402,        0 ! !END! CAVE
718          ! X =  -704.80,  -836.57,     1400,        0 ! !END! CAVE
719          ! X =  -704.01,  -836.64,     1348,        0 ! !END! CAVE
720          ! X =  -703.23,  -836.70,     1341,        0 ! !END! CAVE
721          ! X =  -702.45,  -836.77,     1292,        0 ! !END! CAVE
722          ! X =  -701.66,  -836.83,     1280,        0 ! !END! CAVE
723          ! X =  -700.88,  -836.89,     1280,        0 ! !END! CAVE
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724          ! X =  -700.10,  -836.96,     1248,        0 ! !END! CAVE
725          ! X =  -699.32,  -837.02,     1219,        0 ! !END! CAVE
726          ! X =  -698.53,  -837.09,     1219,        0 ! !END! CAVE
727          ! X =  -697.75,  -837.15,     1242,        0 ! !END! CAVE
728          ! X =  -696.97,  -837.21,     1219,        0 ! !END! CAVE
729          ! X =  -696.19,  -837.28,     1148,        0 ! !END! CAVE
730          ! X =  -695.40,  -837.34,     1152,        0 ! !END! CAVE
731          ! X =  -694.62,  -837.41,     1219,        0 ! !END! CAVE
732          ! X =  -699.24,  -836.10,     1281,        0 ! !END! CAVE
733          ! X =  -698.46,  -836.16,     1305,        0 ! !END! CAVE
734          ! X =  -697.68,  -836.23,     1236,        0 ! !END! CAVE
735          ! X =  -696.89,  -836.29,     1230,        0 ! !END! CAVE
736          ! X =  -696.11,  -836.35,     1229,        0 ! !END! CAVE
737          ! X =  -747.39,  -873.01,     1359,        0 ! !END! GUMO
738          ! X =  -745.81,  -873.15,     1341,        0 ! !END! GUMO
739          ! X =  -744.24,  -873.29,     1341,        0 ! !END! GUMO
740          ! X =  -742.67,  -873.42,     1338,        0 ! !END! GUMO
741          ! X =  -747.23,  -871.16,     1360,        0 ! !END! GUMO
742          ! X =  -745.65,  -871.30,     1377,        0 ! !END! GUMO
743          ! X =  -744.08,  -871.44,     1379,        0 ! !END! GUMO
744          ! X =  -742.51,  -871.57,     1402,        0 ! !END! GUMO
745          ! X =  -754.92,  -868.63,     1104,        0 ! !END! GUMO
746          ! X =  -753.35,  -868.76,     1125,        0 ! !END! GUMO
747          ! X =  -751.78,  -868.90,     1139,        0 ! !END! GUMO
748          ! X =  -748.64,  -869.18,     1375,        0 ! !END! GUMO
749          ! X =  -747.06,  -869.31,     1315,        0 ! !END! GUMO
750          ! X =  -745.49,  -869.45,     1424,        0 ! !END! GUMO
751          ! X =  -743.92,  -869.59,     1540,        0 ! !END! GUMO
752          ! X =  -742.35,  -869.72,     1608,        0 ! !END! GUMO
753          ! X =  -757.90,  -866.50,     1098,        0 ! !END! GUMO
754          ! X =  -756.33,  -866.64,     1097,        0 ! !END! GUMO
755          ! X =  -754.76,  -866.78,     1109,        0 ! !END! GUMO
756          ! X =  -753.19,  -866.91,     1127,        0 ! !END! GUMO
757          ! X =  -751.62,  -867.05,     1166,        0 ! !END! GUMO
758          ! X =  -750.04,  -867.19,     1207,        0 ! !END! GUMO
759          ! X =  -748.47,  -867.33,     1272,        0 ! !END! GUMO
760          ! X =  -746.90,  -867.46,     1349,        0 ! !END! GUMO
761          ! X =  -745.33,  -867.60,     1463,        0 ! !END! GUMO
762          ! X =  -743.76,  -867.74,     1706,        0 ! !END! GUMO
763          ! X =  -742.19,  -867.87,     2061,        0 ! !END! GUMO
764          ! X =  -740.62,  -868.01,     1829,        0 ! !END! GUMO
765          ! X =  -757.74,  -864.65,     1100,        0 ! !END! GUMO
766          ! X =  -756.16,  -864.79,     1099,        0 ! !END! GUMO
767          ! X =  -754.59,  -864.93,     1111,        0 ! !END! GUMO
768          ! X =  -753.02,  -865.06,     1126,        0 ! !END! GUMO
769          ! X =  -751.45,  -865.20,     1158,        0 ! !END! GUMO
770          ! X =  -749.88,  -865.34,     1217,        0 ! !END! GUMO
771          ! X =  -748.31,  -865.48,     1265,        0 ! !END! GUMO
772          ! X =  -746.74,  -865.61,     1351,        0 ! !END! GUMO
773          ! X =  -745.17,  -865.75,     1677,        0 ! !END! GUMO
774          ! X =  -743.60,  -865.89,     2095,        0 ! !END! GUMO
775          ! X =  -742.03,  -866.02,     2271,        0 ! !END! GUMO
776          ! X =  -740.46,  -866.16,     2043,        0 ! !END! GUMO
777          ! X =  -738.89,  -866.30,     1755,        0 ! !END! GUMO
778          ! X =  -737.32,  -866.43,     1677,        0 ! !END! GUMO
779          ! X =  -735.75,  -866.57,     1616,        0 ! !END! GUMO
780          ! X =  -757.57,  -862.80,     1097,        0 ! !END! GUMO
781          ! X =  -756.00,  -862.94,     1101,        0 ! !END! GUMO
782          ! X =  -754.43,  -863.08,     1115,        0 ! !END! GUMO
783          ! X =  -752.86,  -863.21,     1125,        0 ! !END! GUMO
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784          ! X =  -751.29,  -863.35,     1150,        0 ! !END! GUMO
785          ! X =  -749.72,  -863.49,     1205,        0 ! !END! GUMO
786          ! X =  -748.15,  -863.63,     1279,        0 ! !END! GUMO
787          ! X =  -746.58,  -863.76,     1534,        0 ! !END! GUMO
788          ! X =  -745.01,  -863.90,     2028,        0 ! !END! GUMO
789          ! X =  -743.44,  -864.04,     2369,        0 ! !END! GUMO
790          ! X =  -741.87,  -864.17,     2084,        0 ! !END! GUMO
791          ! X =  -740.30,  -864.31,     2264,        0 ! !END! GUMO
792          ! X =  -738.73,  -864.45,     2141,        0 ! !END! GUMO
793          ! X =  -737.16,  -864.58,     1755,        0 ! !END! GUMO
794          ! X =  -735.59,  -864.72,     1645,        0 ! !END! GUMO
795          ! X =  -757.41,  -860.95,     1097,        0 ! !END! GUMO
796          ! X =  -755.84,  -861.09,     1098,        0 ! !END! GUMO
797          ! X =  -754.27,  -861.23,     1114,        0 ! !END! GUMO
798          ! X =  -752.70,  -861.37,     1128,        0 ! !END! GUMO
799          ! X =  -751.13,  -861.50,     1162,        0 ! !END! GUMO
800          ! X =  -749.56,  -861.64,     1227,        0 ! !END! GUMO
801          ! X =  -747.99,  -861.78,     1352,        0 ! !END! GUMO
802          ! X =  -746.42,  -861.91,     1799,        0 ! !END! GUMO
803          ! X =  -744.85,  -862.05,     2061,        0 ! !END! GUMO
804          ! X =  -743.28,  -862.19,     2508,        0 ! !END! GUMO
805          ! X =  -741.71,  -862.32,     2334,        0 ! !END! GUMO
806          ! X =  -740.14,  -862.46,     2390,        0 ! !END! GUMO
807          ! X =  -738.57,  -862.60,     2316,        0 ! !END! GUMO
808          ! X =  -737.00,  -862.73,     2251,        0 ! !END! GUMO
809          ! X =  -735.43,  -862.87,     1789,        0 ! !END! GUMO
810          ! X =  -755.67,  -859.24,     1099,        0 ! !END! GUMO
811          ! X =  -754.11,  -859.38,     1109,        0 ! !END! GUMO
812          ! X =  -752.54,  -859.52,     1127,        0 ! !END! GUMO
813          ! X =  -750.97,  -859.65,     1158,        0 ! !END! GUMO
814          ! X =  -749.40,  -859.79,     1218,        0 ! !END! GUMO
815          ! X =  -747.83,  -859.93,     1433,        0 ! !END! GUMO
816          ! X =  -746.26,  -860.07,     1666,        0 ! !END! GUMO
817          ! X =  -744.69,  -860.20,     2202,        0 ! !END! GUMO
818          ! X =  -743.12,  -860.34,     2438,        0 ! !END! GUMO
819          ! X =  -741.55,  -860.47,     2255,        0 ! !END! GUMO
820          ! X =  -739.98,  -860.61,     2236,        0 ! !END! GUMO
821          ! X =  -738.41,  -860.75,     2438,        0 ! !END! GUMO
822          ! X =  -736.84,  -860.88,     2239,        0 ! !END! GUMO
823          ! X =  -735.27,  -861.02,     2211,        0 ! !END! GUMO
824          ! X =  -733.70,  -861.15,     1688,        0 ! !END! GUMO
825          ! X =  -730.56,  -861.42,     1516,        0 ! !END! GUMO
826          ! X =  -750.80,  -857.80,     1143,        0 ! !END! GUMO
827          ! X =  -749.23,  -857.94,     1206,        0 ! !END! GUMO
828          ! X =  -747.67,  -858.08,     1604,        0 ! !END! GUMO
829          ! X =  -746.10,  -858.22,     1947,        0 ! !END! GUMO
830          ! X =  -744.53,  -858.35,     2080,        0 ! !END! GUMO
831          ! X =  -742.96,  -858.49,     2084,        0 ! !END! GUMO
832          ! X =  -741.39,  -858.62,     2126,        0 ! !END! GUMO
833          ! X =  -739.82,  -858.76,     2308,        0 ! !END! GUMO
834          ! X =  -738.25,  -858.90,     2013,        0 ! !END! GUMO
835          ! X =  -736.68,  -859.03,     1897,        0 ! !END! GUMO
836          ! X =  -735.11,  -859.17,     1800,        0 ! !END! GUMO
837          ! X =  -733.54,  -859.30,     1732,        0 ! !END! GUMO
838          ! X =  -750.64,  -855.95,     1144,        0 ! !END! GUMO
839          ! X =  -749.07,  -856.09,     1269,        0 ! !END! GUMO
840          ! X =  -747.50,  -856.23,     1709,        0 ! !END! GUMO
841          ! X =  -745.94,  -856.37,     1951,        0 ! !END! GUMO
842          ! X =  -744.37,  -856.50,     1961,        0 ! !END! GUMO
843          ! X =  -742.80,  -856.64,     1950,        0 ! !END! GUMO
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844	! X =	-741.23,	-856.77,	2180,	0	!	!END!	GUMO
845	! X =	-739.66,	-856.91,	2069,	0	!	!END!	GUMO
846	! X =	-738.09,	-857.05,	2265,	0	!	!END!	GUMO
847	! X =	-736.52,	-857.18,	2251,	0	!	!END!	GUMO
848	! X =	-734.95,	-857.32,	1791,	0	!	!END!	GUMO
849	! X =	-733.38,	-857.45,	1851,	0	!	!END!	GUMO
850	! X =	-731.81,	-857.59,	1575,	0	!	!END!	GUMO
851	! X =	-750.48,	-854.10,	1188,	0	!	!END!	GUMO
852	! X =	-748.91,	-854.24,	1407,	0	!	!END!	GUMO
853	! X =	-747.34,	-854.38,	1932,	0	!	!END!	GUMO
854	! X =	-745.77,	-854.52,	1888,	0	!	!END!	GUMO
855	! X =	-744.21,	-854.65,	1914,	0	!	!END!	GUMO
856	! X =	-742.64,	-854.79,	1919,	0	!	!END!	GUMO
857	! X =	-741.07,	-854.93,	2095,	0	!	!END!	GUMO
858	! X =	-739.50,	-855.06,	1921,	0	!	!END!	GUMO
859	! X =	-737.93,	-855.20,	2164,	0	!	!END!	GUMO
860	! X =	-736.36,	-855.33,	1959,	0	!	!END!	GUMO
861	! X =	-734.79,	-855.47,	1841,	0	!	!END!	GUMO
862	! X =	-733.22,	-855.60,	2063,	0	!	!END!	GUMO
863	! X =	-731.66,	-855.74,	1927,	0	!	!END!	GUMO
864	! X =	269.69,	-618.62,	365,	0	!	!END!	CACR
865	! X =	270.45,	-618.59,	365,	0	!	!END!	CACR
866	! X =	271.22,	-618.57,	368,	0	!	!END!	CACR
867	! X =	268.14,	-617.74,	411,	0	!	!END!	CACR
868	! X =	268.90,	-617.72,	462,	0	!	!END!	CACR
869	! X =	269.66,	-617.69,	431,	0	!	!END!	CACR
870	! X =	270.42,	-617.67,	518,	0	!	!END!	CACR
871	! X =	271.19,	-617.64,	487,	0	!	!END!	CACR
872	! X =	271.95,	-617.62,	396,	0	!	!END!	CACR
873	! X =	265.06,	-616.92,	518,	0	!	!END!	CACR
874	! X =	265.82,	-616.89,	523,	0	!	!END!	CACR
875	! X =	266.58,	-616.87,	548,	0	!	!END!	CACR
876	! X =	267.34,	-616.84,	579,	0	!	!END!	CACR
877	! X =	268.11,	-616.82,	547,	0	!	!END!	CACR
878	! X =	268.87,	-616.80,	538,	0	!	!END!	CACR
879	! X =	269.63,	-616.77,	640,	0	!	!END!	CACR
880	! X =	270.39,	-616.75,	608,	0	!	!END!	CACR
881	! X =	259.69,	-616.16,	335,	0	!	!END!	CACR
882	! X =	260.45,	-616.14,	431,	0	!	!END!	CACR
883	! X =	261.22,	-616.11,	457,	0	!	!END!	CACR
884	! X =	261.98,	-616.09,	414,	0	!	!END!	CACR
885	! X =	262.74,	-616.07,	426,	0	!	!END!	CACR
886	! X =	263.50,	-616.04,	426,	0	!	!END!	CACR
887	! X =	264.27,	-616.02,	388,	0	!	!END!	CACR
888	! X =	265.03,	-615.99,	388,	0	!	!END!	CACR
889	! X =	265.79,	-615.97,	365,	0	!	!END!	CACR
890	! X =	266.55,	-615.94,	386,	0	!	!END!	CACR
891	! X =	267.31,	-615.92,	396,	0	!	!END!	CACR
892	! X =	268.08,	-615.90,	426,	0	!	!END!	CACR
893	! X =	268.84,	-615.87,	446,	0	!	!END!	CACR
894	! X =	269.60,	-615.85,	441,	0	!	!END!	CACR
895	! X =	270.36,	-615.82,	457,	0	!	!END!	CACR
896	! X =	271.13,	-615.80,	465,	0	!	!END!	CACR
897	! X =	271.89,	-615.77,	442,	0	!	!END!	CACR
898	! X =	272.65,	-615.75,	426,	0	!	!END!	CACR
899	! X =	259.66,	-615.24,	304,	0	!	!END!	CACR
900	! X =	260.42,	-615.21,	304,	0	!	!END!	CACR
901	! X =	261.19,	-615.19,	319,	0	!	!END!	CACR
902	! X =	261.95,	-615.17,	334,	0	!	!END!	CACR
903	! X =	262.71,	-615.14,	370,	0	!	!END!	CACR

904	! X =	263.47,	-615.12,	405,	0	!	!END!	CACR
905	! X =	264.24,	-615.09,	409,	0	!	!END!	CACR
906	! X =	265.00,	-615.07,	450,	0	!	!END!	CACR
907	! X =	265.76,	-615.05,	518,	0	!	!END!	CACR
908	! X =	266.52,	-615.02,	609,	0	!	!END!	CACR
909	! X =	267.29,	-615.00,	534,	0	!	!END!	CACR
910	! X =	268.05,	-614.97,	517,	0	!	!END!	CACR
911	! X =	268.81,	-614.95,	575,	0	!	!END!	CACR
912	! X =	269.57,	-614.92,	600,	0	!	!END!	CACR
913	! X =	270.33,	-614.90,	609,	0	!	!END!	CACR
914	! X =	271.10,	-614.87,	609,	0	!	!END!	CACR
915	! X =	271.86,	-614.85,	561,	0	!	!END!	CACR
916	! X =	260.40,	-614.29,	335,	0	!	!END!	CACR
917	! X =	261.16,	-614.27,	432,	0	!	!END!	CACR
918	! X =	261.92,	-614.24,	487,	0	!	!END!	CACR
919	! X =	262.68,	-614.22,	499,	0	!	!END!	CACR
920	! X =	263.44,	-614.19,	514,	0	!	!END!	CACR
921	! X =	264.21,	-614.17,	442,	0	!	!END!	CACR
922	! X =	264.97,	-614.15,	439,	0	!	!END!	CACR
923	! X =	265.73,	-614.12,	395,	0	!	!END!	CACR
924	! X =	266.49,	-614.10,	400,	0	!	!END!	CACR
925	! X =	267.26,	-614.07,	426,	0	!	!END!	CACR
926	! X =	268.02,	-614.05,	487,	0	!	!END!	CACR
927	! X =	268.78,	-614.02,	548,	0	!	!END!	CACR
928	! X =	269.54,	-614.00,	548,	0	!	!END!	CACR
929	! X =	270.30,	-613.97,	548,	0	!	!END!	CACR
930	! X =	271.07,	-613.95,	535,	0	!	!END!	CACR
931	! X =	261.13,	-613.34,	304,	0	!	!END!	CACR
932	! X =	261.89,	-613.32,	334,	0	!	!END!	CACR
933	! X =	262.65,	-613.29,	396,	0	!	!END!	CACR
934	! X =	263.41,	-613.27,	457,	0	!	!END!	CACR
935	! X =	264.18,	-613.25,	457,	0	!	!END!	CACR
936	! X =	264.94,	-613.22,	426,	0	!	!END!	CACR
937	! X =	265.70,	-613.20,	411,	0	!	!END!	CACR
938	! X =	266.46,	-613.17,	406,	0	!	!END!	CACR
939	! X =	267.23,	-613.15,	396,	0	!	!END!	CACR
940	! X =	267.99,	-613.12,	401,	0	!	!END!	CACR
941	! X =	268.75,	-613.10,	397,	0	!	!END!	CACR
942	! X =	261.10,	-612.42,	322,	0	!	!END!	CACR
943	! X =	261.86,	-612.39,	334,	0	!	!END!	CACR
944	! X =	359.82,	-362.00,	274,	0	!	!END!	HEGL
945	! X =	360.56,	-361.97,	299,	0	!	!END!	HEGL
946	! X =	361.30,	-361.93,	328,	0	!	!END!	HEGL
947	! X =	362.04,	-361.90,	365,	0	!	!END!	HEGL
948	! X =	358.30,	-361.14,	250,	0	!	!END!	HEGL
949	! X =	359.04,	-361.11,	278,	0	!	!END!	HEGL
950	! X =	359.78,	-361.08,	335,	0	!	!END!	HEGL
951	! X =	360.52,	-361.05,	307,	0	!	!END!	HEGL
952	! X =	361.26,	-361.01,	345,	0	!	!END!	HEGL
953	! X =	357.52,	-360.26,	261,	0	!	!END!	HEGL
954	! X =	358.26,	-360.22,	271,	0	!	!END!	HEGL
955	! X =	359.00,	-360.19,	274,	0	!	!END!	HEGL
956	! X =	359.74,	-360.16,	331,	0	!	!END!	HEGL
957	! X =	360.48,	-360.12,	327,	0	!	!END!	HEGL
958	! X =	361.22,	-360.09,	304,	0	!	!END!	HEGL
959	! X =	361.95,	-360.06,	335,	0	!	!END!	HEGL
960	! X =	362.69,	-360.02,	312,	0	!	!END!	HEGL
961	! X =	363.43,	-359.99,	340,	0	!	!END!	HEGL
962	! X =	364.17,	-359.96,	361,	0	!	!END!	HEGL
963	! X =	364.91,	-359.92,	382,	0	!	!END!	HEGL

964	! X =	357.48,	-359.33,	274,	0	!	!END!	HEGL
965	! X =	358.22,	-359.30,	274,	0	!	!END!	HEGL
966	! X =	358.96,	-359.27,	335,	0	!	!END!	HEGL
967	! X =	359.70,	-359.24,	294,	0	!	!END!	HEGL
968	! X =	360.44,	-359.20,	304,	0	!	!END!	HEGL
969	! X =	361.17,	-359.17,	279,	0	!	!END!	HEGL
970	! X =	361.91,	-359.14,	304,	0	!	!END!	HEGL
971	! X =	362.65,	-359.10,	318,	0	!	!END!	HEGL
972	! X =	363.39,	-359.07,	335,	0	!	!END!	HEGL
973	! X =	364.13,	-359.04,	347,	0	!	!END!	HEGL
974	! X =	364.87,	-359.00,	340,	0	!	!END!	HEGL
975	! X =	358.92,	-358.35,	247,	0	!	!END!	HEGL
976	! X =	359.66,	-358.31,	271,	0	!	!END!	HEGL
977	! X =	360.39,	-358.28,	275,	0	!	!END!	HEGL
978	! X =	361.13,	-358.25,	274,	0	!	!END!	HEGL
979	! X =	361.87,	-358.21,	277,	0	!	!END!	HEGL
980	! X =	362.61,	-358.18,	304,	0	!	!END!	HEGL
981	! X =	363.35,	-358.15,	330,	0	!	!END!	HEGL
982	! X =	364.09,	-358.12,	357,	0	!	!END!	HEGL
983	! X =	364.83,	-358.08,	384,	0	!	!END!	HEGL
984	! X =	365.57,	-358.05,	372,	0	!	!END!	HEGL
985	! X =	356.66,	-357.52,	274,	0	!	!END!	HEGL
986	! X =	357.40,	-357.49,	293,	0	!	!END!	HEGL
987	! X =	358.14,	-357.46,	272,	0	!	!END!	HEGL
988	! X =	358.88,	-357.43,	271,	0	!	!END!	HEGL
989	! X =	359.61,	-357.39,	274,	0	!	!END!	HEGL
990	! X =	360.35,	-357.36,	327,	0	!	!END!	HEGL
991	! X =	361.09,	-357.33,	316,	0	!	!END!	HEGL
992	! X =	361.83,	-357.29,	304,	0	!	!END!	HEGL
993	! X =	362.57,	-357.26,	354,	0	!	!END!	HEGL
994	! X =	363.31,	-357.23,	346,	0	!	!END!	HEGL
995	! X =	364.05,	-357.19,	335,	0	!	!END!	HEGL
996	! X =	364.79,	-357.16,	344,	0	!	!END!	HEGL
997	! X =	365.52,	-357.13,	364,	0	!	!END!	HEGL
998	! X =	357.36,	-356.57,	243,	0	!	!END!	HEGL
999	! X =	358.10,	-356.54,	335,	0	!	!END!	HEGL
1000	! X =	358.83,	-356.50,	324,	0	!	!END!	HEGL
KYOUR000	! X =	359.57,	-356.47,	335,	0	!	!END!	HEGL
KYOUR001	! X =	360.31,	-356.44,	341,	0	!	!END!	HEGL
KYOUR002	! X =	361.05,	-356.41,	333,	0	!	!END!	HEGL
KYOUR003	! X =	361.79,	-356.37,	306,	0	!	!END!	HEGL
KYOUR004	! X =	362.53,	-356.34,	304,	0	!	!END!	HEGL
KYOUR005	! X =	363.27,	-356.31,	365,	0	!	!END!	HEGL
KYOUR006	! X =	364.01,	-356.27,	304,	0	!	!END!	HEGL
KYOUR007	! X =	364.74,	-356.24,	309,	0	!	!END!	HEGL
KYOUR008	! X =	365.48,	-356.21,	307,	0	!	!END!	HEGL
KYOUR009	! X =	357.32,	-355.65,	270,	0	!	!END!	HEGL
KYOUR00A	! X =	358.06,	-355.62,	274,	0	!	!END!	HEGL
KYOUR00B	! X =	358.79,	-355.58,	301,	0	!	!END!	HEGL
KYOUR00C	! X =	359.53,	-355.55,	274,	0	!	!END!	HEGL
KYOUR00D	! X =	360.27,	-355.52,	274,	0	!	!END!	HEGL
KYOUR00E	! X =	361.01,	-355.48,	312,	0	!	!END!	HEGL
KYOUR00F	! X =	361.75,	-355.45,	274,	0	!	!END!	HEGL
KYOUR00G	! X =	362.49,	-355.42,	322,	0	!	!END!	HEGL
KYOUR00H	! X =	363.23,	-355.38,	304,	0	!	!END!	HEGL
KYOUR00I	! X =	363.96,	-355.35,	275,	0	!	!END!	HEGL
KYOUR00J	! X =	364.70,	-355.32,	304,	0	!	!END!	HEGL
KYOUR00K	! X =	365.44,	-355.28,	290,	0	!	!END!	HEGL
KYOUR00L	! X =	362.45,	-354.50,	249,	0	!	!END!	HEGL
KYOUR00M	! X =	363.18,	-354.46,	274,	0	!	!END!	HEGL

KYOUR00N	!	X =	596.70,	-315.57,	106,	0	!	!END!	MING
KYOUR00O	!	X =	598.17,	-315.46,	102,	0	!	!END!	MING
KYOUR00P	!	X =	597.37,	-314.59,	105,	0	!	!END!	MING
KYOUR00Q	!	X =	598.11,	-314.54,	102,	0	!	!END!	MING
KYOUR00R	!	X =	598.84,	-314.48,	102,	0	!	!END!	MING
KYOUR00S	!	X =	597.30,	-313.67,	114,	0	!	!END!	MING
KYOUR00T	!	X =	598.04,	-313.62,	104,	0	!	!END!	MING
KYOUR00U	!	X =	598.77,	-313.56,	102,	0	!	!END!	MING
KYOUR00V	!	X =	599.51,	-313.51,	102,	0	!	!END!	MING
KYOUR00W	!	X =	600.24,	-313.45,	102,	0	!	!END!	MING
KYOUR00X	!	X =	600.98,	-313.40,	103,	0	!	!END!	MING
KYOUR00Y	!	X =	597.97,	-312.70,	108,	0	!	!END!	MING
KYOUR00Z	!	X =	598.70,	-312.65,	105,	0	!	!END!	MING
KYOUR010	!	X =	599.44,	-312.59,	102,	0	!	!END!	MING
KYOUR011	!	X =	600.17,	-312.54,	102,	0	!	!END!	MING
KYOUR012	!	X =	600.91,	-312.48,	102,	0	!	!END!	MING
KYOUR013	!	X =	601.64,	-312.42,	102,	0	!	!END!	MING
KYOUR014	!	X =	602.38,	-312.37,	102,	0	!	!END!	MING
KYOUR015	!	X =	603.11,	-312.31,	102,	0	!	!END!	MING
KYOUR016	!	X =	598.63,	-311.73,	121,	0	!	!END!	MING
KYOUR017	!	X =	599.37,	-311.67,	104,	0	!	!END!	MING
KYOUR018	!	X =	600.10,	-311.62,	102,	0	!	!END!	MING
KYOUR019	!	X =	600.84,	-311.56,	102,	0	!	!END!	MING
KYOUR01A	!	X =	601.57,	-311.51,	102,	0	!	!END!	MING
KYOUR01B	!	X =	602.31,	-311.45,	102,	0	!	!END!	MING
KYOUR01C	!	X =	603.04,	-311.40,	102,	0	!	!END!	MING
KYOUR01D	!	X =	599.30,	-310.75,	121,	0	!	!END!	MING
KYOUR01E	!	X =	600.03,	-310.70,	105,	0	!	!END!	MING
KYOUR01F	!	X =	600.77,	-310.64,	102,	0	!	!END!	MING
KYOUR01G	!	X =	601.50,	-310.59,	102,	0	!	!END!	MING
KYOUR01H	!	X =	602.24,	-310.53,	102,	0	!	!END!	MING
KYOUR01I	!	X =	602.97,	-310.48,	101,	0	!	!END!	MING
KYOUR01J	!	X =	599.97,	-309.78,	117,	0	!	!END!	MING
KYOUR01K	!	X =	600.70,	-309.72,	101,	0	!	!END!	MING
KYOUR01L	!	X =	601.43,	-309.67,	101,	0	!	!END!	MING
KYOUR01M	!	X =	602.17,	-309.61,	102,	0	!	!END!	MING
KYOUR01N	!	X =	602.90,	-309.56,	101,	0	!	!END!	MING
KYOUR01O	!	X =	600.63,	-308.80,	106,	0	!	!END!	MING
KYOUR01P	!	X =	601.36,	-308.75,	102,	0	!	!END!	MING
KYOUR01Q	!	X =	602.10,	-308.69,	102,	0	!	!END!	MING
KYOUR01R	!	X =	602.83,	-308.64,	102,	0	!	!END!	MING
KYOUR01S	!	X =	601.30,	-307.83,	103,	0	!	!END!	MING
KYOUR01T	!	X =	602.03,	-307.77,	102,	0	!	!END!	MING
KYOUR01U	!	X =	602.76,	-307.72,	102,	0	!	!END!	MING
KYOUR01V	!	X =	601.96,	-306.85,	103,	0	!	!END!	MING
KYOUR01W	!	X =	602.69,	-306.80,	102,	0	!	!END!	MING
KYOUR01X	!	X =	602.63,	-305.88,	103,	0	!	!END!	MING
KYOUR01Y	!	X =	-687.52,	-683.64,	1094,	0	!	!END!	SACR
KYOUR01Z	!	X =	-686.75,	-683.70,	1090,	0	!	!END!	SACR
KYOUR020	!	X =	-685.99,	-683.77,	1093,	0	!	!END!	SACR
KYOUR021	!	X =	-685.22,	-683.83,	1097,	0	!	!END!	SACR
KYOUR022	!	X =	-684.45,	-683.89,	1097,	0	!	!END!	SACR
KYOUR023	!	X =	-683.68,	-683.96,	1086,	0	!	!END!	SACR
KYOUR024	!	X =	-682.91,	-684.02,	1081,	0	!	!END!	SACR
KYOUR025	!	X =	-687.45,	-682.72,	1093,	0	!	!END!	SACR
KYOUR026	!	X =	-686.68,	-682.78,	1087,	0	!	!END!	SACR
KYOUR027	!	X =	-685.91,	-682.84,	1090,	0	!	!END!	SACR
KYOUR028	!	X =	-685.14,	-682.91,	1086,	0	!	!END!	SACR
KYOUR029	!	X =	-684.37,	-682.97,	1088,	0	!	!END!	SACR
KYOUR02A	!	X =	-683.61,	-683.03,	1083,	0	!	!END!	SACR

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KYOUR02B     ! X =  -682.84,  -683.10,     1078,        0 ! !END! SACR
KYOUR02C     ! X =  -689.68,  -681.61,     1096,        0 ! !END! SACR
KYOUR02D     ! X =  -688.91,  -681.67,     1097,        0 ! !END! SACR
KYOUR02E     ! X =  -688.14,  -681.73,     1097,        0 ! !END! SACR
KYOUR02F     ! X =  -687.37,  -681.80,     1097,        0 ! !END! SACR
KYOUR02G     ! X =  -686.60,  -681.86,     1090,        0 ! !END! SACR
KYOUR02H     ! X =  -685.84,  -681.92,     1085,        0 ! !END! SACR
KYOUR02I     ! X =  -685.07,  -681.98,     1081,        0 ! !END! SACR
KYOUR02J     ! X =  -684.30,  -682.05,     1083,        0 ! !END! SACR
KYOUR02K     ! X =  -683.53,  -682.11,     1084,        0 ! !END! SACR
KYOUR02L     ! X =  -682.76,  -682.17,     1076,        0 ! !END! SACR
KYOUR02M     ! X =  -688.83,  -680.75,     1085,        0 ! !END! SACR
KYOUR02N     ! X =  -688.06,  -680.81,     1089,        0 ! !END! SACR
KYOUR02O     ! X =  -687.30,  -680.87,     1086,        0 ! !END! SACR
KYOUR02P     ! X =  -686.53,  -680.94,     1085,        0 ! !END! SACR
KYOUR02Q     ! X =  -685.76,  -681.00,     1086,        0 ! !END! SACR
KYOUR02R     ! X =  -684.99,  -681.06,     1084,        0 ! !END! SACR
KYOUR02S     ! X =  -684.22,  -681.12,     1081,        0 ! !END! SACR
KYOUR02T     ! X =  -683.45,  -681.19,     1081,        0 ! !END! SACR
KYOUR02U     ! X =  -682.69,  -681.25,     1081,        0 ! !END! SACR
KYOUR02V     ! X =  -681.92,  -681.31,     1084,        0 ! !END! SACR
KYOUR02W     ! X =  -687.99,  -679.89,     1085,        0 ! !END! SACR
KYOUR02X     ! X =  -687.22,  -679.95,     1083,        0 ! !END! SACR
KYOUR02Y     ! X =  -686.45,  -680.01,     1081,        0 ! !END! SACR
KYOUR02Z     ! X =  -685.68,  -680.08,     1080,        0 ! !END! SACR
KYOUR030     ! X =  -684.92,  -680.14,     1079,        0 ! !END! SACR
KYOUR031     ! X =  -684.15,  -680.20,     1083,        0 ! !END! SACR
KYOUR032     ! X =  -683.38,  -680.27,     1088,        0 ! !END! SACR
KYOUR033     ! X =  -682.61,  -680.33,     1090,        0 ! !END! SACR
KYOUR034     ! X =  -681.84,  -680.39,     1091,        0 ! !END! SACR
KYOUR035     ! X =  -687.91,  -678.97,     1085,        0 ! !END! SACR
KYOUR036     ! X =  -687.15,  -679.03,     1085,        0 ! !END! SACR
KYOUR037     ! X =  -686.38,  -679.09,     1084,        0 ! !END! SACR
KYOUR038     ! X =  -685.61,  -679.15,     1089,        0 ! !END! SACR
KYOUR039     ! X =  -684.84,  -679.22,     1092,        0 ! !END! SACR
KYOUR03A     ! X =  -684.07,  -679.28,     1095,        0 ! !END! SACR
KYOUR03B     ! X =  -683.30,  -679.34,     1096,        0 ! !END! SACR
KYOUR03C     ! X =  -682.54,  -679.41,     1097,        0 ! !END! SACR
KYOUR03D     ! X =  -681.77,  -679.47,     1090,        0 ! !END! SACR
KYOUR03E     ! X =  -687.07,  -678.11,     1088,        0 ! !END! SACR
KYOUR03F     ! X =  -686.30,  -678.17,     1086,        0 ! !END! SACR
KYOUR03G     ! X =  -685.53,  -678.23,     1095,        0 ! !END! SACR
KYOUR03H     ! X =   318.33,  -456.07,      555,        0 ! !END! UPBU
KYOUR03I     ! X =   319.08,  -456.04,      589,        0 ! !END! UPBU
KYOUR03J     ! X =   321.32,  -455.95,      563,        0 ! !END! UPBU
KYOUR03K     ! X =   318.29,  -455.15,      549,        0 ! !END! UPBU
KYOUR03L     ! X =   319.04,  -455.12,      487,        0 ! !END! UPBU
KYOUR03M     ! X =   319.79,  -455.09,      487,        0 ! !END! UPBU
KYOUR03N     ! X =   320.53,  -455.06,      490,        0 ! !END! UPBU
KYOUR03O     ! X =   318.26,  -454.22,      650,        0 ! !END! UPBU
KYOUR03P     ! X =   319.00,  -454.20,      563,        0 ! !END! UPBU
KYOUR03Q     ! X =   319.75,  -454.17,      540,        0 ! !END! UPBU
KYOUR03R     ! X =   320.50,  -454.14,      502,        0 ! !END! UPBU
KYOUR03S     ! X =   321.25,  -454.11,      526,        0 ! !END! UPBU
KYOUR03T     ! X =   322.74,  -454.05,      534,        0 ! !END! UPBU
KYOUR03U     ! X =   323.49,  -454.02,      563,        0 ! !END! UPBU
KYOUR03V     ! X =   318.22,  -453.30,      548,        0 ! !END! UPBU
KYOUR03W     ! X =   318.97,  -453.27,      628,        0 ! !END! UPBU
KYOUR03X     ! X =   319.71,  -453.24,      623,        0 ! !END! UPBU
KYOUR03Y     ! X =   320.46,  -453.21,      579,        0 ! !END! UPBU
```

```
KYOUR03Z     ! X =   321.21,  -453.19,      469,        0 ! !END! UPBU
KYOUR040     ! X =   321.96,  -453.16,      457,        0 ! !END! UPBU
KYOUR041     ! X =   322.70,  -453.13,      573,        0 ! !END! UPBU
KYOUR042     ! X =   323.45,  -453.10,      605,        0 ! !END! UPBU
KYOUR043     ! X =   324.20,  -453.07,      588,        0 ! !END! UPBU
KYOUR044     ! X =   318.18,  -452.38,      608,        0 ! !END! UPBU
KYOUR045     ! X =   318.93,  -452.35,      660,        0 ! !END! UPBU
KYOUR046     ! X =   319.68,  -452.32,      598,        0 ! !END! UPBU
KYOUR047     ! X =   320.43,  -452.29,      599,        0 ! !END! UPBU
KYOUR048     ! X =   321.17,  -452.26,      639,        0 ! !END! UPBU
KYOUR049     ! X =   321.92,  -452.23,      457,        0 ! !END! UPBU
KYOUR04A     ! X =   322.67,  -452.20,      568,        0 ! !END! UPBU
KYOUR04B     ! X =   318.15,  -451.46,      730,        0 ! !END! UPBU
KYOUR04C     ! X =   318.89,  -451.43,      681,        0 ! !END! UPBU
KYOUR04D     ! X =   319.64,  -451.40,      640,        0 ! !END! UPBU
KYOUR04E     ! X =   320.39,  -451.37,      625,        0 ! !END! UPBU
KYOUR04F     ! X =   321.14,  -451.34,      426,        0 ! !END! UPBU
KYOUR04G     ! X =   321.88,  -451.31,      555,        0 ! !END! UPBU
KYOUR04H     ! X =   322.63,  -451.28,      612,        0 ! !END! UPBU
KYOUR04I     ! X =   317.36,  -450.57,      667,        0 ! !END! UPBU
KYOUR04J     ! X =   318.11,  -450.54,      580,        0 ! !END! UPBU
KYOUR04K     ! X =   318.86,  -450.51,      656,        0 ! !END! UPBU
KYOUR04L     ! X =   319.61,  -450.48,      640,        0 ! !END! UPBU
KYOUR04M     ! X =   320.35,  -450.45,      487,        0 ! !END! UPBU
KYOUR04N     ! X =   321.10,  -450.42,      457,        0 ! !END! UPBU
KYOUR04O     ! X =   321.85,  -450.39,      654,        0 ! !END! UPBU
KYOUR04P     ! X =   322.59,  -450.36,      548,        0 ! !END! UPBU
KYOUR04Q     ! X =   323.34,  -450.33,      622,        0 ! !END! UPBU
KYOUR04R     ! X =   324.09,  -450.30,      683,        0 ! !END! UPBU
KYOUR04S     ! X =   317.33,  -449.64,      579,        0 ! !END! UPBU
KYOUR04T     ! X =   318.08,  -449.61,      554,        0 ! !END! UPBU
KYOUR04U     ! X =   318.82,  -449.58,      609,        0 ! !END! UPBU
KYOUR04V     ! X =   319.57,  -449.56,      622,        0 ! !END! UPBU
KYOUR04W     ! X =   320.32,  -449.53,      427,        0 ! !END! UPBU
KYOUR04X     ! X =   321.06,  -449.50,      555,        0 ! !END! UPBU
KYOUR04Y     ! X =   321.81,  -449.47,      502,        0 ! !END! UPBU
KYOUR04Z     ! X =   322.56,  -449.44,      639,        0 ! !END! UPBU
KYOUR050     ! X =   323.31,  -449.41,      580,        0 ! !END! UPBU
KYOUR051     ! X =   324.05,  -449.38,      639,        0 ! !END! UPBU
KYOUR052     ! X =   318.79,  -448.66,      548,        0 ! !END! UPBU
KYOUR053     ! X =   319.53,  -448.63,      548,        0 ! !END! UPBU
KYOUR054     ! X =   320.28,  -448.60,      438,        0 ! !END! UPBU
KYOUR055     ! X =   321.03,  -448.57,      579,        0 ! !END! UPBU
KYOUR056     ! X =   322.52,  -448.52,      620,        0 ! !END! UPBU
KYOUR057     ! X =   320.24,  -447.68,      579,        0 ! !END! UPBU
KYOUR058     ! X =   320.99,  -447.65,      426,        0 ! !END! UPBU
KYOUR059     ! X =   321.74,  -447.62,      611,        0 ! !END! UPBU
KYOUR05A     ! X =   318.71,  -446.82,      604,        0 ! !END! UPBU
KYOUR05B     ! X =   319.46,  -446.79,      548,        0 ! !END! UPBU
KYOUR05C     ! X =   320.21,  -446.76,      488,        0 ! !END! UPBU
KYOUR05D     ! X =   320.95,  -446.73,      402,        0 ! !END! UPBU
KYOUR05E     ! X =   321.70,  -446.70,      579,        0 ! !END! UPBU
KYOUR05F     ! X =   322.45,  -446.67,      573,        0 ! !END! UPBU
KYOUR05G     ! X =   323.20,  -446.64,      609,        0 ! !END! UPBU
KYOUR05H     ! X =  -159.90,  -584.48,      454,        0 ! !END! WIMO
KYOUR05I     ! X =  -159.14,  -584.49,      486,        0 ! !END! WIMO
KYOUR05J     ! X =  -158.38,  -584.51,      487,        0 ! !END! WIMO
KYOUR05K     ! X =  -157.62,  -584.52,      478,        0 ! !END! WIMO
KYOUR05L     ! X =  -156.86,  -584.53,      518,        0 ! !END! WIMO
KYOUR05M     ! X =  -156.10,  -584.55,      518,        0 ! !END! WIMO
```

```
KYOUR05N     ! X =  -161.40,  -583.52,      510,        0 ! !END! WIMO
KYOUR05O     ! X =  -160.64,  -583.54,      493,        0 ! !END! WIMO
KYOUR05P     ! X =  -159.88,  -583.55,      488,        0 ! !END! WIMO
KYOUR05Q     ! X =  -159.12,  -583.57,      615,        0 ! !END! WIMO
KYOUR05R     ! X =  -158.36,  -583.58,      522,        0 ! !END! WIMO
KYOUR05S     ! X =  -157.60,  -583.60,      494,        0 ! !END! WIMO
KYOUR05T     ! X =  -156.84,  -583.61,      609,        0 ! !END! WIMO
KYOUR05U     ! X =  -156.08,  -583.63,      518,        0 ! !END! WIMO
KYOUR05V     ! X =  -162.14,  -582.58,      487,        0 ! !END! WIMO
KYOUR05W     ! X =  -161.38,  -582.60,      518,        0 ! !END! WIMO
KYOUR05X     ! X =  -160.62,  -582.61,      609,        0 ! !END! WIMO
KYOUR05Y     ! X =  -159.86,  -582.63,      554,        0 ! !END! WIMO
KYOUR05Z     ! X =  -159.10,  -582.64,      578,        0 ! !END! WIMO
KYOUR060     ! X =  -158.34,  -582.66,      557,        0 ! !END! WIMO
KYOUR061     ! X =  -157.59,  -582.67,      571,        0 ! !END! WIMO
KYOUR062     ! X =  -156.83,  -582.69,      670,        0 ! !END! WIMO
KYOUR063     ! X =  -156.07,  -582.70,      518,        0 ! !END! WIMO
KYOUR064     ! X =  -160.60,  -581.69,      518,        0 ! !END! WIMO
KYOUR065     ! X =  -159.85,  -581.71,      548,        0 ! !END! WIMO
KYOUR066     ! X =  -159.09,  -581.72,      548,        0 ! !END! WIMO
KYOUR067     ! X =  -158.33,  -581.73,      518,        0 ! !END! WIMO
KYOUR068     ! X =  -160.59,  -580.77,      517,        0 ! !END! WIMO
KYOUR069     ! X =  -159.83,  -580.78,      579,        0 ! !END! WIMO
KYOUR06A     ! X =  -159.07,  -580.80,      613,        0 ! !END! WIMO
KYOUR06B     ! X =  -158.31,  -580.81,      548,        0 ! !END! WIMO
KYOUR06C     ! X =  -157.55,  -580.82,      523,        0 ! !END! WIMO
KYOUR06D     ! X =  -161.33,  -579.83,      542,        0 ! !END! WIMO
KYOUR06E     ! X =  -160.57,  -579.84,      545,        0 ! !END! WIMO
KYOUR06F     ! X =  -159.81,  -579.86,      552,        0 ! !END! WIMO
KYOUR06G     ! X =  -152.93,  -577.21,      579,        0 ! !END! WIMO
KYOUR06H     ! X =  -155.94,  -576.23,      609,        0 ! !END! WIMO
KYOUR06I     ! X =  -155.19,  -576.25,      654,        0 ! !END! WIMO
KYOUR06J     ! X =  -154.43,  -576.26,      621,        0 ! !END! WIMO
KYOUR06K     ! X =  -153.67,  -576.28,      629,        0 ! !END! WIMO
KYOUR06L     ! X =  -152.91,  -576.29,      579,        0 ! !END! WIMO
KYOUR06M     ! X =  -152.15,  -576.31,      560,        0 ! !END! WIMO
KYOUR06N     ! X =  -156.69,  -575.30,      615,        0 ! !END! WIMO
KYOUR06O     ! X =  -155.93,  -575.31,      641,        0 ! !END! WIMO
KYOUR06P     ! X =  -155.17,  -575.32,      640,        0 ! !END! WIMO
KYOUR06Q     ! X =  -154.41,  -575.34,      662,        0 ! !END! WIMO
KYOUR06R     ! X =  -153.65,  -575.35,      618,        0 ! !END! WIMO
KYOUR06S     ! X =  -152.89,  -575.37,      630,        0 ! !END! WIMO
KYOUR06T     ! X =  -152.13,  -575.38,      534,        0 ! !END! WIMO
KYOUR06U     ! X =  -156.67,  -574.37,      606,        0 ! !END! WIMO
KYOUR06V     ! X =  -155.91,  -574.39,      566,        0 ! !END! WIMO
KYOUR06W     ! X =  -155.15,  -574.40,      633,        0 ! !END! WIMO
KYOUR06X     ! X =  -154.39,  -574.42,      670,        0 ! !END! WIMO
KYOUR06Y     ! X =  -153.63,  -574.43,      609,        0 ! !END! WIMO
KYOUR06Z     ! X =  -152.88,  -574.44,      579,        0 ! !END! WIMO
KYOUR070     ! X =  -152.12,  -574.46,      535,        0 ! !END! WIMO
KYOUR071     ! X =  -155.13,  -573.48,      548,        0 ! !END! WIMO
KYOUR072     ! X =  -154.38,  -573.49,      518,        0 ! !END! WIMO
KYOUR073     ! X =  -153.62,  -573.51,      506,        0 ! !END! WIMO

-------------
    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 D

SAMPLE POSTUTIL CONTROL FILE

```
Invista - Orange BART Analysis
2001 (Ozone files Included)
---------------- 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 =2001.PU.VIS.LST   !
 Data File       MODEL.DAT          ! UTLDAT =2001.PU.VIS.DAT   !


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

 Meteorological data files are needed for the HNO3/NO3 partition option.
 The met data file is the 'CALMET.DAT' format file used in the CALPUFF
 simulation.  If multiple CALMET files had been used in sequence, you
 may list all of these files in subgroup 0b.  Specify the total number
 of CALMET files runs you need to use, and provide the filename for each
 in subgroup 0b.

     Number of CALMET data files (NFILES)
                                     Default: 0       ! NMET    = 36   !


 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   !


 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:

Input File      Default File Name
----------      -----------------
   1            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met01a.met! !END!
   2            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met01b.met! !END!
   3            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met01c.met! !END!
   4            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met02a.met! !END!
   5            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met02b.met! !END!
   6            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met02c.met! !END!
   7            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met03a.met! !END!
   8            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met03b.met! !END!
   9            MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met03c.met! !END!
   10           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met04a.met! !END!
   11           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met04b.met! !END!
   12           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met04c.met! !END!
   13           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met05a.met! !END!
   14           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met05b.met! !END!
   15           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met05c.met! !END!
   16           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met06a.met! !END!
   17           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met06b.met! !END!
   18           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met06c.met! !END!
   19           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met07a.met! !END!
   20           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met07b.met! !END!
   21           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met07c.met! !END!
   22           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met08a.met! !END!
   23           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met08b.met! !END!
   24           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met08c.met! !END!
```

```
   25           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met09a.met! !END!
   26           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met09b.met! !END!
   27           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met09c.met! !END!
   28           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met10a.met! !END!
   29           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met10b.met! !END!
   30           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met10c.met! !END!
   31           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met11a.met! !END!
   32           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met11b.met! !END!
   33           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met11c.met! !END!
   34           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met12a.met! !END!
   35           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met12b.met! !END!
   36           MET.DAT            ! UTLMET = W:\RefinedMetFiles2001
\01Met12c.met! !END!



Input File      Default File Name
----------      -----------------
   1            CALPUFF.DAT        ! MODDAT = 01PFC1V.DAT ! !END!

-------------
Note:  provide NMET lines of the form   * UTLMET = 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  = 0   !

     Number of periods to process
                                 (NPER) -- No default   ! NPER  = 8752
!

     Number of species to process from CALPUFF runs
                           (NSPECINP) -- No default   ! NSPECINP = 6 !

     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 = 0 !


 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 !


 Option to recompute the HNO3/NO3 concentration partition prior to
 performing other actions.  This option will NOT alter any deposition
 fluxes contained in the CALPUFF file(s).  Two partition selections
 are provided.  The first (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 a previous
application
 of POSTUTIL) to compute the partition for individual source groups.

 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

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

    Ammonia concentrations may be available as a modeled species in
    the CALPUFF files.  When NH3 is listed as a processed species in
    Subgroup (2a) (as one of the NSPECINP ASPECI entries), the
    modeled values will be used in the chemical equilibrium
calculation.
    If NH3 is not on this list, the default background value listed
    below will be used.
    Default ammonia concentration (ppb) used for HNO3/NO3 partition:
    (BCKNH3) in ppb               Default: 10.     ! BCKNH3 = 3.  !
```

```
!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 =         PM10 !         !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 =         PM10 !         !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):



-------------
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,                 0.0   *
*     SO4  =      1,                 0.0   *
```

```
*    HNO3  =      1,                  0.0   *
*     NO3  =      1,                  0.0   *
*END*
```

APPENDIX E

SAMPLE CALPOST CONTROL FILE

```
Invista Orange - Big Bend CALPOST
2001 (includes ozone files)
---------------- 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 =2001.PU.VIS.DAT
!
Relative Humidity File     VISB.DAT           ! VISDAT =01PFC1V.VIS   !
Background Data File       BACK.DAT           *BACKDAT =   *
Transmissometer/           VSRN.DAT           *VSRDAT =   *
Nephelometer Data File

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

File                       Default File Name
----                       -----------------
List File                  CALPOST.LST        ! PSTLST =BIBE.vis.01.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                 TSttUUUU.DAT       * TSUNAM =   *

Top Nth Rank Plot          RttUUUUU.DAT
                      or   RttiiUUU.GRD       * TUNAM =   *

Exceedance Plot            XttUUUUU.DAT
                      or   XttUUUUU.GRD       * XUNAM =   *

Echo Plot                  jjjtthhU.DAT
(Specific Days)       or   jjjtthhU.GRD       * EUNAM =   *

Visibility Plot            V24UUUUU.DAT       * VUNAM =   *
(Daily Peak Summary)
```

```
-----------------------------------------------------------------------
--------
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 70 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 fixed strings (tt,ii,jjj, and hh), where
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                jjj= Julian Day
                hh = Hour(ending)
          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 =   0  !

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

     Starting date:    Year  (ISYR) --    No default   ! ISYR  =  2001
!
     (used only if     Month (ISMO) --    No default   ! ISMO  =  1   !
      METRUN = 0)      Day   (ISDY) --    No default   ! ISDY  =  1   !
                       Hour  (ISHR) --    No default   ! ISHR  =  0   !

     Number of hours to process (NHRS) -- No default   ! NHRS  =  8752
!

     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 =  0.0    !
            X(new) = X(old) * A + B         A = 0.0    ! B =  0.0    !
```

```
        (NOT applied if A = B = 0.0)        B = 0.0

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

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:
    416*0, 1048*1, 1482*0
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
                                            ! NDRECP = 480*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)
--------------

    Maximum relative humidity (%) used in particle growth curve
                                (RHMAX) -- Default: 98   ! RHMAX  = 95.0
!

    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   = F  !
     Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC  = F  !
     Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF  = T  !
     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 = PMC !
                   FINE      (SPECPMF) -- Default: PMF ! SPECPMF = PM10
!

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  = 3.0 !
              AMMONIUM NITRATE (EENO3) -- Default: 3.0 ! EENO3  = 3.0 !
              ORGANIC CARBON   (EEOC)  -- Default: 4.0 ! EEOC   = 4.0 !
              SOIL             (EESOIL)-- Default: 1.0 ! EESOIL = 1.0 !
              ELEMENTAL CARBON (EEEC)  -- Default: 10. ! EEEC   = 10.0 !

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

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

         1 =  Supply single light extinction and hygroscopic fraction
              - IWAQM (1993) RH adjustment applied to hygroscopic
background
                and modeled sulfate and nitrate
         2 =  Compute extinction from speciated PM measurements (A)
              - Hourly RH adjustment applied to observed and modeled
sulfate
                and nitrate
              - RH factor is capped at RHMAX
         3 =  Compute extinction from speciated PM measurements (B)
              - Hourly 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 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 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 RH adjustment factor applied to observed and
                modeled sulfate and nitrate

    Additional inputs used for MVISBK = 1:
    --------------------------------------
     Background light extinction (1/Mm)
                            (BEXTBK) -- No default   ! BEXTBK = 12.0 !
     Percentage of particles affected by relative humidity
                            (RHFRAC) -- No default   ! RHFRAC = 10.0 !
```

```
    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 = 2.0, 1.9, 1.6, 1.5, 1.6, 1.6,
1.7, 2.0, 2.1, 1.9, 1.8, 1.9!

    Additional inputs used for MVISBK = 2,3,6:
    ------------------------------------------
     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 = 0.12, 0.12, 0.12, 0.12,
                                          0.12, 0.12, 0.12, 0.12,
                                          0.12, 0.12, 0.12, 0.12 !
     (BKNO3)  -- No default     ! BKNO3 = 0.10, 0.10, 0.10, 0.10,
                                          0.10, 0.10, 0.10, 0.10,
                                          0.10, 0.10, 0.10, 0.10 !
     (BKPMC)  -- No default     ! BKPMC = 3.0, 3.0, 3.0, 3.0,
                                          3.0, 3.0, 3.0, 3.0,
                                          3.0, 3.0, 3.0, 3.0 !
     (BKOC)   -- No default     ! BKOC  = 0.47, 0.47, 0.47, 0.47,
                                          0.47, 0.47, 0.47, 0.47,
                                          0.47, 0.47, 0.47, 0.47 !
     (BKSOIL) -- No default     ! BKSOIL= 0.50, 0.50, 0.50, 0.50,
                                          0.50, 0.50, 0.50, 0.50,
                                          0.50, 0.50, 0.50, 0.50 !
     (BKEC)   -- No default     ! BKEC  = 0.02, 0.02, 0.02, 0.02,
                                          0.02, 0.02, 0.02, 0.02,
                                          0.02, 0.02, 0.02, 0.02 !

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

!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 = T  !

    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 =  4   !

        -- Specific ranks of 'Top-N' values reported
           (NTOP values must be entered)
                   (ITOP(4) array) -- Default:     ! ITOP = 1, 2, 3, 4
!
                                         1,2,3,4
```

```
   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.
      [TSttUUUU.DAT files]
                          (LTIME) -- Default: F   !  LTIME = 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 !

Additional Debug Output

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

!END!

APPENDIX B

MODELED STACK PARAMETERS AND EMISSION RATES

Table B-1. Modeled Stack Parameters and Emission Rates

Revised 07/05/2007

Stack ID#	Source Description	Location LCC		Stack Height (m)	Base Elevation (m)	Diameter (m)	Gas Exit Velocity (m/s)	Stack Gas Exit Temp. (K)	SO_2 Emissions (lbs/hr)	NO_x Emissions (lbs/hr)	PM Emissions (lbs/hr)
		LCC East (km)	LCC North (km)								
05COM-001	Portable Compressors	314.455	-1097.73	1.83	0	0.13	35.05	505.37	-	0.20	-
11BLR-003	Power Boiler No. 5 Stack	314.209	-1097.849	30.48	1	2.44	6.10	482.59	0.15	142.00	5.04
11BLR-004	Power Boiler No. 7 & 8 Stack	314.189	-1097.862	30.48	0	2.44	14.02	472.04	0.33	565.00	14.55
FC-10	Fugitives	314.745	-1097.64	0.91	1	0.01	0.01	298.71	-	1.20	-
PA39	Incinerator	313.841	-1098.232	37.19	1	0.91	13.47	810.93	-	25.00	-
PC-9	Vent Stack	314.76	-1097.595	51.82	1	1.22	28.65	374.82	-	77.00	-
PF40	South ADN Boiler	313.952	-1098.026	22.86	1	3.35	21.95	533.15	-	490.00	5.04
PF41	North ADN Boiler	313.944	-1098.014	22.86	1	3.35	18.59	533.15	-	637.00	14.55
PH2	Start up flare	313.864	-1098.02	44.20	1	3.60	20	1,273	-	119.84	-
PH3	Operating Flare	313.928	-1098.053	54.86	0	3.49	20	1,273	0.60	766.30	0.94
PH63	HCN LOAD/UNLOAD FLARE	313.744	-1098.188	45.72	1	0.02	20	1,273	-	0.74	-
PH70	AMMONIA FLARE	313.865	-1098.023	44.20	0	2.26	20	1,273	-	54.84	-
PD-17A*	FILTERS-FABRIC (BAGHOUSE)	313.928	-1098.053	54.86	0	3.49	20	1,273	-	-	0.47
PD-17B*	FILTERS-FABRIC (BAGHOUSE)	313.928	-1098.053	54.86	0	3.49	20	1,273	-	-	0.47

* To be conservative, combine and model from PH3 because it is the highest stack.

APPENDIX C

ELECTRONIC MEDIA DATA AND FILE INDEX