Air Quality Modeling Protocol: Utah Regional Haze State Implementation Plan

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Utah Division of Air Quality

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1 INTRODUCTION

40 CFR Part 51, Appendix Y contains the Guidelines for Best Available Retrofit Technology (BART) Determinations. The Guidelines address the methodology for determining which sources must apply BART and the evaluation of control options. In particular, the Guidelines state that the CALPUFF modeling system (or another appropriate dispersion model approved by EPA) should be used to predict the visibility improvement expected at a Class I area from potential BART control technologies applied to a single source. The Guidelines also recommend developing a modeling protocol that outlines the model approach.

In accordance with EPA Guidelines, the Utah Division of Air Quality (DAQ) used the CALPUFF model to predict the visibility impacts from four electric generating units (EGUs) that are subject-to-BART to evaluate various control options. This air quality modeling protocol documents the methodology used to conduct the air quality dispersion modeling and the approach to estimate the improvement in visibility to be achieved by BART.

This document is organized as follows:

- Section 2 – Background
- Section 3 – Modeling Approach
- Section 4 – Emissions Data for Modeling
- Section 5 – Modeling System
- Section 6 – Presentation of Results and Reporting

2 BACKGROUND

On December 14, 2012 EPA disapproved Utah's BART determinations for NOx and PM for PacifiCorp's Hunter Unit 1, Hunter Unit 2, Huntington Unit 1, and Huntington Unit 2. EPA determined that the SIP did not contain a full 5-factor analysis as required by the rule. BART for SO_2 was addressed through Utah's participation in a regional milestone program with a backstop trading program under section 309 of the regional haze rule and under section 309 no other pollutants are required to be evaluated for BART. PacifiCorp has already installed controls on all 4 EGUs as required by the BART determination in Utah's 2008 SIP.

Three additional units, PacifiCorp Hunter Unit 3, PacifiCorp Carbon Unit 1, and PacifiCorp Carbon Unit 2 are not subject to BART, but are included in the modeling to address the effect of emission reductions at these units, under an alternative to BART scenario as provided under 40 CFR 51.308(e)(2).

Because PacifiCorp has installed baghouses, the most stringent technology available for particulate matter, modeling for scenario 1 (current conditions) evaluates the visibility improvement due to BART for particulate matter in conjunction with the improvements due to the installation of low-NOx burners with overfire air and upgrades to SO_2 controls. The control scenarios outlined in section 4.0 of this protocol are intended to evaluate the potential visibility improvement due to post-combustion control technologies to reduce NOx emissions.

3 MODELING APPROACH

This section describes the components and information required for the CALPUFF modeling. Each source that causes or contributes to visibility impairment in one or more Class I area must conduct a BART analysis to define the best available retrofit technology applicable to that source, and quantify the visibility improvement at the Class I areas associated with BART controls. This section covers the following elements: emission sources; Class I area identification; pollutants considered; natural background conditions; visibility impairment determination; and the analysis process.

3.1 Emission Sources

The sources that DAQ modeled are listed in Table 1. PacifiCorp Hunter Unit 3 and PacifiCorp Carbon Units 1 and 2 are not subject to BART.

Table 1. Emission Sources Modeled

Company Name	Plant Name	Units
PacifiCorp	Hunter	Boilers #1,2,3
PacifiCorp	Huntington	Boilers #1,2
PacifiCorp	Carbon	Boilers #1,2

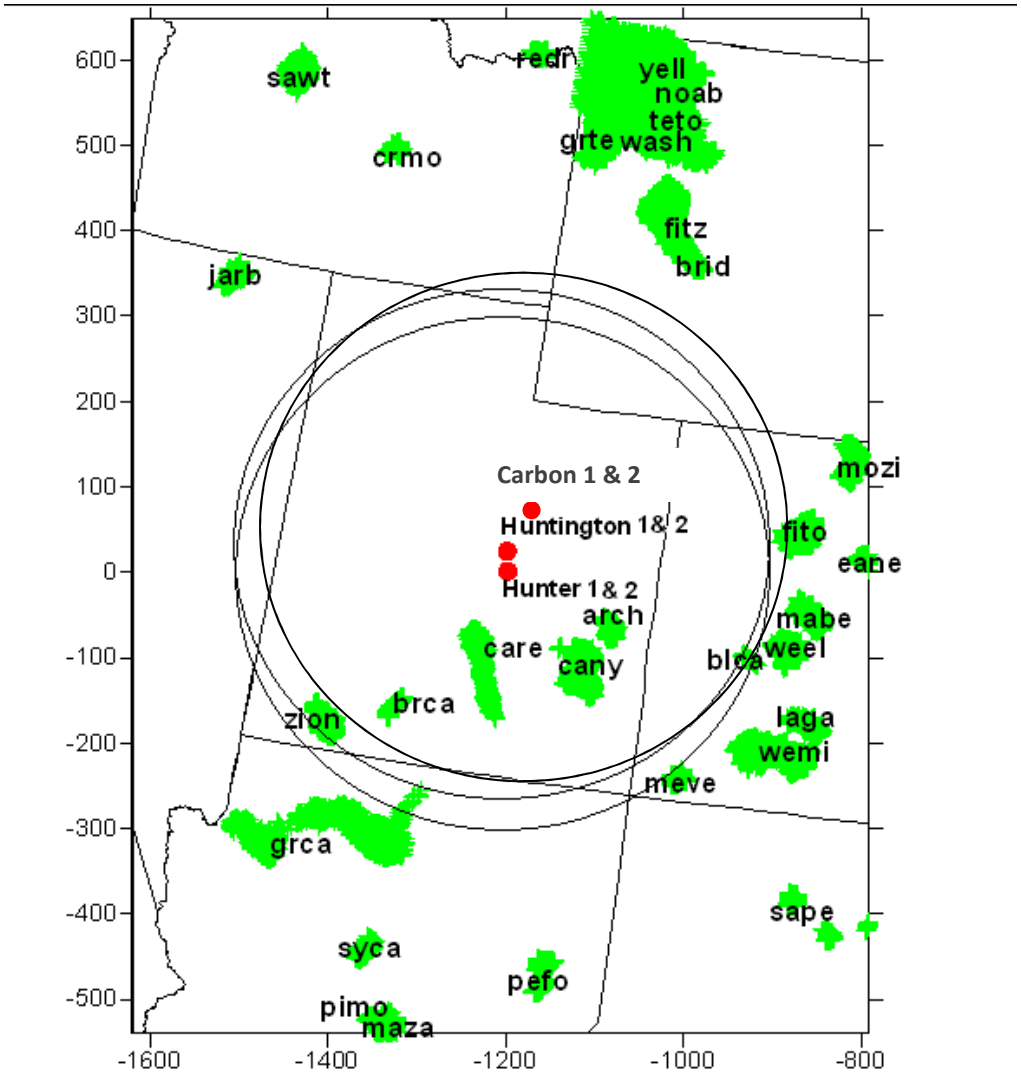
3.2 Class I Areas

DAQ determined the Class I areas to be included in the modeling by the distance of each source to Class I area. The federal Class I areas that were modeled are located within 300 km of the sources that are listed in Table 2. Figure 1 is a map that presents the location of the modeled Class I areas in relation to the Utah sources. Modeled visibility improvement at these Class I areas will be one measure of the effectiveness of BART. Monitoring data showing the effects of the upgrades required by Utah's 2008 RH SIP will also be considered. This approach is consistent with the BART Guidelines.

Table 2. Class I Areas

Source	Class I Areas to be Evaluated
PacifiCorp Hunter Plant, PacifiCorp Huntington Plant, PacifiCorp Carbon Plant	Arches National Park, Canyonlands National Park, Capitol Reef National Park, Bryce National Park, Zion National Park, Mesa Verde National Park, Black Canyon of the Gunnison National Park, Grand Canyon National Park, Flat Tops Wilderness Area

Figure 1. Source Locations in Proximity to Class I Areas



3.3 Pollutants to Consider

The BART Guidelines state that modeling should be conducted for sulfur dioxide (SO_2), nitrogen oxides (NO_x) and direct particulate matter (PM) emissions, including both PM_{10} and $PM_{2.5}$. All of the pollutants were included in the modeling. The emissions data and emissions assumptions are discussed in more detail in Section 4.0 below.

3.4 Natural Background

The FLAG 2010 guideline lists two sets of Natural Conditions corresponding to Annual Average and 20 percent best natural days. To represent natural visibility background in the Class I areas, the values associated to the 20 percent best natural days were used, in lieu of the values associated to the annual average natural days. This approach is consistent with the previous BART modeling conducted for the sources. This definition of natural background is also consistent with the BART Guideline.[1] The specific natural background values used in this protocol were drawn from the FLAG 2010 guideline. Class I area specific natural background assumptions are presented in Appendix A.

3.5 Visibility Calculation

The methodology for performing visibility calculations with the CALPUFF modeling system is described in several documents, including:

- Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts,[2]
- Federal Land Manager's Air Quality Related Values Workgroup (FLAG): Phase I Report,[3] and
- A User's Guide for the CALPUFF Dispersion Model.[4]

The CALPUFF modeling techniques presented in this protocol provide ground level concentrations of visibility impairing pollutants. The concentration estimates from CALPUFF were used with the FLAG 2010 referenced IMPROVE equation[5] to calculate the extinction coefficient (b_{ext}), as shown below.

b_{ext} = $2.2 \times f_S(RH) \times$ [Small Sulfate] + $4.8 \times f_L(RH) \times$ [Large Sulfate]

- $2.4 \times f_S(RH) \times$ [Small Nitrate] + $5.1 \times f_L(RH) \times$ [Large Nitrate]
- $2.8 \times$ [Small Organic Mass] + $6.1 \times$ [Large Organic Mass]
- $10 \times$ [Elemental Carbon]
- $1 \times$ [Fine Soil]
- $0.6 \times$ [Coarse Mass]
- $1.7 \times f_{SS}(RH) \times$ [Sea Salt]
- Rayleigh Scattering (Site Specific)
- $0.33 \times$ [NO_2 (ppb)] {or as: $0.1755 \times$ [NO_2 ($\mu g/m^3$)]}

Where:

[ ] indicates concentrations in $\mu g/m^3$

$f_S(RH)$ = Relative humidity adjustment factor for small sulfate and nitrate

$f_L(RH)$ = Relative humidity adjustment factor for large sulfate and nitrate

$f_{SS}(RH)$ = Relative humidity adjustment factor for sea salt

[1] 70 FR 39124.

[2] Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts, Office of Air Quality Standards, EPA-454/R-98-019, December 1998.

[3] Federal Land Managers' Air Quality Related Values Workgroup (FLAG) 2008. Phase I Report—Revised (2010).

[4] Scire J.S., D.G. Strimaitis, R.J. Yamartino. "A User's Guide for the CALPUFF Dispersion Model." Earth Tech, Concord, MA, January 2000.

[5] Federal Land Managers' Air Quality Related Values Workgroup (FLAG) 2008. Phase I Report—Revised (2010).

For Total Sulfate < 20 $\mu g/m^3$:

[Large Sulfate] = ([Total Sulfate] / 20 $\mu g/m^3$) × [Total Sulfate] For Total Sulfate ≥ 20 $\mu g/m^3$:

[Large Sulfate] = [Total Sulfate] And:

[Small Sulfate] = [Total Sulfate] – [Large Sulfate]

To calculate large and small nitrate and organic mass, substitute ({Large, Small, Total} {Nitrate, Organic Mass}) for Sulfate.

Several different metrics are used to evaluate the change in visibility for the BART analyses: average deciview change, number of days with impact > 0.5 dV, number of days with impact > 1.0 dV, 90th percentile deciview change and the 98th percentile deciview change relative to the 20 percent best days natural background conditions.[6,7] The delta-deciview (Δdv) value is calculated from the source's contribution to extinction, $b_{ext\ (source)}$, and background extinction, $b_{ext(bkg)}$, as follows:

$$\Delta dv = 10\ ln\ (\ b_{ext(bkg)} + b_{ext\ (source)}\ )\ /\ b_{ext(bkg)}\ )$$ [8]

The monthly relative humidity adjustment factors from the above equation and all background assumptions used in the modeling are included in Appendix A.

[6] 70 FR 39119, 39121, 39170.

[7] Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule, Office of Air Quality Planning and Standards, Emissions, Monitoring and Analysis Division, Air Quality Trends Analysis Group, EPA- 454/B-03-005, September 2003.

[8] Federal Land Managers' Air Quality Related Values Workgroup (FLAG) 2008. Phase I Report – Revised (2010).

4 EMISSIONS DATA FOR MODELING

CALPUFF model inputs require source parameters, including pollutant emission rates and stack data (location, height, diameter, exit gas temperature, and exit gas velocity). In accordance with BART Guidelines, the baseline (pre-control) emission rates represented the 24-hour average actual emission rate from the highest emitting day of the meteorological period modeled. The post-control emission rates were calculated as a percentage of pre-control emission rates. This approach is also in accordance with the BART Guidelines. The details of the emissions data used in the modeling are discussed below. The baseline and control scenario emission assumptions used in the updated modeling for the Utah sources listed are presented in Appendix B.

4.1 Emission Scenarios

CALPUFF model inputs require source parameters, including pollutant emission rates and stack data (location, height, diameter, exit gas temperature, and exit gas velocity). With the exception of pollutant emission data, the majority of these parameters are static and do not vary between the baseline and post control scenarios. The pollutant emission rates are variable and are based on the level of control established in each BART scenario. For purposes of this BART analysis, the following table summarizes the various emission units and the different NOx baseline and post-control scenarios evaluated for each unit.

Table 3. NOx Baseline and Post-control Scenario Summary

Emission Unit	Baseline	Post-control Scenario 1 (LNB/OFA)	Post-control Scenario 3 (SCR+LNB/OFA)	Scenario A
Hunter 1	Yes	Yes	Yes	
Hunter 2	Yes	Yes	Yes	
Hunter 3	Yes	No	No	Yes (LNB)
Huntington 1	Yes	Yes	Yes	
Huntington 2	Yes	Yes	Yes	
Carbon 1	Yes	No	No	Shut down
Carbon 2	Yes	No	No	Shut down

Note: Scenarios 1and 3 also include the SO_2 and PM controls required by Utah's 2008 RH SIP

For the baseline scenario, the (pre-control) emission rates were established in accordance with BART Guidelines. These emission rates represent the 24-hour average actual emission rate from the highest emitting day of the meteorological period modeled. This will be further discussed in section 4.2.

For post-control scenario 1, hereinafter referred to as scenario 1 or LNB/OFA, the emission rates were established using average actual emissions following the installation of emission controls for NOx, SO_2, and PM at the units. Although labelled as LNB/OFA, these controls varied from unit to unit. This will be discussed further in section 4.3.1.

The same methodology was followed for post-control scenario 3, hereinafter referred to as scenario 3 or SCR. Again, only the NOx emission rate needed to be adjusted. The NOx emission rate was set as a ratio of the emission rate from Scenario 1 (see section 4.3.2)

4.2 Baseline

Primarily, the calculation of the hourly emission rates was based on information from EPA's Clean Air Markets Database (CAMD). This information formed the basis of the baseline scenarios for Hunter Units 1 & 2 and Huntington Units 1 & 2.

To determine the baseline hourly emission rate, the BART guidelines recommend the use of the 24-hour average actual emission rate from the highest emitting day occurring during that same period. The daily values from this period were sorted to identify the maximum emission rate (and date of occurrence). To convert this maximum daily (ton/day) value into the correct lb/hour value required by CALPUFF, the result was divided by 24 hours/day and multiplied by 2000 lb/ton.

Three non-BART sources, specifically Hunter Unit 3 and Carbon Units 1 & 2, are included in this modeling exercise. Hunter Unit 3's baseline case was developed using a combination of EPA's Acid Rain Database and information contained within Utah DAQ's emission inventory database. The same emission time period of 2001-2003 was used for this case.

A similar approach was used for the two Carbon units; namely retrieving information from a combination of the Acid Rain Database and UDAQ's emission inventory database. However, as both Carbon units are being shut down, the most recent two-year period of operation (calendar years 2012 and 2013) are being used to determine baseline emissions. There were no changes to the emission controls at the Carbon Plant during the time period between 2001 and 2013. This approach provides a more accurate representation of the effectiveness of this "control" option, as well as being in line with federal and state permitting guidelines under Title I (NSR).

4.3 Post Control Scenarios

As was mentioned previously in Section 4.1, there are several post-control scenarios required depending on which emission unit is being discussed. For Hunter Units 1 & 2 and Huntington Units 1 & 2 there are two, corresponding to LNB/OFA and SCR+LNB/OFA respectively. For Hunter Unit 3 and Carbon Units 1 & 2 there is only a single post-control scenario. For Hunter Unit 3 this was the upgrade of first generation LNB to current LNB technology, while the post-control scenario at the Carbon Plant is the permanent shutting down of both units. Each of these scenarios is discussed in greater detail below. The detailed calculations for each of these scenarios is shown in a separate spreadsheet, "Emission Calculation Methodology.pdf."

4.3.1 Scenario 1 – LNB/OFA

The LNB/OFA scenario for Hunter Units 1 &2 and Huntington Units 1 & 2 was developed by treating it in part as though it were a new baseline scenario. BART Guidelines recommend that the post-control emission rates be calculated as a percentage of the baseline hourly emissions. The appropriate percentage can be determined by dividing the LNB/OFA annual rate by the baseline annual rate and multiplying by 100; where that LNB/OFA rate is projected based on an anticipated annual emission rate. With the exception of Hunter Unit 1, LNB/OFA technology has been in place and operating on these units for some time. Therefore, UDAQ has elected to use an actual annual average rate from emission years 2012-2013 as the basis of comparison. Secondly, as Hunter Unit 1 had not yet completed installation of these emission controls until the Spring of

2014, UDAQ is treating this unit as a clone of Hunter Unit 2. The two units are, for all practical purposes, identical in design, and therefore can be treated as such for modeling purposes.

Once the appropriate percentage is determined, the hourly LNB/OFA emission rate is determined by multiplying the baseline hourly emission rate by this percentage and dividing by 100.

As this is the first "post-control" scenario for the four primary BART eligible units (Hunter Units 1 & 2 and Huntington Units 1 & 2) more than just NOx controls are being applied. This initial scenario also includes the installation of fabric filter particulate control and upgrades/installation of dry lime injection SO_2 control at each of the four units. These controls have also already been installed and operating for some time. Exactly the same procedure was followed for determination of hourly emission rates for SO_2, PM_{10} and $PM_{2.5}$. SO_4 emissions are then calculated using the EPRI methodology.[9] As no additional particulate or sulfur removal technology is included in subsequent steps, SO_2 and PM values are held constant beyond Scenario 1.

4.3.2 Scenario 3 – LNB/OFA with SCR

The SCR scenario is a projected emissions scenario. In this case the emissions are determined by selecting the anticipated annual average SCR emission rate as it would appear in any permit issued to the source in question. For each of these sources (Hunter 1 & 2, Huntington 1 & 2), that anticipated annual average emission rate is 0.05 lb/MMBtu. The appropriate percentage can be determined by dividing the SCR annual rate by the baseline annual rate and multiplying by 100.

SCR units form sulfate emissions across the catalyst bed and these emissions are calculated using the EPRI methodology[10]. Because PacifiCorp would need to configure the control system to place an SCR unit prior to the FGD system, most of the sulfate emissions formed across the SCR catalyst bed would be removed by the FGD system. This configurations is accounted for in the EPRI methodology so the overall SO_4 emissions are not significantly increased.

4.3.3 Scenario A – Emission Controls at Hunter 3 and Shutdown of Carbon 1 & 2

For Hunter Unit 3 there is only a single post-control scenario. This scenario is presented as part of an alternative measure to source-by-source BART. This reflects the upgrade from first generation LNB to current LNB technology on this unit in 2008. The methodology for calculating emissions under this scenario follows that of Scenario 1 above, however there is no additional particulate or sulfur removal technology being installed as part of this scenario.

For Carbon Units 1 & 2, the single post-control scenario involves the permanent shut down of both units. Accordingly, emission rates for all pollutants are zero.

[9] Electric Power Research Institute (EPRI) Document 1023790, Estimating Total Sulfuric Acid Emissions from Stationary Power Plants, April 2, 2012.
[10] Ibid.

4.4 Post Processing Combinations

As described in Section 5.3, the effect of multiple units in ammonia limited conditions must be accounted for in model post-processing using POSTUTIL. Table 4 below summarizes the descriptions of the baseline and control scenarios that are included in each POSTUTIL run.

Table 4. POSTUTIL Modeling Combinations

	Hunter 1	**Hunter 2**	**Hunter 3**	**Huntington 1**	**Huntington 2**	**Carbon 1**	**Carbon 2**
Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Alternative	Scenario 1	Scenario 1	Scenario A	Scenario 1	Scenario 1	Scenario A	Scenario A
Most Stringent NOx Control	Scenario 3	Scenario 3	Baseline	Scenario 3	Scenario 3	Baseline	Baseline

5 MODELING SYSTEM

The visibility impact modeling used the CALPUFF suite of programs, and followed the procedures and recommendations outlined in applicable documents. For the most part, the regulatory default options were utilized for the CALPUFF modeling. Details are provided below for the non-default options selected for this modeling. The requirements and recommendations outlined in the documents listed below were also followed:

- EPA's Guidance for Estimating Natural Visibility Conditions under the Regional Haze Rule,[11]
- Appendix W of 40 CFR Part 51, Guideline on Air Quality Models,[12]
- Interagency Workgroup on Air Quality Modeling Phase 2 report,[13]
- Federal Land Managers' Air Quality Related Values Workgroup – Phase I Report,[14]
- User's Guide for the CALPUFF Dispersion Model[15]

Tables listing the specific modeling parameters for each CALPUFF module are located in the Appendices.

The individual CALPUFF modules of the CALPUFF modeling system and the version numbers used in the updated modeling are presented in Table 5. The latest regulatory versions approved at the time of the modeling and default options of the CALPUFF modeling system were used for the modeling.

Table 5. CALPUFF Modeling System

Program	Version	Level
CALMET	5.8.4	130731
CALPUFF	5.8.4	130731
CALPOST	6.221	080724
POSTUTIL	1.56	070627

5.1 CALMET

CALMET is a diagnostic wind model that develops hourly wind and temperature fields in a three-dimensional, gridded modeling domain. Meteorological inputs to CALMET can include surface and upper-air observations from multiple meteorological monitoring stations. The CALMET model can also utilize gridded analysis fields from various mesoscale models, such as

[11] Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule, Office of Air Quality Planning and Standards, Emissions, Monitoring and Analysis Division, Air Quality Trends Analysis Group, EPA- 454/B-03-005, September 2003.
[12] Appendix W, 40 CFR Part 51: Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule, Vol. 70, No. 216, 68218-68261, November 9, 2005.
[13] Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts, Office of Air Quality Standards, EPA-454/R-98-019, December 1998.
[14] Federal Land Managers' Air Quality Related Values Workgroup (FLAG) 2008. Phase I Report—Revised (2010).
[15] Scire J.S., D.G. Strimaitis, R.J. Yamartino. "A User's Guide for the CALPUFF Dispersion Model." Earth Tech, Concord, MA, January 2000.

the Fifth-Generation Penn State/NCAR Mesoscale Model (MM5), to better represent regional wind flows and complex terrain circulations.

The MM5/CALMET meteorological fields were developed for 2001, 2002, and 2003. Figure 2 and Figure 3 show the CALMET model domain and the locations of the meteorological observations that were input to CALMET, including surface, upper-air, and precipitation stations. The model domain is centered in east-central Utah, and extends to the west covering 5 Class I areas in Utah, 1 Class I area in Arizona, and 3 Class I areas in western Colorado.

For most of the technical options, default settings were used in the CALMET input files. Table 5 lists the key user-defined CALMET settings that were selected, and Appendix C presents the CALMET Control File inputs.

Figure 2. Modeling Domain and Class I Areas

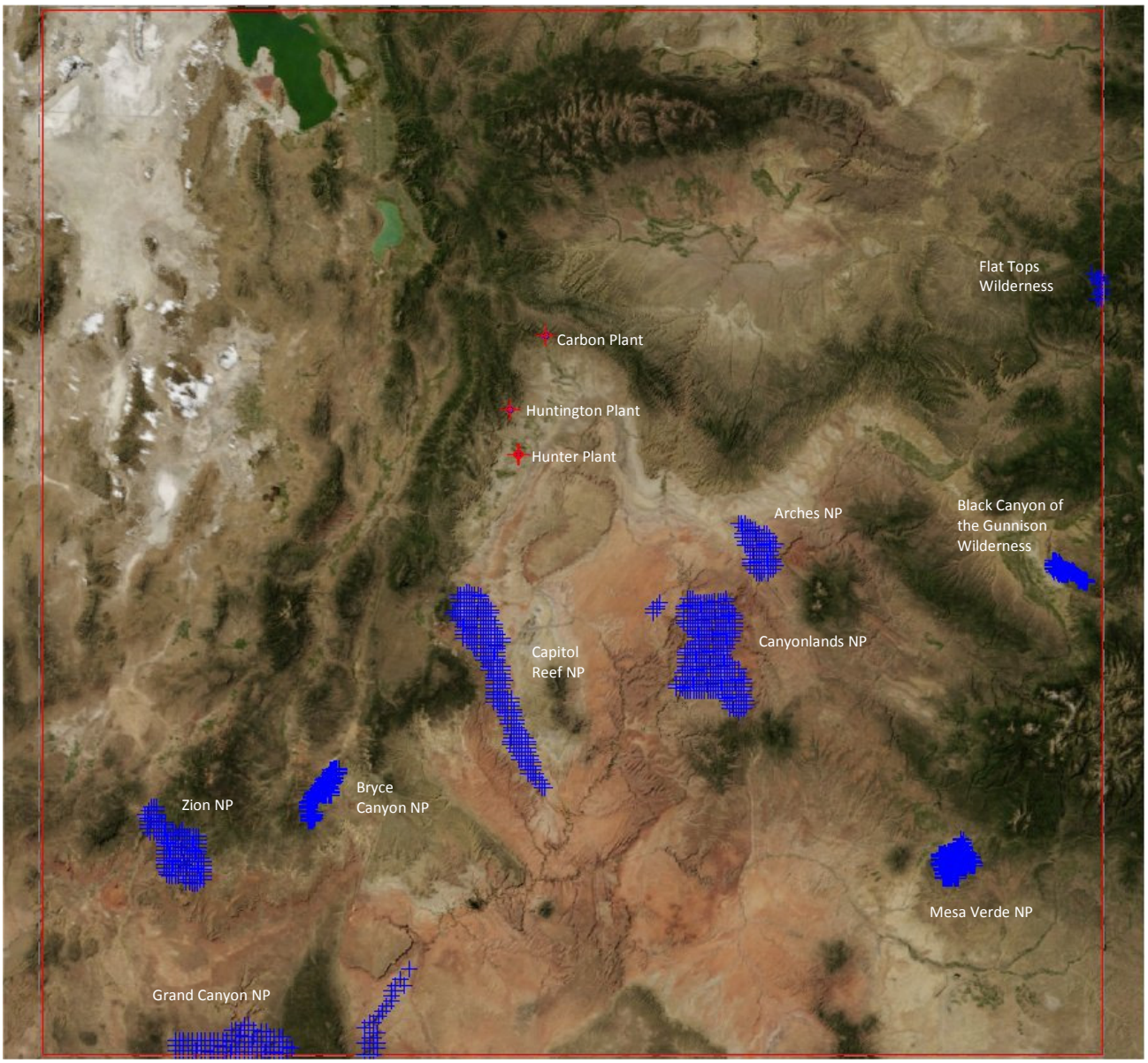


Figure 3. Observations Input for CALMET Modeling (orange is surface, light blue is precipitation, blue diamond is upper air)

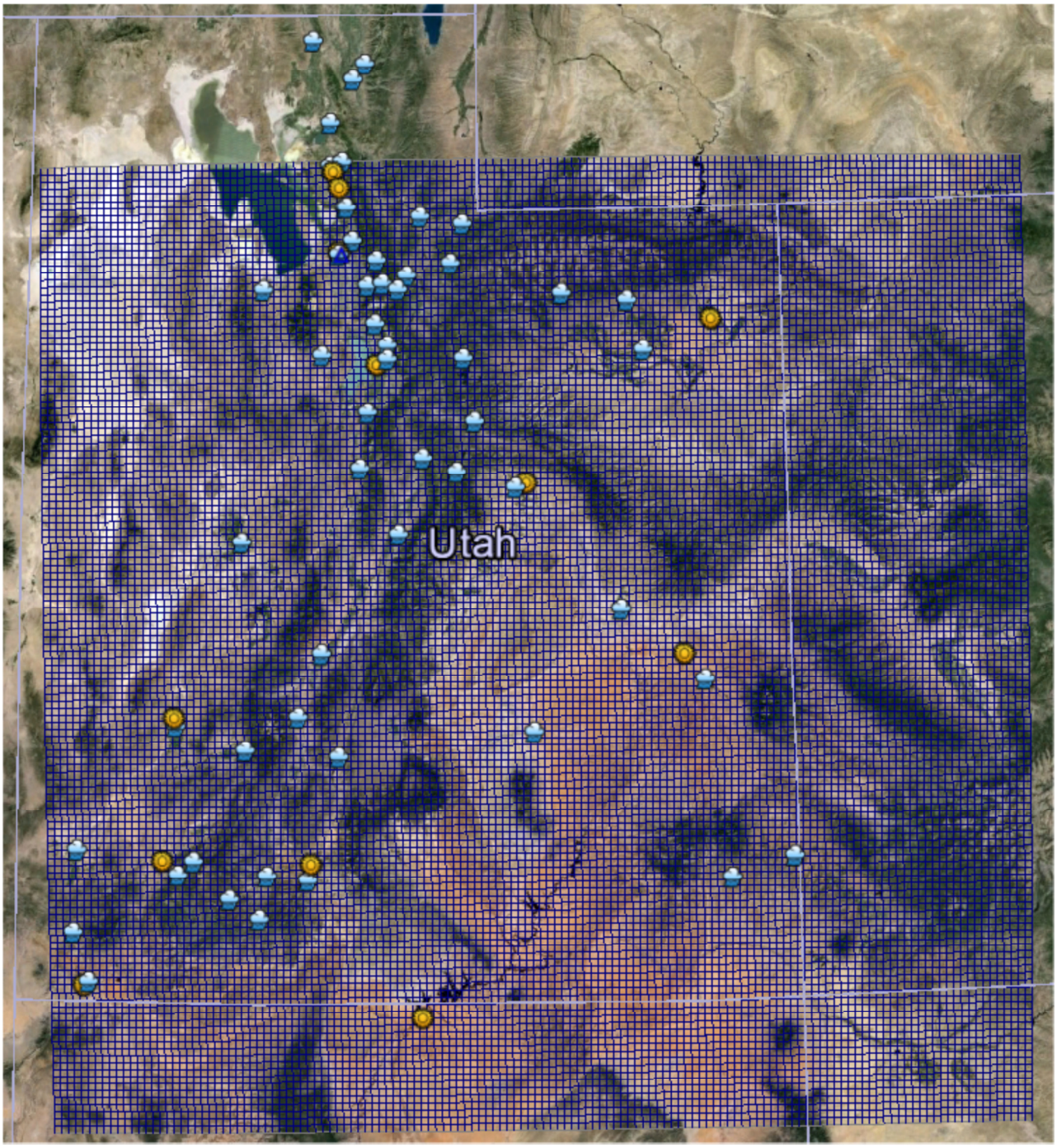


Table 6. Key User-Defined CALMET Settings

Variable	Description	Value
PMAP	Map Projection	LCC (Lambert Conformal Conic)
DGRIDKM	Grid Spacing (km)	4
NZ	Number of Layers	11
ZFACE	Cell Face Heights (m)	0, 20, 100, 200, 350, 500, 750, 1000, 2000, 3000, 4000, 5000
RMIN2	Minimum Distance for Extrapolation	1
IPROG	Use Gridded Prognostic Model Output	14 (MM5 Data)
RMAX 1	Maximum Radius of Influence (surface layer, km)	10
RMAX 2	Maximum Radius of Influence (layers aloft, km)	100
TERRAD	Radius of Influence for Terrain (km)	20
R1	Relative Weighting of First Guess Wind Field and Observations (km)	5
R2	Relative Weighting Aloft (km)	50

DAQ used the cell face heights (ZFACE) established by the WRAP in the August 15, 2006 WRAP BART modeling protocol that was widely used for western BART analyses. The cell face heights used in CALMET allow for a more detailed vertical resolution in the model at the elevations near the plume center-line from the Hunter and Huntington Power Plants. In addition, since the plume is expected to be well mixed at the downwind locations of the Class I areas, the modeled concentrations are not expected to be sensitive to cell face heights.

DAQ used TERRAD, R1, and R2 settings established by PacifiCorp in their 2012 modeling protocol that included CALMET settings previously approved for use under the PSD program. The TERRAD, R1/R2 values had been determined to be appropriate after reviewing the distance from the surface stations to the nearest terrain features (TERRAD) and each other (R1/R2). After CALMET was run, PacifiCorp determined that the windfields were consistent and there were not any major conflicts between the prognostic data (MM5) set and the observations. Therefore, these values were retained in PacifiCorp's 2012 modeling protocol. The surface stations in the modeled area are very sparse in the area between PacifiCorp's plants and the Class I areas and would therefore have very little influence on surface winds, and even less impact on upper level winds that would transport emissions from the plants to the Class I areas.

5.2 CALPUFF

The CALPUFF model was used with each of the three years of meteorological data to calculate pollutant concentrations at receptors in multiple Class I areas for all units and control scenarios. In general, the application of CALPUFF uses the regulatory default options and follows the procedures and recommendations outlined in applicable documents. Details of the parameter settings in CALPUFF are provided in Appendix D. However, the major features are outlined below.

- Building downwash effects were included.
- Puff splitting was not used, following the recommendations outlined in the IWAQM Phase 2 report.[16]
- Hourly ozone files were used to define background ozone concentration. Data from Canyonlands was used for the entire domain.
- The background ozone concentration (BCKO3 = 80 ppb) was used only when hourly data were missing.
- The background ammonia concentrations were based on the IWAQM guidance, which for this area is a constant 1 ppb for all months.
- MESOPUFF II chemical transformation rates were used.
- The species emitted were the seven identified in CALPUFF: SO_2, SO_4, NO_x, EC, SOA, PM-fine ($PM_{2.5}$), and PM-coarse (PM_{10} - $PM_{2.5}$).
- The species modeled were the nine identified in CALPUFF: SO_2, SO_4, NO_x, EC, SOA, HNO_3, NO_3, PM-fine ($PM_{2.5}$), and PM-coarse (PM_{10} - $PM_{2.5}$). $PM_{2.5}$ was speciated per NPS method at http://www2.nature.nps.gov/air/Permits/ect/index.cfm.
- Pasquill-Gifford Dispersion Coefficients for rural areas were used because the area in the modeling domains is rural.
- Each unit of each source was modeled in one run for each model scenario or control scenario and meteorological year.

5.2.1 Background Ozone Concentrations

Data from Canyonlands was used for the entire domain. There is limited ozone data available for the years 2001-2003 outside of the Wasatch Front urban area and Canyonlands is representative of regional ozone concentrations in the modeling domain. A background ozone value of 60 ppb was assumed when hourly data were missing. DAQ did not use the default value of 80 ppb ozone because this level is not often reached in the area.

[16] Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts, Office of Air Quality Standards, EPA-454/R-98-019, December 1998.

5.2.2 Background Ammonia Concentrations

The CALPUFF model requires input data to specify representative monthly background ammonia concentrations for use in the transformation of gaseous nitric acid to particulate ammonium nitrate and also for the formation of particulate ammonium sulfate.

DAQ relied on the IWAQM default ammonia value for arid areas. DAQ intends to perform ammonia sensitivity modeling in future runs due to the low background ammonia values recorded at the Navajo Lake site in New Mexico (NDAP, AMon network). DAQ recently began collecting ammonia data at Canyonlands and the values so far are comparable to those measured at Navajo Lake.

5.2.3 Receptor Locations

Predicted visibility impacts were computed at a set of gridded receptor locations for the Class I areas within the area considered for this modeling. These data are in Appendix E, and were downloaded from the National Park Service website.[17]

[17] National Park Service website with Class I area receptor information. http://www2.nature.nps.gov/air/Maps/Receptors/index.cfm.

5.3 POST-PROCESSING

Visibility impacts were calculated from the CALPUFF concentration results using POSTUTIL and CALPOST. POSTUTIL was used to repartition total nitrate by accounting for ammonia-limiting conditions. The output from CALPOST provides the highest deciview impacts on each day from all receptors within each Class I area modeled. Details of the parameter settings in CALPOST and POSTUTIL are provided in Appendix F and G, respectively, with some of the major features summarized below:

- For the visibility calculation, Method 8, Mode 5 (MVISBK=8, M8_MODE=5) was employed. This method uses monthly average relative humidity and f(RH) values for each Class I area, which are based on data from FLAG 2010.
- Particulate species for the visibility analysis included SO_4, NO_3, EC, SOA, PM-Fine ($PM_{2.5}$), and PM-Coarse (PM_{10} - $PM_{2.5}$).
- Natural background extinction calculations used the 20 percent best natural days for each Class I area considered for this modeling. The values assumed for the 20 percent best natural days are included in Appendix A.
- Tables providing the monthly relative humidity adjustment factors [f(RH)] and 20 percent best days coefficients are provided in Appendix A, and are based on data from FLAG 2010.
- POSTUTIL was used to perform HNO_3/NO_3 repartitioning for all three plants for each model scenario and meteorological year to provide a consistent comparison between alternatives.
- CALPOST was processed separately for each model scenario and meteorological year for each of the Class I areas in separate runs.
- The 98th percentile value was reported to three decimal places because of the level of precision reported by CALPOST. This value was based on the 8th highest day for each year, as reported in the ranked 24-hour delta-deciview listing for each Class I area. The highest value over the 3 modeled years was reported as the 98th percentile value. The 98th percentile value across all three years was also determined by using the 22nd highest value in the 3-year period.

5.3.1 POSTUTIL

The ammonia-limiting correction in the POSTUTIL postprocessor was used in all the model simulations to repartition the CALPUFF- predicted nitrate concentrations. This correction in POSTUTIL repartitions the particulate nitrate and gaseous nitric acid concentrations based on nitrate and sulfate concentrations from all of the units modeled at a given receptor, the available background ammonia, and gridded temperature and humidity data. The CALPUFF model simulates individual units (or sources) that may have multiple parcels of air originating at each of the units. CALPUFF also assumes that the background ammonia concentration is fully available to react with emissions from each unit, regardless of the number of units or overlapping air parcels. However, in reality, the total emissions from the combined units compete for the available ammonia and there is a possibility that different air parcels can overlap at a Class I area. The ammonia-limiting correction in POSTUTIL is designed to repartition the available ammonia to react with emissions from all of the units and overlapping air parcels,

thereby avoiding double counting of the background ammonia. This approach is a standard configuration in the CALPUFF modeling system.

To apply the ammonia-limiting correction in POSTUTIL, the MNITRATE=1 setting was used, the CALPUFF data were not scaled to alter the emission rate of all units modeled, and the associated background ammonia concentration outlined in section 5.2.2 was applied to each source. The output concentration file from CALPUFF contains information on each puff and which emission unit it came from. Details of the parameter settings in POSTUTIL are provided in Appendix G.

5.3.2 CALPOST

The CALPOST postprocessor was used to calculate the visibility impacts from all units at the source at a given receptor for each meteorological year modeled. The visibility impacts were determined by comparing the impacts of sulfate, nitrate, nitrogen dioxide, course particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) from the source to the 20 percent best days natural background conditions at each Class I area (i.e., delta-deciview [Δdv]). The Δdv calculations followed the FLAG 2010 guidance. In particular, Method 8 was used to assess the visibility impacts of the individual BART sources. Method 8 uses an improved algorithm to estimate the light scattering and visibility impairment caused by air pollutants. To ensure compliance with the FLAG 2010 guidance, the CALPOST setting MVISCHECK was set to 1. All settings that comply with MVISCHECK, include:

- MVISBK = 8 to invoke the latest FLAG guidance (latest IMPROVE equation); and
- M8_MODE = 5 to use species specific relative humidity factors.

The species concentrations of the 20 percent best days natural background conditions at each Class I area are defined in Appendix A, Table A-1. The species-specific relative humidity adjustment factors for each Class I area are defined in Appendix A, Table A-2 to Table A-5.

6 PRESENTATION OF RESULTS AND REPORTING

The change in visibility impairment (i.e., delta-deciview [Δdv]) for the visibility modeling is based on the increase in the haze index from a source relative to natural background, defined as the 20 percent best natural visibility days for each Class I area.

EPA has recognized that the CALPUFF model can be conservative in estimating visibility impairment, and therefore, consistent with the BART Guidelines, DAQ used the 98th percentile model results instead of the maximum modeled visibility impairment to address the possibility of model over predictions.[18] The FLAG 2010 guidance also recognizes that the visibility impairment is based on the 98th Δdv percentile value (or 8th highest value).

Output from CALPOST was configured to provide a ranked list of the Δdv values in each Class I area. The 98th percentile Δdv value was then determined directly from the CALPOST output. The impacts (or 98th percentile Δdv value) were calculated separately for each meteorological year for each source impact on the Class I areas.

If the simulation is a control simulation, the 98th percentile Δdv improvement (or visibility improvement) was also determined separately for each meteorological year and Class I area. The 98th percentile Δdv improvement is defined as the difference in 98th Δdv of the baseline and the 98th percentile Δdv of the control case.

Because the alternative scenario includes emission reductions of SO_2 and PM in addition to reductions of NOx, and because emission reductions are occurring at 3 separate plants, the visibility impact will vary from day to day and may not be best represented by the 98th percentile value. For example, the visibility improvement on one day may be more influenced by SO_2 reductions and on the next day may be more influenced by SO_2 reductions. For this reason, the results will be presented in a variety of metrics to better reflect the complexity of the comparison.

[18] 40 CFR 51 Appendix Y.IV.D. and 70 FR 39121.

APPENDIX A – BACKGROUND CONDITIONS ASSUMED FOR MODELING

Table A-1. 20 Percent Best Natural Background Conditions by Aerosol Component and Class I Area [μg/m^3]

Class I Area	Ammonium Sulfate	Ammonium Nitrate	Organic Carbon	Elemental Carbon	SOIL	Coarse Matter	Sea Salt
Arches NP	0.07	0.06	0.23	0.01	0.14	0.89	0.01
Bryce Canyon NP	0.04	0.05	0.18	0.01	0.1	0.6	0
Canyonlands NP	0.07	0.06	0.23	0.01	0.14	0.89	0.01
Capitol Reef NP	0.06	0.07	0.26	0.01	0.15	0.79	0.01
Zion NP	0.05	0.06	0.28	0.01	0.1	0.6	0.01
Black Canyon of the Gunnison NP	0.06	0.04	0.24	0.01	0.13	0.88	0
Mesa Verde NP	0.06	0.05	0.24	0.01	0.17	0.67	0
Grand Canyon NP	0.04	0.03	0.12	0.01	0.10	0.59	0
Flat Tops Wilderness	0.04	0.03	0.14	0.01	0.08	0.36	0

Values gathered from Table 5 of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) 2008. Phase I Report—Revised (2010).

Table A-2. Monthly $f_L(RH)$ – Large $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factors by Month and Class I Area

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Arches NP	2.28	2.12	1.73	1.57	1.5	1.28	1.34	1.47	1.51	1.56	1.9	2.13
Black Canyon of the Gunnison NP	2.15	2.05	1.83	1.75	1.74	1.51	1.59	1.78	1.8	1.68	1.96	2.06
Bryce Canyon NP	2.31	2.16	1.82	1.56	1.47	1.26	1.3	1.46	1.46	1.55	1.87	2.15
Canyonlands NP	2.32	2.16	1.78	1.58	1.51	1.28	1.36	1.53	1.55	1.58	1.93	2.17
Capitol Reef NP	2.36	2.22	1.84	1.63	1.54	1.31	1.36	1.52	1.55	1.61	1.95	2.22
Mesa Verde NP	2.45	2.25	1.98	1.57	1.61	1.31	1.62	1.87	1.75	1.66	2.01	2.3
Zion NP	2.32	2.18	1.83	1.56	1.45	1.26	1.24	1.38	1.4	1.51	1.84	2.14
Grand Canyon NP	2.13	2.01	1.74	1.46	1.36	1.19	1.29	1.49	1.47	1.50	1.75	1.98
Flat Tops Wilderness	2.09	2.04	1.87	1.84	1.86	1.62	1.59	1.7	1.79	1.72	1.97	2.03

Values gathered from Table 7 of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) 2008. Phase I Report—Revised (2010).

Table A-3. Monthly $f_S(RH)$ – Small $(NH_4)_2SO_4$ and NH_4NO_3 Relative Humidity Adjustment Factors by Month and Class I Area

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Arches NP	2.96	2.7	2.09	1.84	1.75	1.4	1.49	1.69	1.76	1.83	2.33	2.69
Black Canyon of the Gunnison NP	2.71	2.56	2.23	2.12	2.12	1.75	1.87	2.17	2.21	2	2.42	2.57
Bryce Canyon NP	3.02	2.77	2.23	1.84	1.7	1.38	1.42	1.67	1.67	1.81	2.3	2.75
Canyonlands NP	3.03	2.77	2.17	1.86	1.76	1.4	1.52	1.78	1.81	1.87	2.38	2.77
Capitol Reef NP	3.1	2.86	2.27	1.94	1.81	1.45	1.52	1.77	1.81	1.91	2.43	2.86
Mesa Verde NP	3.32	2.96	2.55	1.88	1.96	1.46	1.94	2.35	2.13	2.04	2.57	3.06
Zion NP	3.05	2.81	2.26	1.84	1.67	1.37	1.33	1.54	1.58	1.75	2.25	2.72
Grand Canyon NP	2.73	2.53	2.12	1.69	1.52	1.27	1.42	1.72	1.69	1.74	2.11	2.49
Flat Tops Wilderness	2.61	2.53	2.28	2.26	2.31	1.91	1.86	2.04	2.19	2.06	2.42	2.51

Values gathered from Table 8 of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) 2008. Phase I Report—Revised (2010).
/B-03-005, September 2003.

APPENDIX B – EMISSION ASSUMPTIONS FOR MODELING

Table B.1 – Modeling Assumptions for Hunter Unit 1

CALPUFF Inputs	Baseline	Scenario 1	Scenario 3
SO_2 (lb/hr)	807.5	570	570
Total Sulfate (SO_4)(lb/hr)	4.50	0.11	1.64
NOx (lb/hr)	2388	1202	298
HNO_3	0	0	0
NO_3	0	0	0
PM_{10} (lb/hr)	156	35.63	35.63
$PM_{2.5}$ (lb/hr)	68	34.3	34.3
Stack Height (meters)	183	183	183
Base Elevation (meters)	1720	1720	1720
Stack Diameter (meters)	7.3	7.3	7.3
Exit Velocity (meters/second)	17.3	17.3	17.3
Exit Temperature (Kelvin)	330	317	317

Table B.2 – Modeling Assumptions for Hunter Unit 2

CALPUFF Inputs	Baseline	Scenario 1	Scenario 3
SO_2 (lb/hr)	807.5	570	570
Total Sulfate (SO_4)(lb/hr)	4.50	0.10	1.53
NOx (lb/hr)	1975	1044	259
HNO_3	0	0	0
NO_3	0	0	0
PM_{10} (lb/hr)	156	37.2	37.2
$PM_{2.5}$ (lb/hr)	68	35.8	35.8
Stack Height (meters)	183	183	183
Base Elevation (meters)	1720	1720	1720
Stack Diameter (meters)	7.3	7.3	7.3
Exit Velocity (meters/second)	17.3	17.3	17.3
Exit Temperature (Kelvin)	330	317	317

Table B.3 – Modeling Assumptions for Hunter Unit 3

CALPUFF Inputs	Baseline	Scenario A
SO_2 (lb/hr)	269.8	269.8
Total Sulfate (SO_4)(lb/hr)	0.37	0.37
NOx (lb/hr)	2038.3	1240.3
HNO_3	0	0
NO_3	0	0
PM_{10} (lb/hr)	44.6	44.6
$PM_{2.5}$ (lb/hr)	25.7	25.7
Stack Height (meters)	182.88	182.88
Base Elevation (meters)	1736.61	1736.61
Stack Diameter (meters)	7.3	7.3
Exit Velocity (meters/second)	13.4	13.4
Exit Temperature (Kelvin)	322	322

Table B.4 – Modeling Assumptions for Huntington Unit 1

CALPUFF Inputs	Baseline	Scenario 1	Scenario 3
SO_2 (lb/hr)	843.2	595	595
Total Sulfate (SO_4)(lb/hr)	5.97	0.10	1.55
NOx (lb/hr)	2260	1338	301
HNO_3	0	0	0
NO_3	0	0	0
PM_{10} (lb/hr)	163	37.2	37.2
$PM_{2.5}$ (lb/hr)	70	35.8	35.8
Stack Height (meters)	183	183	183
Base Elevation (meters)	1964	1964	1964
Stack Diameter (meters)	7.3	7.3	7.3
Exit Velocity (meters/second)	19.6	19.6	19.6
Exit Temperature (Kelvin)	330	317	317

Table B.5 – Modeling Assumptions for Huntington Unit 2

CALPUFF Inputs	Baseline	Scenario 1	Scenario 3
SO_2 (lb/hr)	4464	595.2	595.2
Total Sulfate (SO_4)(lb/hr)	8.12	0.11	1.61
NOx (lb/hr)	2014	1166	261
HNO_3	0	0	0
NO_3	0	0	0
PM_{10} (lb/hr)	163	35.7	35.7
$PM_{2.5}$ (lb/hr)	70	34.3	34.3
Stack Height (meters)	183	183	183
Base Elevation (meters)	1964	1964	1964
Stack Diameter (meters)	7.3	7.3	7.3
Exit Velocity (meters/second)	19.6	19.6	19.6
Exit Temperature (Kelvin)	330	317	317

Table B.6 – Modeling Assumptions for Carbon Unit 1

CALPUFF Inputs	Baseline	Scenario A
SO_2 (lb/hr)	1347.75	0
Total Sulfate (SO_4)(lb/hr)	1.54	0
NOx (lb/hr)	437.58	0
HNO_3	0	0
NO_3	0	0
PM_{10} (lb/hr)	15.14	0
$PM_{2.5}$ (lb/hr)	3.02	0
Stack Height (meters)	61.0	61.0
Base Elevation (meters)	1881.6	1881.6
Stack Diameter (meters)	3.1	3.1
Exit Velocity (meters/second)	25.6	25.6
Exit Temperature (Kelvin)	414.0	414.0

Table B.7 – Modeling Assumptions for Carbon Unit 2

CALPUFF Inputs	Baseline	Scenario 1
SO_2 (lb/hr)	1811.75	0
Total Sulfate (SO_4)(lb/hr)	2.32	0
NOx (lb/hr)	696.08	0
HNO_3	0	0
NO_3	0	0
PM_{10} (lb/hr)	25.0	0
$PM_{2.5}$ (lb/hr)	4.99	0
Stack Height (meters)	61.0	61.0
Base Elevation (meters)	1880.3	1880.3
Stack Diameter (meters)	3.7	3.7
Exit Velocity (meters/second)	27.0	27.0
Exit Temperature (Kelvin)	424.0	424.0

APPENDIX C – CALMET CONTROL FILE INPUTS

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


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT = Jan01_geo\GEO.DAT !
SURF.DAT      input    ! SRFDAT = surf01/SURF01.DAT !
CLOUD.DAT     input    * CLDDAT = *
PRECIP.DAT    input    ! PRCDAT = precip01/PRECIP01.DAT !

WT.DAT        input    * WTDAT = *

CALMET.LST    output   ! METLST = Jan01.LST !
CALMET.DAT    output   ! METDAT = Jan_2001.DAT !
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 = F !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA = 1 !
    Number of overwater met stations
                                (NOWSTA) No default     ! NOWSTA = 0 !

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

    Number of MM4/MM5/3D.DAT files
                                (NM3D) No default       ! NM3D = 33 !

    Number of IGF-CALMET.DAT files
                                (NIGF)   No default     ! NIGF = 0 !

                      !END!
------------------------------------------------------------------------------
Subgroup (b)
```

```
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type       File Name
------------  ----       ---------
UP1.DAT     input   1  ! UPDAT=UPSLC01.DAT!    !END!

------------------------------------------------------------------------------
Subgroup (c)
-----------------------------------------
Overwater station files (one per station)
-----------------------------------------
Default Name  Type       File Name
------------  ----       ---------

------------------------------------------------------------------------------
Subgroup (d)
------------------------------------------------
MM4/MM5/3D.DAT files (consecutive or overlapping)
------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
MM41.DAT     input   1  ! M3DDAT=mm5\20001231.mm5!    !END!
MM42.DAT     input   2  ! M3DDAT=mm5\20010101.mm5!    !END!
MM43.DAT     input   3  ! M3DDAT=mm5\20010102.mm5!    !END!
MM44.DAT     input   4  ! M3DDAT=mm5\20010103.mm5!    !END!
MM45.DAT     input   5  ! M3DDAT=mm5\20010104.mm5!    !END!
MM46.DAT     input   6  ! M3DDAT=mm5\20010105.mm5!    !END!
MM47.DAT     input   7  ! M3DDAT=mm5\20010106.mm5!    !END!
MM48.DAT     input   8  ! M3DDAT=mm5\20010107.mm5!    !END!
MM49.DAT     input   9  ! M3DDAT=mm5\20010108.mm5!    !END!
MM410.DAT     input   10  ! M3DDAT=mm5\20010109.mm5!    !END!
MM411.DAT     input   11  ! M3DDAT=mm5\20010110.mm5!    !END!
MM412.DAT     input   12  ! M3DDAT=mm5\20010111.mm5!    !END!
MM413.DAT     input   13  ! M3DDAT=mm5\20010112.mm5!    !END!
MM414.DAT     input   14  ! M3DDAT=mm5\20010113.mm5!    !END!
MM415.DAT     input   15  ! M3DDAT=mm5\20010114.mm5!    !END!
MM416.DAT     input   16  ! M3DDAT=mm5\20010115.mm5!    !END!
MM417.DAT     input   17  ! M3DDAT=mm5\20010116.mm5!    !END!
MM418.DAT     input   18  ! M3DDAT=mm5\20010117.mm5!    !END!
MM419.DAT     input   19  ! M3DDAT=mm5\20010118.mm5!    !END!
MM420.DAT     input   20  ! M3DDAT=mm5\20010119.mm5!    !END!
MM421.DAT     input   21  ! M3DDAT=mm5\20010120.mm5!    !END!
```

```
MM422.DAT     input   22  ! M3DDAT=mm5\20010121.mm5!    !END!
MM423.DAT     input   23  ! M3DDAT=mm5\20010122.mm5!    !END!
MM424.DAT     input   24  ! M3DDAT=mm5\20010123.mm5!    !END!
MM425.DAT     input   25  ! M3DDAT=mm5\20010124.mm5!    !END!
MM426.DAT     input   26  ! M3DDAT=mm5\20010125.mm5!    !END!
MM427.DAT     input   27  ! M3DDAT=mm5\20010126.mm5!    !END!
MM428.DAT     input   28  ! M3DDAT=mm5\20010127.mm5!    !END!
MM429.DAT     input   29  ! M3DDAT=mm5\20010128.mm5!    !END!
MM430.DAT     input   30  ! M3DDAT=mm5\20010129.mm5!    !END!
MM431.DAT     input   31  ! M3DDAT=mm5\20010130.mm5!    !END!
MM432.DAT     input   32  ! M3DDAT=mm5\20010131.mm5!    !END!
MM433.DAT     input   33  ! M3DDAT=mm5\20010201.mm5!    !END!

-------------------------------------------------------------------------------
Subgroup (e)
------------------------------------------------
IGF-CALMET.DAT files (consecutive or overlapping)
------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
* IGFDATFILES = *
-------------------------------------------------------------------------------
Subgroup (f)
----------------
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 = *
DCST.GRD      output     * DCSTGD = *

-------------------------------------------------------------------------------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (f) must have ONE 'END' (surrounded by
           delimiters) at the end of the group
```

```
       (3) Subgroups (b) through (e) are included ONLY if the corresponding
           number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and each 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 !

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

     Base time zone        (IBTZ) -- No default       ! IBTZ = 7 !
        PST = 08, MST = 07
        CST = 06, EST = 05

     Length of run (hours) (IRLG) -- No default       ! IRLG = 744 !

     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


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                    No Default       ! MREG = 0 !

        0 = NO checks are made
        1 = Technical options must conform to USEPA guidance
                  IMIXH    -1       Maul-Carson convective mixing height
                                    over land; OCD mixing height overwater
                  ICOARE   0        OCD deltaT method for overwater fluxes
                  THRESHL  0.0      Threshold buoyancy flux over land needed
                                    to sustain convective mixing height growth

!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 !
     (FNORTH)                    Default=0.0     ! FNORTH = 0 !
```

```
UTM zone (1 to 60)
(Used only if PMAP=UTM)
(IUTMZN)                    No Default      ! IUTMZN = 19 !

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 = 38.883N  !
(RLON0)                     No Default      ! RLON0 = 110.839W  !

    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 = 36.976N  !
(XLAT2)                     No Default      ! XLAT2 = 40.791N  !


    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-84).  Other local
models may be in use, and their selection in CALMET will make its output
consistent with local mapping products.  The list of Datum-Regions with
official transformation parameters is provided by the National Imagery and
Mapping Agency (NIMA).

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

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


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 = 138 !
       No. Y grid cells (NY)      No default     ! NY = 136 !

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 = -264 !
   Y coordinate (YORIGKM)         No default     ! YORIGKM = -280 !
                                  Units: km
```

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

        No. of vertical layers (NZ)    No default     ! NZ = 11 !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))    No defaults
                                       Units: m
        ! ZFACE = 0.00,20.00,100.00,200.00,350.00,500.00,750.00,1000.00,2000.00,3000.00,4000.00,5000.00 !

!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 = F !
       (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  6  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 = *
 ------------------------


 Specify which levels of the W wind component to print
 (NOTE: W defined at TOP cell face --  6  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 = *


 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 = *

 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 !

    Print distance to land
    internal variables (LDBCST)      Default: F       ! LDBCST = F !
    (F = Do not print, T = print)
    (Output in .GRD file DCST.GRD, defined in input group 0)

 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 = 1 !

    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 MM4/MM5/3D.DAT for upper air data
          2 = No surface, overwater, or upper air observations
              Use MM4/MM5/3D.DAT for surface, overwater, and upper air data
```

```
    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

       Number of surface stations   (NSSTA)  No default     ! NSSTA = 12 !

       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5/3D.DAT precip data)
                                    (NPSTA)  No default     ! NPSTA = 54 !

    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
                    at 850mb (Teixera)

    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 = 2 !
       (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 = 1 !
   (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 = 0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0 !

       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 !

       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 MM5/3D.DAT file as Step 1 field [IWFCOD = 0]
        14 = Yes, use winds from MM5/3D.DAT file as initial guess field [IWFCOD = 1]
        15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD = 1]

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

       Use coarse CALMET fields as initial guess fields (IGFMET)
       (overwrites IGF based on prognostic wind fields if any)
                                            Default: 0      ! IGFMET = 0 !

    RADIUS OF INFLUENCE PARAMETERS

       Use varying radius of influence      Default: F      ! LVARY = F !
       (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 = 10 !
                                            Units: km
       Maximum radius of influence over land
       aloft (RMAX2)                        No default      ! RMAX2 = 100 !
                                            Units: km
       Maximum radius of influence over water
```

```
   (RMAX3)                                No default      ! RMAX3 = 50 !
                                          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 = 20 !

                                          Units: km
   Relative weighting of the first
   guess field and observations in the
   SURFACE layer (R1)                     No default      ! R1 = 5 !
   (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 = 50 !
   (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 = 0 !
   (Used only if IPROG = 1)               Units: km
   -------------------------

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

   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 = 2,10*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 = 11*12 !

   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 = 11*0 !
   (Used only if IEXTRP = 3 or -3)


BARRIER INFORMATION

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

   Level (1 to NZ) up to which barriers
   apply (KBAR)                          Default: NZ     ! KBAR = 10 !

   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 =  !
      Y coordinate of BEGINNING
      of each barrier (YBBAR(NBAR))      ! YBBAR =  !

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

```
DIAGNOSTIC MODULE DATA INPUT OPTIONS

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

      Surface met. station to use for
      the surface temperature (ISURFT)   No default     ! ISURFT = 11 !
      (Must be a value from 1 to NSSTA)
      (Used only if IDIOPT1 = 0)
      --------------------------

   Temperature lapse rate used in the    Default: 0     ! IDIOPT2 = 0 !
      computation of terrain-induced
      circulations (IDIOPT2)
      0 = Compute internally from (at least) twice-daily
          upper air observations or prognostic fields
      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 = 1 !
      (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
      --------------------------

   Initial Guess Field Winds
   (IDIOPT3)                             Default: 0     ! IDIOPT3 = 0 !
      0 = Compute internally from
          observations or prognostic wind fields
      1 = Read hourly preprocessed domain-average wind values
          from a data file (DIAG.DAT)

      Upper air station to use for
      the initial guess winds (IUPWND)   Default: -1    ! IUPWND = 1 !
```

```
   (Must be a value from -1 to NUSTA, with
   -1 indicating 3-D initial guess fields,
   and IUPWND>1 domain-scaled (i.e. constant) IGF)
   (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= 1.0, 1000.00 !
   (Used only if IDIOPT3 = 0, NOOBS>0 and IUPWND>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 =  !
 X Grid line 2 defining the region of interest
                                                   ! XG2 =  !
 Y Grid line 1 defining the region of interest
                                                   ! YG1 =  !
 Y Grid line 2 defining the region of interest
                                                   ! YG2 =  !
```

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

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

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

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


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

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

!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 = 0.0001 !
                                         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)


CONVECTIVE MIXING HEIGHT OPTIONS:
   Method to compute the convective
   mixing height(IMIHXH)                Default: 1      ! IMIXH = 1 !
       1: Maul-Carson for land and water cells
      -1: Maul-Carson for land cells only -
          OCD mixing height overwater
       2: Batchvarova and Gryning for land and water cells
      -2: Batchvarova and Gryning for land cells only
          OCD mixing height overwater

   Threshold buoyancy flux required to
   sustain convective mixing height growth
   overland (THRESHL)                   Default: 0.05   ! THRESHL = 0.05 !
   (expressed as a heat flux            units: W/m3
    per meter of boundary layer)


   Threshold buoyancy flux required to
   sustain convective mixing height growth
   overwater (THRESHW)                  Default: 0.05   ! THRESHW = 0.05 !
   (expressed as a heat flux            units: W/m3
    per meter of boundary layer)


   Option for overwater lapse rates used
   in convective mixing height growth
   (ITWPROG)                            Default: 0      ! ITWPROG = 0 !
```

```
   0 : use SEA.DAT lapse rates and deltaT (or assume neutral
       conditions if missing)
   1 : use prognostic lapse rates (only if IPROG>2)
       and SEA.DAT deltaT (or neutral if missing)
   2 : use prognostic lapse rates and prognostic delta T
       (only if iprog>12 and 3D.DAT version# 2.0 or higher)

   Land Use category ocean in 3D.DAT datasets
   (ILUOC3D)                          Default: 16     ! ILUOC3D = 16 !
   Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16
         if MM4.DAT,           typically iluoc3d = 7


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 = 50 !
   (ZIMIN)                            Units: meters
   Maximum overland mixing height     Default: 3000.  ! ZIMAX = 4000 !
   (ZIMAX)                            Units: meters
   Minimum overwater mixing height    Default:   50.  ! ZIMINW = 50 !
   (ZIMINW) -- (Not used if observed  Units: meters
   overwater mixing hts. are used)
   Maximum overwater mixing height    Default: 3000.  ! ZIMAXW = 3000 !
   (ZIMAXW) -- (Not used if observed  Units: meters
   overwater mixing hts. are used)


OVERWATER SURFACE FLUXES METHOD and PARAMETERS
      (ICOARE)                        Default: 10      ! ICOARE = 10 !
       0: original deltaT method (OCD)
      10: COARE with no wave parameterization (jwave=0, Charnock)
      11: COARE with wave option jwave=1 (Oost et al.)
          and default wave properties
     -11: COARE with wave option jwave=1 (Oost et al.)
          and observed wave properties (must be in SEA.DAT files)
```

```
      12: COARE with wave option 2 (Taylor and Yelland)
           and default wave properties
     -12: COARE with wave option 2 (Taylor and Yelland)
          and observed wave properties (must be in SEA.DAT files)

      Coastal/Shallow water length scale (DSHELF)
      (for modified z0 in shallow water)
      ( COARE fluxes only)
                                    Default : 0.        ! DSHELF = 0 !
                                    units: km

       COARE warm layer computation (IWARM)             ! IWARM = 0 !
       1: on - 0: off (must be off if SST measured with
       IR radiometer)               Default: 0

       COARE cool skin layer computation (ICOOL)        ! ICOOL = 0 !
       1: on - 0: off (must be off if SST measured with
       IR radiometer)               Default: 0

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 MM5/3D.DAT for upper air data
          (only if NOOBS = 0,1)
      2 = No surface or upper air observations
          Use MM5/3D.DAT 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 = 12 !
```

```
      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          Units: K/m
      water (TGDEFB)

      Default temperature gradient          Default: -.0045 ! TGDEFA = -0.0045 !
      above the mixing height over          Units: K/m
      water (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  (SIGMAP)         Default: 100.0   ! SIGMAP = 100 !
       (0.0 => use half dist. btwn          Units: km
        nearest stns w & w/out
        precip when NFLAGP = 3)
      Minimum Precip. Rate Cutoff (CUTP)    Default: 0.01    ! CUTP = 0.01 !
       (values <CUTP = 0.0 mm/hr)          Units: mm/hr
!END!


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

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

     SURFACE STATION VARIABLES
     (One record per station --  12  records in all)


            1     2
        Name     ID     X coord.   Y coord.    Time   Anem.
                          (km)       (km)       zone   Ht.(m)
```

```
       ------------------------------------------------------------
! SS1  ='BCE'    24756  -115.560   -129.310      7.000     10.000  !
! SS2  ='CDC'    24755  -199.250   -126.560      7.000     10.000  !
! SS3  ='CNY'    24776    94.610    -14.190      7.000     10.000  !
! SS4  ='HIF'    25755   -95.000    248.900      7.000     10.000  !
! SS5  ='MLF'    24797  -191.170    -46.860      7.000     10.000  !
! SS6  ='OGD'    25750   -98.250    257.830      7.000     10.000  !
! SS7  ='PGA'    23710   -54.440   -216.510      7.000     10.000  !
! SS8  ='PUC'    24700     7.640     81.780      7.000     10.000  !
! SS9  ='PVU'    25724   -74.970    148.740      7.000     10.000  !
! SS10 ='SGU'    24754  -245.450   -196.340      7.000     10.000  !
! SS11 ='SLC'    25720   -95.460    212.250      7.000      6.000  !
! SS12 ='VEL'    25705   111.900    172.490      7.000     10.000  !

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

      2
        Six digit integer for station ID

!END!


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

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

     UPPER AIR STATION VARIABLES
     (One record per station --  3  records in all)

             1     2
         Name    ID      X coord.   Y coord.  Time zone
                           (km)       (km)
        ---------------------------------------------
! US1  ='slc'    24127   -95.484    210.030       7 !

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

```
      2
        Five digit integer for station ID

!END!


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

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  ='UT01'  420086  -145.200   -159.910  !
! PS2  ='UT02'  420168   -98.950    -69.620  !
! PS3  ='UT03'  420336   106.100    -28.470  !
! PS4  ='UT04'  420342   -71.140    194.220  !
! PS5  ='UT05'  420522  -151.370    -65.470  !
! PS6  ='UT06'  420738   119.940   -139.240  !
! PS7  ='UT07'  420820   -87.780    218.820  !
! PS8  ='UT08'  421008  -117.450   -138.160  !
! PS9  ='UT09'  421260  -190.630   -134.540  !
! PS10 ='UT10'  421267  -181.630   -126.980  !
! PS11 ='UT11'  421308   155.020   -127.540  !
! PS12 ='UT12'  421590   -26.200    227.250  !
! PS13 ='UT13'  421759   -79.620    193.190  !
! PS14 ='UT14'  422090  -151.750     51.060  !
! PS15 ='UT15'  422256  -161.790   -148.490  !
! PS16 ='UT16'  422385   -49.750    231.810  !
! PS17 ='UT17'  422561  -247.540   -119.670  !
! PS18 ='UT18'  422578   -63.820     54.300  !
! PS19 ='UT19'  422696  -105.520    154.640  !
! PS20 ='UT20'  422702   -49.770     96.360  !
! PS21 ='UT21'  422726   -90.930    237.740  !
! PS22 ='UT22'  423348  -138.030    191.790  !
```

```
! PS23 ='UT23'  423418    59.670     10.990  !
! PS24 ='UT24'  423611    10.390    -56.910  !
! PS25 ='UT25'  423780  -140.350   -135.580  !
! PS26 ='UT26'  424538   -91.770    237.750  !
! PS27 ='UT27'  425186   -79.990    318.730  !
! PS28 ='UT28'  425194   -86.750    309.910  !
! PS29 ='UT29'  425477  -121.360    -47.120  !
! PS30 ='UT30'  425654  -190.400    -51.310  !
! PS31 ='UT31'  425815    28.700    187.280  !
! PS32 ='UT32'  425892   -74.400    207.580  !
! PS33 ='UT33'  426127    65.150    183.060  !
! PS34 ='UT34'  426135   -84.950     91.120  !
! PS35 ='UT35'  426374   -33.030    205.070  !
! PS36 ='UT36'  426404   -93.150    263.320  !
! PS37 ='UT37'  426414   -99.880    261.180  !
! PS38 ='UT38'  426455   -68.910    159.780  !
! PS39 ='UT39'  426648   -57.580    198.550  !
! PS40 ='UT40'  426757   -99.560    285.620  !
! PS41 ='UT41'  426938  -108.920    332.430  !
! PS42 ='UT42'  427026     1.630     79.560  !
! PS43 ='UT43'  427064   -68.980    152.010  !
! PS44 ='UT44'  427260  -107.790    -11.800  !
! PS45 ='UT45'  427395    73.880    155.390  !
! PS46 ='UT46'  427516  -242.720   -194.200  !
! PS47 ='UT47'  427598   -95.470    211.140  !
! PS48 ='UT48'  427690   -80.350    122.150  !
! PS49 ='UT49'  427729   -30.960     88.500  !
! PS50 ='UT50'  427846   -62.710    190.820  !
! PS51 ='UT51'  427959   -20.590    116.210  !
! PS52 ='UT52'  428371   -26.450    151.750  !
! PS53 ='UT53'  428939   -75.590    172.060  !
! PS54 ='UT54'  429136  -250.740   -166.200  !
```

APPENDIX D – CALPUFF CONTROL FILE INPUTS

```
---------------- 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 = Basecase_02.LST !
CONC.DAT      output   ! CONDAT = Conc_Basecase_02.DAT !
DFLX.DAT      output   ! DFDAT = DFLX.DAT !
WFLX.DAT      output   ! WFDAT = WFLX.DAT !

VISB.DAT      output   ! VISDAT = VISB.DAT !
RHO2D.DAT     output   * RHODAT = *
RESTARTE.DAT  output   * RSTARTE = *
------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT = *
VOLEMARB.DAT  input    * VOLDAT = *
BAEMARB.DAT   input    * ARDAT = *
LNEMARB.DAT   input    * LNDAT = *
------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    ! OZDAT = ..\..\ozone\O3_CAN02.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 = 12 !

     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=..\..\..\Calmet\2002\Jan_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Feb_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Mar_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Apr_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\May_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Jun_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Jul_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Aug_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Sep_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Oct_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Nov_02.DAT     !  !END!
 none          input    ! METDAT=..\..\..\Calmet\2002\Dec_02.DAT     !  !END!


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

  The following PTEMARB.DAT filenames are processed in sequence if NPTDAT>0
  (Each file contains a subset of the sources, for the entire simulation)

Default Name  Type          File Name
------------  ----          ---------
* PTDATLIST = *


-------------
Subgroup (0c)
-------------

  The following BAEMARB.DAT filenames are processed in sequence if NARDAT>0
  (Each file contains a subset of the sources, for the entire simulation)

Default Name  Type          File Name
------------  ----          ---------
* ARDATLIST = *


-------------
Subgroup (0d)
-------------

  The following VOLEMARB.DAT filenames are processed in sequence if NARDAT>0
  (Each file contains a subset of the sources, for the entire simulation)
```

```
Default Name  Type          File Name
------------  ----          ---------
* VOLDATLIST = *

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

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 = 2002 !
     (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 = 7 !
        PST = 8., MST = 7.
        CST = 6., EST = 5.

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

     Number of chemical species (NSPEC)
                                  Default: 5       ! NSPEC = 9 !

     Number of chemical species
     to be emitted  (NSE)         Default: 3       ! NSE = 7 !

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

     Restart Configuration:

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

           0 = Do not read or write a restart file
```

```
          1 = Read a restart file at the beginning of
              the run
          2 = Write a restart file during run
          3 = Read a restart file at beginning of run
              and write a restart file during run

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

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

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

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

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

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

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


!END!


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

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

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

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

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

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

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

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

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

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

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

```
   1 = yes (i.e., puffs are split)

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

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

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

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


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

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

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

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

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

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

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


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


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

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

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

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

PDF used for dispersion under convective conditions?
                                      Default: 0     ! MPDF = 0 !
```

```
(MPDF)
   0 = no
   1 = yes

Sub-Grid TIBL module used for shore line?
                                     Default: 0     ! MSGTIBL = 0 !
(MSGTIBL)
   0 = no
   1 = yes

Boundary conditions (concentration) modeled?
                                     Default: 0     ! MBCON = 0 !
(MBCON)
   0 = no
   1 = yes, using formatted BCON.DAT file
   2 = yes, using unformatted CONC.DAT file

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

Individual source contributions saved?
                                     Default: 0     ! MSOURCE = 0 !
(MSOURCE)
   0 = no
   1 = yes


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

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

```
        0 = no
        1 = yes  - report results in PLUME Mode format
        2 = yes  - report results in RECEPTOR Mode format


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                        Default: 1     ! MREG = 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
                        SVMIN    0.5 (m/s)


!END!


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

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

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

  The following species are modeled:
```

```
! CSPEC =          SO2 !            !END!
! CSPEC =          SO4 !            !END!
! CSPEC =          NOX !            !END!
! CSPEC =         HNO3 !            !END!
! CSPEC =          NO3 !            !END!
! CSPEC =           EC !            !END!
! CSPEC =          SOA !            !END!
! CSPEC =          PMF !            !END!
! CSPEC =          PMC !            !END!
```

	SPECIES NAME (Limit: 12 Characters in length)	MODELED (0=NO, 1=YES)	EMITTED (0=NO, 1=YES)	Dry DEPOSITED (0=NO, 1=COMPUTED-GAS 2=COMPUTED-PARTICLE 3=USER-SPECIFIED)	OUTPUT GROUP NUMBER (0=NONE, 1=1st CGRUP, 2=2nd CGRUP, 3= etc.)	
!	SO2 =	1,	1,	1,	0	!
!	SO4 =	1,	1,	2,	0	!
!	NOX =	1,	1,	1,	0	!
!	HNO3 =	1,	0,	1,	0	!
!	NO3 =	1,	0,	2,	0	!
!	EC =	1,	1,	2,	0	!
!	SOA =	1,	1,	2,	0	!
!	PMF =	1,	1,	2,	0	!
!	PMC =	1,	1,	2,	0	!

```
!END!
```

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

Subgroup (3b)

The following names are used for Species-Groups in which results for certain species are combined (added) prior to output. The CGRUP name will be used as the species name in output files. Use this feature to model specific particle-size distributions

```
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.


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


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

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

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

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

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

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                  No Default      ! IUTMZN = 19 !

     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 = 38.883N !
     (RLON0)                   No Default      ! RLON0 = 110.839W !

         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 = 36.976N !
(XLAT2)                    No Default      ! XLAT2 = 40.791N !

    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-84).  Other local
models may be in use, and their selection in CALMET will make its output
consistent with local mapping products.  The list of Datum-Regions with
official transformation parameters is provided by the National Imagery and
Mapping Agency (NIMA).

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

```
     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84     ! DATUM = NAR-C !


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 = 138 !
            No. Y grid cells (NY)      No default     ! NY = 136 !
         No. vertical layers (NZ)      No default     ! NZ = 11 !

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

                Cell face heights
                    (ZFACE(nz+1))      No defaults
                                       Units: m
   ! ZFACE =  0.0, 20.0, 100.0, 200.0, 350.0, 500.0, 750.0, 1000.0, 2000.0, 3000.0, 4000.0, 5000.0 !

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

            X coordinate (XORIGKM)     No default     ! XORIGKM = -264 !
            Y coordinate (YORIGKM)     No default     ! YORIGKM = -280 !
                                      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 = 138 !
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP = 136 !
                  (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 = 2 !
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP = 2 !
         (JBCOMP <= JESAMP <= JECOMP)


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

!END!


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

```
INPUT GROUP: 5 -- Output Options
--------------
                                        *                       *
     FILE                        DEFAULT VALUE             VALUE THIS RUN
     ----                        -------------             --------------

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

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


    QA PLOT FILE OUTPUT OPTION:

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

    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported 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 = 1 !
    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,           1,           0,           1,           0   !
!         SO4 =     0,           1,           0,           1,           0,           1,           0   !
!         NOX =     0,           1,           0,           1,           0,           1,           0   !
```

```
!         HNO3 =     0,           1,           0,           1,           0,           1,           0   !
!          NO3 =     0,           1,           0,           1,           0,           1,           0   !
!           EC =     0,           1,           0,           1,           0,           1,           0   !
!          SOA =     0,           1,           0,           1,           0,           1,           0   !
!          PMF =     0,           1,           0,           1,           0,           1,           0   !
!          PMC =     0,           1,           0,           1,           0,           1,           0   !

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


     OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

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

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

       Number of puffs to track
       (NPFDEB)                                  Default: 1     ! NPFDEB = 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 = 1.0 !
       to meters (MHILL=1)

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

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

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM = 0.0 !
       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)
      -------     -----------      ----------      ----------    --------------------     ----------------------
!         HNO3 =     0.1628,             1,            18,                0,                  1E-7 !
!          NOX =     0.1656,             1,             8,                5,                   3.5 !
!          SO2 =     0.1509,          1000,             8,                0,                  0.04 !


!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)
      -------      -------------------        ------------------
!           EC =         0.48,                       2   !
!          NO3 =         0.48,                       2   !
!          PMC =         0.48,                       2   !
!          PMF =         0.48,                       2   !
!          SO4 =         0.48,                       2   !
!          SOA =         0.48,                       2   !

!END!


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


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

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

     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.
       ---------      --------------       --------------
!           EC =        1.00E-04,            3.00E-05 !
!         HNO3 =        6.00E-05,             0.00E00 !
!          NO3 =        1.00E-04,            3.00E-05 !
!          NOX =         0.00E00,             0.00E00 !
!          PMC =        1.00E-04,            3.00E-05 !
!          PMF =        1.00E-04,            3.00E-05 !
!          SO2 =        3.00E-05,             0.00E00 !
!          SO4 =        1.00E-04,            3.00E-05 !
!          SOA =        1.00E-04,            3.00E-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 = 60, 60, 60, 60, 60, 60, 60, 60, 60, 60, 60, 60 !

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

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

    Nighttime NOx loss rate (RNITE2)
    in percent/hour                   Default: 2.0          ! RNITE2 = 2 !

    Nighttime HNO3 formation rate (RNITE3)
    in percent/hour                   Default: 2.0          ! RNITE3 = 2 !

    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 = 550 !

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

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

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

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

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

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

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

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

        Roughness length (m) for modeling domain
        (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 = 4,5 or MTURBVW = 1 or 3)
   (ISIGMAV)                               Default: 1      ! ISIGMAV = 1 !
       0 = read sigma-theta
       1 = read sigma-v

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

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

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

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

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

Number of iterations used when computing
```

```
the transport wind for a sampling step
that includes gradual rise (for CALMET
and PROFILE winds)
(NCOUNT)                                  Default: 2      ! NCOUNT = 2 !

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

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

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

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

      ! SVMIN =  0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5 !
      ! SWMIN = 0.2, 0.12, 0.08, 0.06, 0.03, 0.016, 0.2, 0.12, 0.08, 0.06, 0.03, 0.016 !

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

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

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

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

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, 10.8 !

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, 0.1, 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 = 0.02, 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 = 0.5, 0.5, 0.5, 0.5, 0.35, 0.35 !

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

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

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

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

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

  Split is allowed only if last hour's mixing
  height (m) exceeds a minimum value
  (ZISPLIT)                           Default: 100.       ! ZISPLIT = 100 !

  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 !

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

  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 = 1E-7 !

Integration control variables ------------------------

  Fractional convergence criterion for numerical SLUG
```

```
       sampling integration
       (EPSSLUG)                          Default:   1.0e-04  ! EPSSLUG = 0.0001 !

       Fractional convergence criterion for numerical AREA
       source integration
       (EPSAREA)                          Default:   1.0e-06  ! EPSAREA = 1E-6 !

       Trajectory step-length (m) used for numerical rise
       integration
       (DSRISE)                           Default:   1.0      ! DSRISE = 1 !

       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 !

       Search radius (km) about a receptor for sampling nearest BC puff.
       BC puffs are typically emitted with a spacing of one grid cell
       length, so the search radius should be greater than DGRIDKM.
       (RSAMPBC)                          Default:   10.      ! RSAMPBC = 10 !

       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 = 7 !
```

```
     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 = HUNTER1 !
   1 ! X =  -16.502,   32.582,   183.0, 1720.0,       7.3,  17.3,  330.0,  1.0,   807.5,     4.5,  2388.0,
       0,       0,   0.962,    20.8,  46.238,    88.0 !
   1 ! ZPLTFM =      0.0 !
   1 ! FMFAC =      1.0 !   !END!

   2 ! SRCNAM = HUNTER2 !
   2 ! X =  -16.407,   32.581,   183.0, 1720.0,       7.3,  17.3,  330.0,  1.0,   807.5,     4.5,  1975.0,
       0,       0,   0.962,    20.8,  46.238,    88.0 !
```

```
  2 ! ZPLTFM =      0.0 !
  2 ! FMFAC =      1.0 !   !END!

  3 ! SRCNAM = HUNTER3 !
  3 ! X =  -16.333,   32.545,   183.0, 1723.9,       7.3,  13.4,  322.0,  1.0,   269.8,    0.37,  2038.3,
    0,       0,   0.275,  5.9467, 19.4783,    18.9 !
  3 ! ZPLTFM =      0.0 !
  3 ! FMFAC =      1.0 !   !END!

  4 ! SRCNAM = HUNTG1 !
  4 ! X =  -20.716,   55.406,   183.0, 1964.0,       7.3,  19.6,  330.0,  1.0,   843.2,    5.97,  2260.0,
    0,       0,  1.0052, 21.7333, 47.2615,    93.0 !
  4 ! ZPLTFM =      0.0 !
  4 ! FMFAC =      1.0 !   !END!

  5 ! SRCNAM = HUNTG2 !
  5 ! X =  -20.669,   55.334,   183.0, 1964.0,       7.3,  19.6,  330.0,  1.0,  4464.0,    8.12,  2014.0,
    0,       0,  1.0052, 21.7333, 47.2615,    93.0 !
  5 ! ZPLTFM =      0.0 !
  5 ! FMFAC =      1.0 !   !END!

  6 ! SRCNAM = CARB_1 !
  6 ! X =   -2.195,   94.013,    61.0, 1881.6,       3.1,  25.6,  414.0,  1.0, 1347.75,    1.54,  437.58,
    0,       0, 0.09336,  2.0187,    0.91,  12.118 !
  6 ! ZPLTFM =      0.0 !
  6 ! FMFAC =      1.0 !   !END!

  7 ! SRCNAM = CARB_2 !
  7 ! X =   -2.181,   93.985,    61.0, 1880.3,       3.7,  27.0,  424.0,  1.0, 1811.75,    2.32,  696.08,
    0,       0,  0.1542,  3.3333,     1.5, 20.0125 !
  7 ! ZPLTFM =      0.0 !
  7 ! FMFAC =      1.0 !   !END!
```

---

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

SRCNAM is a 12-character name for a source
        (No default)
X   is an array holding the source data listed by the column headings
        (No default)
SIGYZI is an array holding the initial sigma-y and sigma-z (m)

```
            (Default: 0.,0.)
     ZPLTFM  is the platform height (m) for sources influenced by an isolated
             structure that has a significant open area between the surface
             and the bulk of the structure, such as an offshore oil platform.
             The Base Elevation is that of the surface (ground or ocean),
             and the Stack Height is the release height above the Base (not
             above the platform).  Building heights entered in Subgroup 13c
             must be those of the buildings on the platform, measured from
             the platform deck.  ZPLTFM is used only with MBDW=1 (ISC
             downwash method) for sources with building downwash.
             (Default: 0.0)
     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 for buildings resting on the surface
     2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)
     NOTE: must be entered as a REAL number (i.e., with decimal point)

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

---------------
Subgroup (13c)
---------------

           BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
           -------------------------------------------------------
Source                                                              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)
------     ---------------------------------------------------------------------

   1 ! SRCNAM = HUNTER1 !
   1 ! HEIGHT  =   70.00,   70.00,   70.00,   70.00,   70.00,   70.00,
                   70.00,   59.00,   59.00,   59.00,    0.00,   28.00,
                   30.00,   30.00,   30.00,   70.00,   70.00,   70.00,
                   70.00,   70.00,   70.00,   70.00,   70.00,   70.00,
```

```
                  70.00,   59.00,   59.00,   59.00,    0.00,   28.00,
                  30.00,   30.00,   30.00,   70.00,   70.00,   47.00 !
   1 ! WIDTH   =   42.87,  123.79,  121.65,  115.82,  106.47,   93.89,
                   78.45,  143.96,  128.15,  134.99,    0.00,   54.47,
                  293.25,  336.77,  370.06,   47.82,   42.87,   36.61,
                   42.87,  123.79,  121.65,  115.82,  106.47,   93.89,
                   78.45,  134.53,  128.15,  134.98,    0.00,   54.47,
                  293.25,  336.77,  370.06,   47.82,   42.87,  144.71 !
!END!
   2 ! SRCNAM = HUNTER2 !
   2 ! HEIGHT  =   70.00,   70.00,   70.00,   70.00,   70.00,   70.00,
                   59.00,   59.00,   59.00,   59.00,   59.00,   70.00,
                   70.00,   70.00,   70.00,   70.00,   70.00,   70.00,
                   70.00,   70.00,   70.00,   70.00,   70.00,   70.00,
                   59.00,   59.00,   59.00,   59.00,   59.00,   59.00,
                   47.00,   47.00,   70.00,   70.00,   70.00,   70.00 !
   2 ! WIDTH   =  122.16,  123.79,  121.65,  115.82,  106.47,   93.89,
                   59.22,  134.53,  128.15,  134.99,   59.23,   52.28,
                   53.58,   53.26,  122.53,  124.39,  122.46,  116.82,
                  122.16,  123.79,  121.65,  115.82,  106.47,   93.89,
                   59.23,  134.53,  128.15,  134.98,   59.23,   64.89,
                  136.29,  146.18,  122.53,  124.39,  122.46,  116.82 !
!END!
   3 ! SRCNAM = HUNTER3 !
   3 ! HEIGHT  =   70.00,   70.00,   59.00,   59.00,   59.00,   59.00,
                   59.00,    0.00,    0.00,    0.00,   59.00,   70.00,
                   70.00,   70.00,   70.00,   70.00,   70.00,   70.00,
                   70.00,   70.00,   59.00,   59.00,   59.00,   59.00,
                   59.00,    0.00,    0.00,    0.00,   59.00,   59.00,
                   59.00,   70.00,   70.00,   70.00,   70.00,   70.00 !
   3 ! WIDTH   =  122.16,  123.79,   69.68,   70.20,   68.59,   64.89,
                   59.22,    0.00,    0.00,    0.00,   59.23,   52.28,
                   53.58,  116.95,  122.53,  124.39,  122.46,  116.82,
                  122.16,  123.79,   69.68,   70.20,   68.59,   64.89,
                   59.23,    0.00,    0.00,    0.00,   59.23,   64.89,
                   68.59,  116.95,  122.53,  124.39,  122.46,  116.82 !
!END!
   4 ! SRCNAM = HUNTG1 !
   4 ! HEIGHT  =   22.86,   22.86,   22.86,   67.36,   47.24,   47.24,
                   47.24,   67.36,   47.24,   47.24,   47.24,   22.86,
                   22.86,    0.00,    0.00,    0.00,   22.86,   22.86,
                   22.86,   22.86,   22.86,   67.36,   67.36,   67.36,
                   67.36,   67.36,   67.36,   67.36,   67.36,   22.86,
                   22.86,    0.00,    0.00,    0.00,   22.86,   22.86 !
   4 ! WIDTH   =   62.11,   67.73,   71.29,   38.79,  143.55,  143.55,
```

```
                142.60,   40.77,  127.88,  114.55,   97.73,   42.88,
                 32.66,    0.00,    0.00,    0.00,   45.45,   54.61,
                 62.11,   67.73,   71.29,   38.79,   35.83,   36.51,
                 39.24,   40.77,   41.28,   40.58,   38.62,   42.88,
                 32.66,    0.00,    0.00,    0.00,   45.45,   54.61 !
!END!
   5 ! SRCNAM = HUNTG2 !
   5 ! HEIGHT  =   47.24,   47.24,   47.24,   67.36,   47.24,   47.24,
                   47.24,   67.36,   22.86,    0.00,    0.00,    0.00,
                    0.00,    0.00,    0.00,   22.86,   22.86,   47.24,
                   67.36,   67.36,   67.36,   67.36,   67.36,   67.36,
                   67.36,   67.36,   22.86,    0.00,    0.00,    0.00,
                    0.00,    0.00,    0.00,   22.86,   22.86,   47.24 !
   5 ! WIDTH   =  114.55,  127.89,  137.34,   38.52,  143.55,  143.55,
                  142.60,   40.78,   64.70,    0.00,    0.00,    0.00,
                    0.00,    0.00,    0.00,   34.90,   44.77,  113.73,
                   40.41,   41.12,   40.57,   38.52,   35.34,   36.06,
                   39.01,   40.78,   64.70,    0.00,    0.00,    0.00,
                    0.00,    0.00,    0.00,   53.55,   44.77,  113.73 !
!END!
   6 ! SRCNAM = CARB_1 !
   6 ! HEIGHT  =   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00 !
   6 ! WIDTH   =  102.34,  102.99,  100.51,   94.98,   86.56,   75.51,
                   67.76,   80.23,   90.26,   97.55,  101.88,  103.11,
                  101.21,   96.23,   88.33,   82.28,   91.83,   98.58,
                  102.34,  102.99,  100.51,   94.98,   86.56,   75.51,
                   67.76,   80.23,   90.26,   97.55,  101.88,  103.11,
                  101.21,   96.23,   88.33,   82.28,   91.82,   98.58 !
!END!
   7 ! SRCNAM = CARB_2 !
   7 ! HEIGHT  =   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00,
                   40.00,   40.00,   40.00,   40.00,   40.00,   40.00 !
   7 ! WIDTH   =  102.34,  102.99,  100.51,   94.98,   86.56,   75.51,
                   67.76,   80.23,   90.26,   97.55,  101.88,  103.11,
                  101.21,   96.23,   88.33,   82.28,   91.83,   98.58,
                  102.34,  102.99,  100.51,   94.98,   86.56,   75.51,
```

```
                  67.76,   80.23,   90.26,   97.55,  101.88,  103.11,
                 101.21,   96.23,   88.33,   82.28,   91.82,   98.58 !
!END!
```

---

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)

---

a

POINT SOURCE: VARIABLE EMISSIONS DATA

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

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

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

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


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


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

---------------
Subgroup (14a)
---------------

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

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

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

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

!END!

---------------
Subgroup (14b)
---------------
```

AREA SOURCE: CONSTANT DATA[a]

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

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

[b] An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by IARU (e.g. 1 for g/m**2/s).

Subgroup (14c)

COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON

Source No.	Ordered list of X followed by list of Y, grouped by source[a]

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

Subgroup (14d)

AREA SOURCE: VARIABLE EMISSIONS DATA[a]

Use this subgroup to describe temporal variations in the emission

rates given in 14b. Factors entered multiply the rates in 14b.
Skip sources here that have constant emissions. For more elaborate
variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

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

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

---

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

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

Subgroup (15a)

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

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

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

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

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

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

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

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

   Average building length (XL)                No default   ! XL = 0.0 !
                                               (in meters)

   Average building height (HBL)               No default   ! HBL = 0.0 !
                                               (in meters)

   Average building width (WBL)                No default   ! WBL = 0.0 !
                                               (in meters)

   Average line source width (WML)             No default   ! WML = 0.0 !
                                               (in meters)

   Average separation between buildings (DXL)  No default   ! DXL = 0.0 !
                                               (in meters)

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

!END!
```

Subgroup (15b)

BUOYANT LINE SOURCE: CONSTANT DATA

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

---

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

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

Subgroup (15c)

BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA [a]

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

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

- 0 = Constant
- 1 = Diurnal cycle (24 scaling factors: hours 1-24)
- 2 = Monthly cycle (12 scaling factors: months 1-12)
- 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
- 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper

```
                                bounds (m/s) defined in Group 12
          5 =       Temperature   (12 scaling factors, where temperature
                                  classes have upper bounds (C) of:
                                  0, 5, 10, 15, 20, 25, 30, 35, 40,
                                  45, 50, 50+)


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


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


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

---------------
Subgroup (16a)
---------------

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

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

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

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

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

!END!

Subgroup (16b)

---

a

VOLUME SOURCE: CONSTANT DATA

---

b

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

---

a

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

b

An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are
modeled, but not emitted. Units are specified by 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 = 1974 !

!END!

Subgroup (17b)

NON-GRIDDED (DISCRETE) RECEPTOR DATA[a]

Receptor No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground[b] (m)

```
 1 ! X =       107.515,      -29.329,      1328.0,          0.0 !   !END!
 2 ! X =       108.966,      -29.309,      1351.0,          0.0 !   !END!
 3 ! X =       110.416,      -29.289,      1387.0,          0.0 !   !END!
 4 ! X =       113.318,      -29.248,      1221.0,          0.0 !   !END!
 5 ! X =       106.040,      -27.499,      1462.0,          0.0 !   !END!
 6 ! X =       107.490,      -27.480,      1402.0,          0.0 !   !END!
 7 ! X =       108.940,      -27.460,      1336.0,          0.0 !   !END!
 8 ! X =       110.391,      -27.440,      1279.0,          0.0 !   !END!
 9 ! X =       111.841,      -27.420,      1359.0,          0.0 !   !END!
10 ! X =       113.291,      -27.399,      1386.0,          0.0 !   !END!
11 ! X =       114.742,      -27.378,      1405.0,          0.0 !   !END!
12 ! X =       116.192,      -27.357,      1215.0,          0.0 !   !END!
13 ! X =       104.565,      -25.670,      1364.0,          0.0 !   !END!
14 ! X =       106.015,      -25.650,      1280.0,          0.0 !   !END!
15 ! X =       107.465,      -25.631,      1279.0,          0.0 !   !END!
16 ! X =       108.915,      -25.611,      1284.0,          0.0 !   !END!
17 ! X =       110.365,      -25.591,      1280.0,          0.0 !   !END!
18 ! X =       111.815,      -25.571,      1370.0,          0.0 !   !END!
19 ! X =       113.265,      -25.550,      1462.0,          0.0 !   !END!
20 ! X =       114.715,      -25.529,      1577.0,          0.0 !   !END!
21 ! X =       117.615,      -25.487,      1346.0,          0.0 !   !END!
22 ! X =       104.540,      -23.821,      1280.0,          0.0 !   !END!
23 ! X =       105.990,      -23.801,      1363.0,          0.0 !   !END!
24 ! X =       107.440,      -23.782,      1401.0,          0.0 !   !END!
25 ! X =       108.890,      -23.762,      1340.0,          0.0 !   !END!
26 ! X =       110.339,      -23.742,      1341.0,          0.0 !   !END!
27 ! X =       111.789,      -23.722,      1403.0,          0.0 !   !END!
28 ! X =       113.239,      -23.701,      1485.0,          0.0 !   !END!
29 ! X =       114.688,      -23.680,      1583.0,          0.0 !   !END!
30 ! X =       116.138,      -23.659,      1388.0,          0.0 !   !END!
31 ! X =       104.516,      -21.972,      1340.0,          0.0 !   !END!
32 ! X =       105.965,      -21.952,      1388.0,          0.0 !   !END!
33 ! X =       107.415,      -21.933,      1440.0,          0.0 !   !END!
34 ! X =       108.864,      -21.913,      1402.0,          0.0 !   !END!
35 ! X =       110.313,      -21.893,      1418.0,          0.0 !   !END!
36 ! X =       111.763,      -21.873,      1500.0,          0.0 !   !END!
37 ! X =       113.212,      -21.852,      1584.0,          0.0 !   !END!
38 ! X =       114.661,      -21.831,      1606.0,          0.0 !   !END!
39 ! X =       116.111,      -21.810,      1274.0,          0.0 !   !END!
40 ! X =       105.941,      -20.103,      1426.0,          0.0 !   !END!
41 ! X =       107.390,      -20.084,      1462.0,          0.0 !   !END!
42 ! X =       108.839,      -20.064,      1505.0,          0.0 !   !END!
43 ! X =       110.288,      -20.044,      1517.0,          0.0 !   !END!
```

```
44 ! X =       111.737,      -20.024,      1549.0,          0.0 !   !END!
45 ! X =       113.186,      -20.003,      1584.0,          0.0 !   !END!
46 ! X =       114.635,      -19.982,      1431.0,          0.0 !   !END!
47 ! X =       105.916,      -18.254,      1462.0,          0.0 !   !END!
48 ! X =       107.365,      -18.235,      1517.0,          0.0 !   !END!
49 ! X =       108.813,      -18.215,      1513.0,          0.0 !   !END!
50 ! X =       110.262,      -18.195,      1462.0,          0.0 !   !END!
51 ! X =       111.711,      -18.175,      1463.0,          0.0 !   !END!
52 ! X =       113.159,      -18.154,      1451.0,          0.0 !   !END!
53 ! X =       114.608,      -18.134,      1342.0,          0.0 !   !END!
54 ! X =       105.891,      -16.405,      1523.0,          0.0 !   !END!
55 ! X =       107.340,      -16.386,      1523.0,          0.0 !   !END!
56 ! X =       108.788,      -16.366,      1402.0,          0.0 !   !END!
57 ! X =       110.236,      -16.346,      1401.0,          0.0 !   !END!
58 ! X =       111.685,      -16.326,      1361.0,          0.0 !   !END!
59 ! X =       113.133,      -16.305,      1341.0,          0.0 !   !END!
60 ! X =       114.581,      -16.285,      1340.0,          0.0 !   !END!
61 ! X =       116.030,      -16.263,      1340.0,          0.0 !   !END!
62 ! X =       101.523,      -14.613,      1451.0,          0.0 !   !END!
63 ! X =       102.971,      -14.594,      1460.0,          0.0 !   !END!
64 ! X =       104.419,      -14.576,      1518.0,          0.0 !   !END!
65 ! X =       105.867,      -14.556,      1488.0,          0.0 !   !END!
66 ! X =       107.315,      -14.537,      1407.0,          0.0 !   !END!
67 ! X =       108.763,      -14.517,      1404.0,          0.0 !   !END!
68 ! X =       110.211,      -14.497,      1458.0,          0.0 !   !END!
69 ! X =       111.659,      -14.477,      1494.0,          0.0 !   !END!
70 ! X =       113.107,      -14.456,      1402.0,          0.0 !   !END!
71 ! X =       114.555,      -14.436,      1402.0,          0.0 !   !END!
72 ! X =       116.003,      -14.415,      1440.0,          0.0 !   !END!
73 ! X =       117.451,      -14.393,      1411.0,          0.0 !   !END!
74 ! X =       101.499,      -12.764,      1521.0,          0.0 !   !END!
75 ! X =       102.947,      -12.745,      1524.0,          0.0 !   !END!
76 ! X =       104.394,      -12.727,      1467.0,          0.0 !   !END!
77 ! X =       105.842,      -12.707,      1462.0,          0.0 !   !END!
78 ! X =       107.290,      -12.688,      1493.0,          0.0 !   !END!
79 ! X =       108.737,      -12.668,      1547.0,          0.0 !   !END!
80 ! X =       110.185,      -12.648,      1582.0,          0.0 !   !END!
81 ! X =       111.633,      -12.628,      1481.0,          0.0 !   !END!
82 ! X =       113.080,      -12.607,      1440.0,          0.0 !   !END!
83 ! X =       114.528,      -12.587,      1395.0,          0.0 !   !END!
84 ! X =       100.028,      -10.934,      1491.0,          0.0 !   !END!
85 ! X =       101.475,      -10.915,      1528.0,          0.0 !   !END!
86 ! X =       102.923,      -10.896,      1499.0,          0.0 !   !END!
87 ! X =       104.370,      -10.878,      1491.0,          0.0 !   !END!
88 ! X =       105.817,      -10.858,      1493.0,          0.0 !   !END!
```

```
 89 ! X =       107.265,      -10.839,      1540.0,          0.0 !   !END!
 90 ! X =       108.712,      -10.819,      1584.0,          0.0 !   !END!
 91 ! X =       110.159,      -10.799,      1471.0,          0.0 !   !END!
 92 ! X =       111.607,      -10.779,      1432.0,          0.0 !   !END!
 93 ! X =       113.054,      -10.758,      1402.0,          0.0 !   !END!
 94 ! X =       114.501,      -10.738,      1343.0,          0.0 !   !END!
 95 ! X =       100.005,       -9.085,      1584.0,          0.0 !   !END!
 96 ! X =       101.452,       -9.066,      1523.0,          0.0 !   !END!
 97 ! X =       102.899,       -9.047,      1509.0,          0.0 !   !END!
 98 ! X =       104.346,       -9.029,      1532.0,          0.0 !   !END!
 99 ! X =       105.793,       -9.009,      1621.0,          0.0 !   !END!
100 ! X =       107.240,       -8.990,      1588.0,          0.0 !   !END!
101 ! X =       108.687,       -8.970,      1484.0,          0.0 !   !END!
102 ! X =       111.581,       -8.930,      1401.0,          0.0 !   !END!
103 ! X =       113.028,       -8.909,      1362.0,          0.0 !   !END!
104 ! X =       101.428,       -7.217,      1524.0,          0.0 !   !END!
105 ! X =       102.875,       -7.198,      1584.0,          0.0 !   !END!
106 ! X =       104.321,       -7.180,      1645.0,          0.0 !   !END!
107 ! X =       105.768,       -7.160,      1525.0,          0.0 !   !END!
108 ! X =       107.215,       -7.141,      1460.0,          0.0 !   !END!
109 ! X =        99.958,       -5.386,      1585.0,          0.0 !   !END!
110 ! X =       101.404,       -5.368,      1587.0,          0.0 !   !END!
111 ! X =       102.851,       -5.349,      1575.0,          0.0 !   !END!
112 ! X =       104.297,       -5.330,      1492.0,          0.0 !   !END!
113 ! X =        98.489,       -3.556,      1640.0,          0.0 !   !END!
114 ! X =        99.935,       -3.537,      1560.0,          0.0 !   !END!
115 ! X =       101.381,       -3.519,      1513.0,          0.0 !   !END!
116 ! X =      -125.903,     -158.516,      2621.0,          0.0 !   !END!
117 ! X =      -125.166,     -158.528,      2501.0,          0.0 !   !END!
118 ! X =      -124.429,     -158.539,      2380.0,          0.0 !   !END!
119 ! X =      -123.692,     -158.551,      2374.0,          0.0 !   !END!
120 ! X =      -125.889,     -157.592,      2620.0,          0.0 !   !END!
121 ! X =      -125.152,     -157.603,      2410.0,          0.0 !   !END!
122 ! X =      -124.414,     -157.615,      2367.0,          0.0 !   !END!
123 ! X =      -123.677,     -157.626,      2331.0,          0.0 !   !END!
124 ! X =      -122.940,     -157.637,      2315.0,          0.0 !   !END!
125 ! X =      -125.874,     -156.667,      2621.0,          0.0 !   !END!
126 ! X =      -125.137,     -156.679,      2530.0,          0.0 !   !END!
127 ! X =      -124.400,     -156.690,      2466.0,          0.0 !   !END!
128 ! X =      -123.663,     -156.701,      2382.0,          0.0 !   !END!
129 ! X =      -122.926,     -156.713,      2380.0,          0.0 !   !END!
130 ! X =      -122.189,     -156.724,      2438.0,          0.0 !   !END!
131 ! X =      -125.860,     -155.743,      2564.0,          0.0 !   !END!
132 ! X =      -125.123,     -155.754,      2580.0,          0.0 !   !END!
133 ! X =      -124.386,     -155.766,      2677.0,          0.0 !   !END!
```

```
134 ! X =      -123.649,     -155.777,      2637.0,          0.0 !   !END!
135 ! X =      -122.912,     -155.788,      2662.0,          0.0 !   !END!
136 ! X =      -122.175,     -155.799,      2573.0,          0.0 !   !END!
137 ! X =      -125.845,     -154.818,      2591.0,          0.0 !   !END!
138 ! X =      -125.108,     -154.830,      2624.0,          0.0 !   !END!
139 ! X =      -124.372,     -154.841,      2682.0,          0.0 !   !END!
140 ! X =      -123.635,     -154.852,      2608.0,          0.0 !   !END!
141 ! X =      -122.898,     -154.864,      2647.0,          0.0 !   !END!
142 ! X =      -122.161,     -154.875,      2438.0,          0.0 !   !END!
143 ! X =      -125.831,     -153.894,      2611.0,          0.0 !   !END!
144 ! X =      -125.094,     -153.905,      2681.0,          0.0 !   !END!
145 ! X =      -124.357,     -153.916,      2554.0,          0.0 !   !END!
146 ! X =      -123.621,     -153.928,      2403.0,          0.0 !   !END!
147 ! X =      -122.884,     -153.939,      2444.0,          0.0 !   !END!
148 ! X =      -122.147,     -153.950,      2453.0,          0.0 !   !END!
149 ! X =      -126.553,     -152.958,      2561.0,          0.0 !   !END!
150 ! X =      -125.816,     -152.969,      2639.0,          0.0 !   !END!
151 ! X =      -125.080,     -152.981,      2625.0,          0.0 !   !END!
152 ! X =      -126.539,     -152.033,      2622.0,          0.0 !   !END!
153 ! X =      -125.802,     -152.045,      2687.0,          0.0 !   !END!
154 ! X =      -125.065,     -152.056,      2443.0,          0.0 !   !END!
155 ! X =      -126.524,     -151.108,      2629.0,          0.0 !   !END!
156 ! X =      -125.788,     -151.120,      2676.0,          0.0 !   !END!
157 ! X =      -125.051,     -151.131,      2563.0,          0.0 !   !END!
158 ! X =      -126.510,     -150.184,      2623.0,          0.0 !   !END!
159 ! X =      -125.773,     -150.195,      2682.0,          0.0 !   !END!
160 ! X =      -125.037,     -150.207,      2439.0,          0.0 !   !END!
161 ! X =      -126.495,     -149.259,      2597.0,          0.0 !   !END!
162 ! X =      -125.759,     -149.271,      2601.0,          0.0 !   !END!
163 ! X =      -125.022,     -149.282,      2417.0,          0.0 !   !END!
164 ! X =      -124.286,     -149.294,      2362.0,          0.0 !   !END!
165 ! X =      -126.481,     -148.335,      2540.0,          0.0 !   !END!
166 ! X =      -125.744,     -148.346,      2602.0,          0.0 !   !END!
167 ! X =      -125.008,     -148.358,      2682.0,          0.0 !   !END!
168 ! X =      -124.272,     -148.369,      2597.0,          0.0 !   !END!
169 ! X =      -124.994,     -147.433,      2676.0,          0.0 !   !END!
170 ! X =      -124.258,     -147.445,      2681.0,          0.0 !   !END!
171 ! X =      -123.522,     -147.456,      2440.0,          0.0 !   !END!
172 ! X =      -122.785,     -147.467,      2382.0,          0.0 !   !END!
173 ! X =      -122.049,     -147.478,      2374.0,          0.0 !   !END!
174 ! X =      -124.243,     -146.520,      2621.0,          0.0 !   !END!
175 ! X =      -123.507,     -146.531,      2601.0,          0.0 !   !END!
176 ! X =      -122.771,     -146.543,      2457.0,          0.0 !   !END!
177 ! X =      -122.035,     -146.554,      2358.0,          0.0 !   !END!
178 ! X =      -121.299,     -146.565,      2289.0,          0.0 !   !END!
```

```
179 ! X =      -124.229,     -145.596,      2565.0,          0.0 !   !END!
180 ! X =      -123.493,     -145.607,      2621.0,          0.0 !   !END!
181 ! X =      -122.757,     -145.618,      2484.0,          0.0 !   !END!
182 ! X =      -122.021,     -145.629,      2374.0,          0.0 !   !END!
183 ! X =      -121.285,     -145.640,      2256.0,          0.0 !   !END!
184 ! X =      -123.479,     -144.682,      2621.0,          0.0 !   !END!
185 ! X =      -122.743,     -144.694,      2617.0,          0.0 !   !END!
186 ! X =      -122.007,     -144.705,      2406.0,          0.0 !   !END!
187 ! X =      -121.271,     -144.716,      2398.0,          0.0 !   !END!
188 ! X =      -120.536,     -144.727,      2316.0,          0.0 !   !END!
189 ! X =      -119.800,     -144.738,      2274.0,          0.0 !   !END!
190 ! X =      -119.064,     -144.749,      2211.0,          0.0 !   !END!
191 ! X =      -118.328,     -144.760,      2251.0,          0.0 !   !END!
192 ! X =      -117.592,     -144.770,      2234.0,          0.0 !   !END!
193 ! X =      -116.856,     -144.781,      2210.0,          0.0 !   !END!
194 ! X =      -116.120,     -144.792,      2126.0,          0.0 !   !END!
195 ! X =      -115.384,     -144.802,      2134.0,          0.0 !   !END!
196 ! X =      -114.648,     -144.813,      2073.0,          0.0 !   !END!
197 ! X =      -113.912,     -144.823,      2071.0,          0.0 !   !END!
198 ! X =      -123.465,     -143.758,      2565.0,          0.0 !   !END!
199 ! X =      -122.729,     -143.769,      2563.0,          0.0 !   !END!
200 ! X =      -121.993,     -143.780,      2496.0,          0.0 !   !END!
201 ! X =      -121.257,     -143.791,      2319.0,          0.0 !   !END!
202 ! X =      -120.522,     -143.802,      2316.0,          0.0 !   !END!
203 ! X =      -119.786,     -143.813,      2323.0,          0.0 !   !END!
204 ! X =      -119.050,     -143.824,      2256.0,          0.0 !   !END!
205 ! X =      -118.314,     -143.835,      2401.0,          0.0 !   !END!
206 ! X =      -117.578,     -143.846,      2414.0,          0.0 !   !END!
207 ! X =      -116.843,     -143.857,      2260.0,          0.0 !   !END!
208 ! X =      -116.107,     -143.867,      2134.0,          0.0 !   !END!
209 ! X =      -115.371,     -143.878,      2181.0,          0.0 !   !END!
210 ! X =      -114.635,     -143.888,      2095.0,          0.0 !   !END!
211 ! X =      -113.899,     -143.899,      2091.0,          0.0 !   !END!
212 ! X =      -122.715,     -142.845,      2573.0,          0.0 !   !END!
213 ! X =      -121.979,     -142.856,      2550.0,          0.0 !   !END!
214 ! X =      -121.244,     -142.867,      2451.0,          0.0 !   !END!
215 ! X =      -120.508,     -142.878,      2561.0,          0.0 !   !END!
216 ! X =      -119.772,     -142.889,      2437.0,          0.0 !   !END!
217 ! X =      -119.036,     -142.900,      2451.0,          0.0 !   !END!
218 ! X =      -118.301,     -142.911,      2499.0,          0.0 !   !END!
219 ! X =      -117.565,     -142.921,      2432.0,          0.0 !   !END!
220 ! X =      -116.829,     -142.932,      2225.0,          0.0 !   !END!
221 ! X =      -116.094,     -142.943,      2251.0,          0.0 !   !END!
222 ! X =      -115.358,     -142.953,      2134.0,          0.0 !   !END!
223 ! X =      -114.622,     -142.964,      2195.0,          0.0 !   !END!
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224 ! X =      -113.886,     -142.974,      2072.0,          0.0 !   !END!
225 ! X =      -121.230,     -141.942,      2472.0,          0.0 !   !END!
226 ! X =      -120.494,     -141.953,      2438.0,          0.0 !   !END!
227 ! X =      -119.758,     -141.964,      2499.0,          0.0 !   !END!
228 ! X =      -119.023,     -141.975,      2499.0,          0.0 !   !END!
229 ! X =      -118.287,     -141.986,      2467.0,          0.0 !   !END!
230 ! X =      -117.551,     -141.997,      2440.0,          0.0 !   !END!
231 ! X =      -116.816,     -142.008,      2477.0,          0.0 !   !END!
232 ! X =      -116.080,     -142.018,      2496.0,          0.0 !   !END!
233 ! X =      -115.345,     -142.029,      2275.0,          0.0 !   !END!
234 ! X =      -114.609,     -142.039,      2212.0,          0.0 !   !END!
235 ! X =      -113.873,     -142.050,      2118.0,          0.0 !   !END!
236 ! X =      -120.480,     -141.029,      2437.0,          0.0 !   !END!
237 ! X =      -119.745,     -141.040,      2468.0,          0.0 !   !END!
238 ! X =      -119.009,     -141.051,      2438.0,          0.0 !   !END!
239 ! X =      -118.274,     -141.062,      2495.0,          0.0 !   !END!
240 ! X =      -117.538,     -141.072,      2494.0,          0.0 !   !END!
241 ! X =      -116.802,     -141.083,      2499.0,          0.0 !   !END!
242 ! X =      -116.067,     -141.094,      2471.0,          0.0 !   !END!
243 ! X =      -115.331,     -141.104,      2388.0,          0.0 !   !END!
244 ! X =      -114.596,     -141.115,      2253.0,          0.0 !   !END!
245 ! X =      -120.466,     -140.104,      2421.0,          0.0 !   !END!
246 ! X =      -119.731,     -140.115,      2437.0,          0.0 !   !END!
247 ! X =      -118.995,     -140.126,      2438.0,          0.0 !   !END!
248 ! X =      -118.260,     -140.137,      2438.0,          0.0 !   !END!
249 ! X =      -117.524,     -140.148,      2498.0,          0.0 !   !END!
250 ! X =      -116.789,     -140.159,      2338.0,          0.0 !   !END!
251 ! X =      -116.054,     -140.169,      2285.0,          0.0 !   !END!
252 ! X =      -115.318,     -140.180,      2314.0,          0.0 !   !END!
253 ! X =      -114.583,     -140.190,      2256.0,          0.0 !   !END!
254 ! X =      -118.246,     -139.213,      2438.0,          0.0 !   !END!
255 ! X =      -117.511,     -139.223,      2438.0,          0.0 !   !END!
256 ! X =      -116.776,     -139.234,      2352.0,          0.0 !   !END!
257 ! X =      -116.040,     -139.245,      2256.0,          0.0 !   !END!
258 ! X =      -115.305,     -139.255,      2203.0,          0.0 !   !END!
259 ! X =      -114.569,     -139.266,      2186.0,          0.0 !   !END!
260 ! X =      -113.834,     -139.276,      2196.0,          0.0 !   !END!
261 ! X =      -113.099,     -139.286,      2092.0,          0.0 !   !END!
262 ! X =      -118.233,     -138.288,      2438.0,          0.0 !   !END!
263 ! X =      -117.498,     -138.299,      2438.0,          0.0 !   !END!
264 ! X =      -116.762,     -138.309,      2415.0,          0.0 !   !END!
265 ! X =      -116.027,     -138.320,      2317.0,          0.0 !   !END!
266 ! X =      -115.292,     -138.331,      2288.0,          0.0 !   !END!
267 ! X =      -114.556,     -138.341,      2257.0,          0.0 !   !END!
268 ! X =      -113.821,     -138.352,      2200.0,          0.0 !   !END!
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269 ! X =      -113.086,     -138.362,      2110.0,          0.0 !   !END!
270 ! X =      -112.350,     -138.372,      2065.0,          0.0 !   !END!
271 ! X =      -118.219,     -137.363,      2426.0,          0.0 !   !END!
272 ! X =      -117.484,     -137.374,      2433.0,          0.0 !   !END!
273 ! X =      -116.749,     -137.385,      2438.0,          0.0 !   !END!
274 ! X =      -116.014,     -137.396,      2317.0,          0.0 !   !END!
275 ! X =      -115.278,     -137.406,      2280.0,          0.0 !   !END!
276 ! X =      -114.543,     -137.417,      2265.0,          0.0 !   !END!
277 ! X =      -113.808,     -137.427,      2203.0,          0.0 !   !END!
278 ! X =      -113.073,     -137.437,      2133.0,          0.0 !   !END!
279 ! X =      -112.337,     -137.448,      2181.0,          0.0 !   !END!
280 ! X =      -111.602,     -137.458,      2117.0,          0.0 !   !END!
281 ! X =      -117.471,     -136.450,      2426.0,          0.0 !   !END!
282 ! X =      -116.735,     -136.460,      2437.0,          0.0 !   !END!
283 ! X =      -116.000,     -136.471,      2417.0,          0.0 !   !END!
284 ! X =      -115.265,     -136.482,      2386.0,          0.0 !   !END!
285 ! X =      -114.530,     -136.492,      2247.0,          0.0 !   !END!
286 ! X =      -113.795,     -136.503,      2257.0,          0.0 !   !END!
287 ! X =      -113.060,     -136.513,      2206.0,          0.0 !   !END!
288 ! X =      -112.325,     -136.523,      2270.0,          0.0 !   !END!
289 ! X =      -111.589,     -136.533,      2217.0,          0.0 !   !END!
290 ! X =      -116.722,     -135.536,      2377.0,          0.0 !   !END!
291 ! X =      -115.987,     -135.547,      2377.0,          0.0 !   !END!
292 ! X =      -115.252,     -135.557,      2348.0,          0.0 !   !END!
293 ! X =      -114.517,     -135.568,      2285.0,          0.0 !   !END!
294 ! X =      -113.782,     -135.578,      2316.0,          0.0 !   !END!
295 ! X =      -113.047,     -135.588,      2256.0,          0.0 !   !END!
296 ! X =      -112.312,     -135.599,      2202.0,          0.0 !   !END!
297 ! X =      -111.577,     -135.609,      2169.0,          0.0 !   !END!
298 ! X =      -115.239,     -134.633,      2364.0,          0.0 !   !END!
299 ! X =      -114.504,     -134.643,      2318.0,          0.0 !   !END!
300 ! X =      -113.769,     -134.653,      2251.0,          0.0 !   !END!
301 ! X =      -113.034,     -134.664,      2226.0,          0.0 !   !END!
302 ! X =      -112.299,     -134.674,      2142.0,          0.0 !   !END!
303 ! X =      -111.564,     -134.684,      2072.0,          0.0 !   !END!
304 ! X =      -114.491,     -133.719,      2318.0,          0.0 !   !END!
305 ! X =      -113.756,     -133.729,      2238.0,          0.0 !   !END!
306 ! X =      -113.021,     -133.739,      2195.0,          0.0 !   !END!
307 ! X =      -112.286,     -133.750,      2133.0,          0.0 !   !END!
308 ! X =      -111.551,     -133.760,      2150.0,          0.0 !   !END!
309 ! X =      -110.816,     -133.770,      2147.0,          0.0 !   !END!
310 ! X =      -110.081,     -133.780,      2072.0,          0.0 !   !END!
311 ! X =      -114.477,     -132.794,      2316.0,          0.0 !   !END!
312 ! X =      -113.743,     -132.804,      2246.0,          0.0 !   !END!
313 ! X =      -113.008,     -132.815,      2197.0,          0.0 !   !END!
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314 ! X =      -112.273,     -132.825,      2163.0,          0.0 !   !END!
315 ! X =      -111.538,     -132.835,      2217.0,          0.0 !   !END!
316 ! X =      -110.803,     -132.845,      2148.0,          0.0 !   !END!
317 ! X =      -110.069,     -132.855,      2104.0,          0.0 !   !END!
318 ! X =      -114.464,     -131.869,      2316.0,          0.0 !   !END!
319 ! X =      -113.730,     -131.880,      2316.0,          0.0 !   !END!
320 ! X =      -112.995,     -131.890,      2316.0,          0.0 !   !END!
321 ! X =      -112.260,     -131.901,      2219.0,          0.0 !   !END!
322 ! X =      -111.525,     -131.911,      2245.0,          0.0 !   !END!
323 ! X =      -110.791,     -131.921,      2269.0,          0.0 !   !END!
324 ! X =      -110.056,     -131.931,      2224.0,          0.0 !   !END!
325 ! X =      -112.247,     -130.976,      2316.0,          0.0 !   !END!
326 ! X =      -111.513,     -130.986,      2315.0,          0.0 !   !END!
327 ! X =      -110.778,     -130.996,      2349.0,          0.0 !   !END!
328 ! X =      -110.043,     -131.006,      2339.0,          0.0 !   !END!
329 ! X =        98.244,     -101.570,      1929.0,          0.0 !   !END!
330 ! X =        93.830,      -99.774,      1950.0,          0.0 !   !END!
331 ! X =        95.294,      -99.756,      1828.0,          0.0 !   !END!
332 ! X =        96.758,      -99.739,      1843.0,          0.0 !   !END!
333 ! X =        99.685,      -99.703,      1798.0,          0.0 !   !END!
334 ! X =       101.148,      -99.685,      1901.0,          0.0 !   !END!
335 ! X =        93.809,      -97.925,      1828.0,          0.0 !   !END!
336 ! X =        95.272,      -97.907,      1896.0,          0.0 !   !END!
337 ! X =        96.735,      -97.890,      1828.0,          0.0 !   !END!
338 ! X =        98.198,      -97.872,      1828.0,          0.0 !   !END!
339 ! X =        99.662,      -97.854,      1824.0,          0.0 !   !END!
340 ! X =       101.125,      -97.836,      1875.0,          0.0 !   !END!
341 ! X =       102.588,      -97.817,      1735.0,          0.0 !   !END!
342 ! X =        92.324,      -96.093,      1832.0,          0.0 !   !END!
343 ! X =        93.787,      -96.076,      1895.0,          0.0 !   !END!
344 ! X =        95.250,      -96.058,      1825.0,          0.0 !   !END!
345 ! X =        96.713,      -96.041,      1877.0,          0.0 !   !END!
346 ! X =        98.176,      -96.023,      1959.0,          0.0 !   !END!
347 ! X =        99.639,      -96.005,      2062.0,          0.0 !   !END!
348 ! X =       101.102,      -95.987,      1737.0,          0.0 !   !END!
349 ! X =       102.564,      -95.968,      1713.0,          0.0 !   !END!
350 ! X =        92.303,      -94.244,      1828.0,          0.0 !   !END!
351 ! X =        93.765,      -94.227,      1876.0,          0.0 !   !END!
352 ! X =        95.228,      -94.209,      1767.0,          0.0 !   !END!
353 ! X =        96.691,      -94.192,      1869.0,          0.0 !   !END!
354 ! X =        98.153,      -94.174,      1910.0,          0.0 !   !END!
355 ! X =        99.616,      -94.156,      1706.0,          0.0 !   !END!
356 ! X =       101.078,      -94.138,      1887.0,          0.0 !   !END!
357 ! X =        90.819,      -92.411,      1803.0,          0.0 !   !END!
358 ! X =        92.282,      -92.395,      1755.0,          0.0 !   !END!
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359 ! X =        93.744,      -92.378,      1706.0,          0.0 !   !END!
360 ! X =        95.206,      -92.360,      1855.0,          0.0 !   !END!
361 ! X =        96.668,      -92.343,      1913.0,          0.0 !   !END!
362 ! X =        98.130,      -92.325,      1829.0,          0.0 !   !END!
363 ! X =        99.593,      -92.307,      1767.0,          0.0 !   !END!
364 ! X =       101.055,      -92.289,      1706.0,          0.0 !   !END!
365 ! X =        70.332,      -90.768,      1357.0,          0.0 !   !END!
366 ! X =        71.794,      -90.755,      1645.0,          0.0 !   !END!
367 ! X =        73.256,      -90.742,      1731.0,          0.0 !   !END!
368 ! X =        74.718,      -90.729,      1755.0,          0.0 !   !END!
369 ! X =        76.179,      -90.715,      1767.0,          0.0 !   !END!
370 ! X =        77.641,      -90.701,      1764.0,          0.0 !   !END!
371 ! X =        79.103,      -90.686,      1748.0,          0.0 !   !END!
372 ! X =        80.565,      -90.672,      1798.0,          0.0 !   !END!
373 ! X =        82.027,      -90.657,      1789.0,          0.0 !   !END!
374 ! X =        83.489,      -90.642,      1796.0,          0.0 !   !END!
375 ! X =        84.951,      -90.626,      1761.0,          0.0 !   !END!
376 ! X =        86.413,      -90.611,      1754.0,          0.0 !   !END!
377 ! X =        87.875,      -90.595,      1772.0,          0.0 !   !END!
378 ! X =        89.337,      -90.579,      1874.0,          0.0 !   !END!
379 ! X =        90.798,      -90.562,      1767.0,          0.0 !   !END!
380 ! X =        92.260,      -90.546,      1706.0,          0.0 !   !END!
381 ! X =        93.722,      -90.529,      1691.0,          0.0 !   !END!
382 ! X =        95.184,      -90.511,      1852.0,          0.0 !   !END!
383 ! X =        96.646,      -90.494,      1676.0,          0.0 !   !END!
384 ! X =        98.108,      -90.476,      1828.0,          0.0 !   !END!
385 ! X =        99.570,      -90.458,      1828.0,          0.0 !   !END!
386 ! X =       101.032,      -90.440,      1645.0,          0.0 !   !END!
387 ! X =        65.931,      -88.957,      1703.0,          0.0 !   !END!
388 ! X =        67.392,      -88.944,      1643.0,          0.0 !   !END!
389 ! X =        68.854,      -88.932,      1536.0,          0.0 !   !END!
390 ! X =        70.316,      -88.919,      1193.0,          0.0 !   !END!
391 ! X =        71.777,      -88.906,      1576.0,          0.0 !   !END!
392 ! X =        73.239,      -88.893,      1634.0,          0.0 !   !END!
393 ! X =        74.700,      -88.880,      1529.0,          0.0 !   !END!
394 ! X =        76.162,      -88.866,      1666.0,          0.0 !   !END!
395 ! X =        77.623,      -88.852,      1688.0,          0.0 !   !END!
396 ! X =        79.085,      -88.837,      1670.0,          0.0 !   !END!
397 ! X =        80.547,      -88.823,      1706.0,          0.0 !   !END!
398 ! X =        82.008,      -88.808,      1706.0,          0.0 !   !END!
399 ! X =        83.470,      -88.793,      1713.0,          0.0 !   !END!
400 ! X =        84.931,      -88.777,      1706.0,          0.0 !   !END!
401 ! X =        86.393,      -88.762,      1828.0,          0.0 !   !END!
402 ! X =        87.854,      -88.746,      1706.0,          0.0 !   !END!
403 ! X =        89.316,      -88.730,      1783.0,          0.0 !   !END!
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404 ! X =        90.777,      -88.713,      1767.0,          0.0 !   !END!
405 ! X =        92.239,      -88.697,      1676.0,          0.0 !   !END!
406 ! X =        93.701,      -88.680,      1645.0,          0.0 !   !END!
407 ! X =        95.162,      -88.662,      1645.0,          0.0 !   !END!
408 ! X =        96.624,      -88.645,      1642.0,          0.0 !   !END!
409 ! X =        98.085,      -88.627,      1645.0,          0.0 !   !END!
410 ! X =        99.547,      -88.609,      1795.0,          0.0 !   !END!
411 ! X =       101.008,      -88.591,      1706.0,          0.0 !   !END!
412 ! X =        65.916,      -87.107,      1647.0,          0.0 !   !END!
413 ! X =        67.377,      -87.095,      1613.0,          0.0 !   !END!
414 ! X =        68.838,      -87.083,      1682.0,          0.0 !   !END!
415 ! X =        70.299,      -87.070,      1631.0,          0.0 !   !END!
416 ! X =        71.761,      -87.057,      1248.0,          0.0 !   !END!
417 ! X =        73.222,      -87.044,      1461.0,          0.0 !   !END!
418 ! X =        74.683,      -87.030,      1221.0,          0.0 !   !END!
419 ! X =        76.144,      -87.017,      1582.0,          0.0 !   !END!
420 ! X =        77.606,      -87.003,      1554.0,          0.0 !   !END!
421 ! X =        79.067,      -86.988,      1584.0,          0.0 !   !END!
422 ! X =        80.528,      -86.974,      1654.0,          0.0 !   !END!
423 ! X =        81.989,      -86.959,      1670.0,          0.0 !   !END!
424 ! X =        83.450,      -86.944,      1667.0,          0.0 !   !END!
425 ! X =        84.912,      -86.928,      1706.0,          0.0 !   !END!
426 ! X =        86.373,      -86.913,      1645.0,          0.0 !   !END!
427 ! X =        87.834,      -86.897,      1762.0,          0.0 !   !END!
428 ! X =        89.295,      -86.881,      1694.0,          0.0 !   !END!
429 ! X =        90.757,      -86.864,      1686.0,          0.0 !   !END!
430 ! X =        92.218,      -86.848,      1686.0,          0.0 !   !END!
431 ! X =        93.679,      -86.831,      1609.0,          0.0 !   !END!
432 ! X =        95.140,      -86.813,      1678.0,          0.0 !   !END!
433 ! X =        96.601,      -86.796,      1625.0,          0.0 !   !END!
434 ! X =        98.062,      -86.778,      1706.0,          0.0 !   !END!
435 ! X =        99.524,      -86.760,      1767.0,          0.0 !   !END!
436 ! X =       100.985,      -86.742,      1645.0,          0.0 !   !END!
437 ! X =        68.822,      -85.234,      1516.0,          0.0 !   !END!
438 ! X =        70.283,      -85.221,      1476.0,          0.0 !   !END!
439 ! X =        71.744,      -85.208,      1523.0,          0.0 !   !END!
440 ! X =        73.205,      -85.195,      1347.0,          0.0 !   !END!
441 ! X =        74.666,      -85.181,      1477.0,          0.0 !   !END!
442 ! X =        76.127,      -85.168,      1190.0,          0.0 !   !END!
443 ! X =        77.588,      -85.154,      1317.0,          0.0 !   !END!
444 ! X =        79.048,      -85.139,      1523.0,          0.0 !   !END!
445 ! X =        80.509,      -85.125,      1463.0,          0.0 !   !END!
446 ! X =        81.970,      -85.110,      1639.0,          0.0 !   !END!
447 ! X =        83.431,      -85.095,      1611.0,          0.0 !   !END!
448 ! X =        84.892,      -85.079,      1645.0,          0.0 !   !END!
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449 ! X =        86.353,      -85.064,      1697.0,          0.0 !   !END!
450 ! X =        87.814,      -85.048,      1645.0,          0.0 !   !END!
451 ! X =        89.275,      -85.032,      1645.0,          0.0 !   !END!
452 ! X =        90.736,      -85.015,      1626.0,          0.0 !   !END!
453 ! X =        92.196,      -84.999,      1584.0,          0.0 !   !END!
454 ! X =        93.657,      -84.982,      1584.0,          0.0 !   !END!
455 ! X =        95.118,      -84.964,      1584.0,          0.0 !   !END!
456 ! X =        96.579,      -84.947,      1584.0,          0.0 !   !END!
457 ! X =        98.040,      -84.929,      1584.0,          0.0 !   !END!
458 ! X =        99.501,      -84.911,      1601.0,          0.0 !   !END!
459 ! X =       100.962,      -84.893,      1647.0,          0.0 !   !END!
460 ! X =        68.806,      -83.385,      1584.0,          0.0 !   !END!
461 ! X =        70.267,      -83.372,      1588.0,          0.0 !   !END!
462 ! X =        71.727,      -83.359,      1524.0,          0.0 !   !END!
463 ! X =        73.188,      -83.346,      1555.0,          0.0 !   !END!
464 ! X =        74.649,      -83.332,      1639.0,          0.0 !   !END!
465 ! X =        76.109,      -83.319,      1536.0,          0.0 !   !END!
466 ! X =        77.570,      -83.305,      1279.0,          0.0 !   !END!
467 ! X =        79.030,      -83.290,      1371.0,          0.0 !   !END!
468 ! X =        80.491,      -83.276,      1498.0,          0.0 !   !END!
469 ! X =        81.951,      -83.261,      1463.0,          0.0 !   !END!
470 ! X =        83.412,      -83.246,      1595.0,          0.0 !   !END!
471 ! X =        84.872,      -83.230,      1645.0,          0.0 !   !END!
472 ! X =        86.333,      -83.215,      1675.0,          0.0 !   !END!
473 ! X =        87.793,      -83.199,      1584.0,          0.0 !   !END!
474 ! X =        89.254,      -83.183,      1584.0,          0.0 !   !END!
475 ! X =        90.715,      -83.166,      1584.0,          0.0 !   !END!
476 ! X =        92.175,      -83.150,      1584.0,          0.0 !   !END!
477 ! X =        93.636,      -83.133,      1533.0,          0.0 !   !END!
478 ! X =        95.096,      -83.115,      1523.0,          0.0 !   !END!
479 ! X =        96.557,      -83.098,      1578.0,          0.0 !   !END!
480 ! X =        98.017,      -83.080,      1604.0,          0.0 !   !END!
481 ! X =        68.790,      -81.536,      1628.0,          0.0 !   !END!
482 ! X =        70.251,      -81.523,      1585.0,          0.0 !   !END!
483 ! X =        71.711,      -81.510,      1584.0,          0.0 !   !END!
484 ! X =        73.171,      -81.497,      1582.0,          0.0 !   !END!
485 ! X =        74.631,      -81.483,      1641.0,          0.0 !   !END!
486 ! X =        76.091,      -81.470,      1607.0,          0.0 !   !END!
487 ! X =        77.552,      -81.456,      1547.0,          0.0 !   !END!
488 ! X =        79.012,      -81.441,      1474.0,          0.0 !   !END!
489 ! X =        80.472,      -81.427,      1524.0,          0.0 !   !END!
490 ! X =        81.932,      -81.412,      1463.0,          0.0 !   !END!
491 ! X =        83.393,      -81.397,      1463.0,          0.0 !   !END!
492 ! X =        84.853,      -81.381,      1584.0,          0.0 !   !END!
493 ! X =        86.313,      -81.366,      1586.0,          0.0 !   !END!
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494 ! X =        87.773,      -81.350,      1584.0,          0.0 !   !END!
495 ! X =        89.233,      -81.334,      1584.0,          0.0 !   !END!
496 ! X =        90.694,      -81.317,      1575.0,          0.0 !   !END!
497 ! X =        92.154,      -81.301,      1530.0,          0.0 !   !END!
498 ! X =        93.614,      -81.284,      1524.0,          0.0 !   !END!
499 ! X =        95.074,      -81.266,      1523.0,          0.0 !   !END!
500 ! X =        96.534,      -81.249,      1581.0,          0.0 !   !END!
501 ! X =        97.994,      -81.231,      1584.0,          0.0 !   !END!
502 ! X =        70.234,      -79.674,      1701.0,          0.0 !   !END!
503 ! X =        71.694,      -79.661,      1645.0,          0.0 !   !END!
504 ! X =        73.154,      -79.648,      1634.0,          0.0 !   !END!
505 ! X =        74.614,      -79.634,      1608.0,          0.0 !   !END!
506 ! X =        76.074,      -79.621,      1645.0,          0.0 !   !END!
507 ! X =        77.534,      -79.606,      1584.0,          0.0 !   !END!
508 ! X =        78.994,      -79.592,      1287.0,          0.0 !   !END!
509 ! X =        80.454,      -79.578,      1230.0,          0.0 !   !END!
510 ! X =        81.913,      -79.563,      1497.0,          0.0 !   !END!
511 ! X =        83.373,      -79.548,      1478.0,          0.0 !   !END!
512 ! X =        84.833,      -79.532,      1562.0,          0.0 !   !END!
513 ! X =        86.293,      -79.517,      1535.0,          0.0 !   !END!
514 ! X =        87.753,      -79.501,      1525.0,          0.0 !   !END!
515 ! X =        89.213,      -79.485,      1523.0,          0.0 !   !END!
516 ! X =        90.673,      -79.468,      1524.0,          0.0 !   !END!
517 ! X =        92.132,      -79.452,      1524.0,          0.0 !   !END!
518 ! X =        93.592,      -79.435,      1520.0,          0.0 !   !END!
519 ! X =        95.052,      -79.417,      1500.0,          0.0 !   !END!
520 ! X =        96.512,      -79.400,      1523.0,          0.0 !   !END!
521 ! X =        97.972,      -79.382,      1570.0,          0.0 !   !END!
522 ! X =        70.218,      -77.825,      1584.0,          0.0 !   !END!
523 ! X =        71.678,      -77.812,      1552.0,          0.0 !   !END!
524 ! X =        73.137,      -77.799,      1540.0,          0.0 !   !END!
525 ! X =        74.597,      -77.785,      1643.0,          0.0 !   !END!
526 ! X =        76.056,      -77.771,      1634.0,          0.0 !   !END!
527 ! X =        77.516,      -77.757,      1585.0,          0.0 !   !END!
528 ! X =        78.975,      -77.743,      1553.0,          0.0 !   !END!
529 ! X =        80.435,      -77.729,      1523.0,          0.0 !   !END!
530 ! X =        81.894,      -77.714,      1192.0,          0.0 !   !END!
531 ! X =        83.354,      -77.699,      1402.0,          0.0 !   !END!
532 ! X =        84.814,      -77.683,      1523.0,          0.0 !   !END!
533 ! X =        86.273,      -77.668,      1523.0,          0.0 !   !END!
534 ! X =        87.733,      -77.652,      1523.0,          0.0 !   !END!
535 ! X =        89.192,      -77.636,      1463.0,          0.0 !   !END!
536 ! X =        90.652,      -77.619,      1500.0,          0.0 !   !END!
537 ! X =        92.111,      -77.603,      1523.0,          0.0 !   !END!
538 ! X =        93.571,      -77.586,      1493.0,          0.0 !   !END!
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539 ! X =        95.030,      -77.568,      1493.0,          0.0 !   !END!
540 ! X =        70.202,      -75.976,      1677.0,          0.0 !   !END!
541 ! X =        71.661,      -75.963,      1467.0,          0.0 !   !END!
542 ! X =        73.120,      -75.950,      1543.0,          0.0 !   !END!
543 ! X =        74.579,      -75.936,      1560.0,          0.0 !   !END!
544 ! X =        76.039,      -75.922,      1579.0,          0.0 !   !END!
545 ! X =        77.498,      -75.908,      1505.0,          0.0 !   !END!
546 ! X =        78.957,      -75.894,      1463.0,          0.0 !   !END!
547 ! X =        80.416,      -75.880,      1495.0,          0.0 !   !END!
548 ! X =        81.876,      -75.865,      1238.0,          0.0 !   !END!
549 ! X =        83.335,      -75.850,      1463.0,          0.0 !   !END!
550 ! X =        84.794,      -75.834,      1341.0,          0.0 !   !END!
551 ! X =        86.253,      -75.819,      1523.0,          0.0 !   !END!
552 ! X =        87.712,      -75.803,      1522.0,          0.0 !   !END!
553 ! X =        89.171,      -75.787,      1351.0,          0.0 !   !END!
554 ! X =        90.631,      -75.770,      1476.0,          0.0 !   !END!
555 ! X =        92.090,      -75.754,      1434.0,          0.0 !   !END!
556 ! X =        93.549,      -75.737,      1479.0,          0.0 !   !END!
557 ! X =        70.186,      -74.127,      1798.0,          0.0 !   !END!
558 ! X =        71.644,      -74.114,      1584.0,          0.0 !   !END!
559 ! X =        73.103,      -74.101,      1495.0,          0.0 !   !END!
560 ! X =        74.562,      -74.087,      1504.0,          0.0 !   !END!
561 ! X =        76.021,      -74.073,      1523.0,          0.0 !   !END!
562 ! X =        77.480,      -74.059,      1523.0,          0.0 !   !END!
563 ! X =        78.939,      -74.045,      1462.0,          0.0 !   !END!
564 ! X =        80.398,      -74.031,      1273.0,          0.0 !   !END!
565 ! X =        81.857,      -74.016,      1290.0,          0.0 !   !END!
566 ! X =        83.315,      -74.001,      1419.0,          0.0 !   !END!
567 ! X =        84.774,      -73.985,      1510.0,          0.0 !   !END!
568 ! X =        86.233,      -73.970,      1176.0,          0.0 !   !END!
569 ! X =        87.692,      -73.954,      1218.0,          0.0 !   !END!
570 ! X =        89.151,      -73.938,      1312.0,          0.0 !   !END!
571 ! X =        90.610,      -73.921,      1462.0,          0.0 !   !END!
572 ! X =        70.169,      -72.278,      1576.0,          0.0 !   !END!
573 ! X =        71.628,      -72.265,      1700.0,          0.0 !   !END!
574 ! X =        73.086,      -72.252,      1484.0,          0.0 !   !END!
575 ! X =        74.545,      -72.238,      1405.0,          0.0 !   !END!
576 ! X =        76.004,      -72.224,      1474.0,          0.0 !   !END!
577 ! X =        77.462,      -72.210,      1417.0,          0.0 !   !END!
578 ! X =        78.921,      -72.196,      1463.0,          0.0 !   !END!
579 ! X =        80.379,      -72.182,      1422.0,          0.0 !   !END!
580 ! X =        81.838,      -72.167,      1218.0,          0.0 !   !END!
581 ! X =        83.296,      -72.152,      1219.0,          0.0 !   !END!
582 ! X =        84.755,      -72.136,      1460.0,          0.0 !   !END!
583 ! X =        86.213,      -72.121,      1413.0,          0.0 !   !END!
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584 ! X =        87.672,      -72.105,      1406.0,          0.0 !   !END!
585 ! X =        89.130,      -72.089,      1212.0,          0.0 !   !END!
586 ! X =        90.589,      -72.072,      1245.0,          0.0 !   !END!
587 ! X =        70.153,      -70.429,      1456.0,          0.0 !   !END!
588 ! X =        71.611,      -70.416,      1508.0,          0.0 !   !END!
589 ! X =        73.070,      -70.403,      1527.0,          0.0 !   !END!
590 ! X =        74.528,      -70.389,      1401.0,          0.0 !   !END!
591 ! X =        75.986,      -70.375,      1497.0,          0.0 !   !END!
592 ! X =        77.444,      -70.361,      1598.0,          0.0 !   !END!
593 ! X =        78.902,      -70.347,      1343.0,          0.0 !   !END!
594 ! X =        80.360,      -70.333,      1233.0,          0.0 !   !END!
595 ! X =        81.819,      -70.318,      1306.0,          0.0 !   !END!
596 ! X =        83.277,      -70.303,      1368.0,          0.0 !   !END!
597 ! X =        84.735,      -70.287,      1462.0,          0.0 !   !END!
598 ! X =        86.193,      -70.272,      1463.0,          0.0 !   !END!
599 ! X =        87.651,      -70.256,      1190.0,          0.0 !   !END!
600 ! X =        89.110,      -70.240,      1204.0,          0.0 !   !END!
601 ! X =        90.568,      -70.223,      1433.0,          0.0 !   !END!
602 ! X =        71.595,      -68.567,      1472.0,          0.0 !   !END!
603 ! X =        73.053,      -68.554,      1394.0,          0.0 !   !END!
604 ! X =        74.510,      -68.540,      1344.0,          0.0 !   !END!
605 ! X =        75.968,      -68.526,      1340.0,          0.0 !   !END!
606 ! X =        77.426,      -68.512,      1463.0,          0.0 !   !END!
607 ! X =        78.884,      -68.498,      1240.0,          0.0 !   !END!
608 ! X =        80.342,      -68.484,      1219.0,          0.0 !   !END!
609 ! X =        81.800,      -68.469,      1218.0,          0.0 !   !END!
610 ! X =        83.258,      -68.454,      1402.0,          0.0 !   !END!
611 ! X =        84.715,      -68.438,      1528.0,          0.0 !   !END!
612 ! X =        86.173,      -68.423,      1524.0,          0.0 !   !END!
613 ! X =        87.631,      -68.407,      1403.0,          0.0 !   !END!
614 ! X =        89.089,      -68.391,      1409.0,          0.0 !   !END!
615 ! X =        90.547,      -68.374,      1219.0,          0.0 !   !END!
616 ! X =        92.005,      -68.358,      1401.0,          0.0 !   !END!
617 ! X =        75.951,      -66.677,      1524.0,          0.0 !   !END!
618 ! X =        77.408,      -66.663,      1282.0,          0.0 !   !END!
619 ! X =        78.866,      -66.649,      1340.0,          0.0 !   !END!
620 ! X =        80.323,      -66.634,      1349.0,          0.0 !   !END!
621 ! X =        81.781,      -66.620,      1523.0,          0.0 !   !END!
622 ! X =        83.238,      -66.605,      1536.0,          0.0 !   !END!
623 ! X =        84.696,      -66.589,      1610.0,          0.0 !   !END!
624 ! X =        86.153,      -66.574,      1574.0,          0.0 !   !END!
625 ! X =        87.611,      -66.558,      1422.0,          0.0 !   !END!
626 ! X =        89.068,      -66.542,      1419.0,          0.0 !   !END!
627 ! X =        90.526,      -66.525,      1341.0,          0.0 !   !END!
628 ! X =        91.983,      -66.509,      1425.0,          0.0 !   !END!
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629 ! X =        77.390,      -64.814,      1242.0,          0.0 !   !END!
630 ! X =        78.847,      -64.800,      1469.0,          0.0 !   !END!
631 ! X =        80.305,      -64.785,      1462.0,          0.0 !   !END!
632 ! X =        81.762,      -64.771,      1340.0,          0.0 !   !END!
633 ! X =        83.219,      -64.756,      1645.0,          0.0 !   !END!
634 ! X =        84.676,      -64.740,      1730.0,          0.0 !   !END!
635 ! X =        86.133,      -64.725,      1492.0,          0.0 !   !END!
636 ! X =        87.590,      -64.709,      1447.0,          0.0 !   !END!
637 ! X =        89.048,      -64.693,      1284.0,          0.0 !   !END!
638 ! X =        90.505,      -64.676,      1341.0,          0.0 !   !END!
639 ! X =        91.962,      -64.660,      1200.0,          0.0 !   !END!
640 ! X =        93.419,      -64.643,      1353.0,          0.0 !   !END!
641 ! X =        94.876,      -64.625,      1348.0,          0.0 !   !END!
642 ! X =        75.916,      -62.979,      1421.0,          0.0 !   !END!
643 ! X =        77.372,      -62.965,      1243.0,          0.0 !   !END!
644 ! X =        78.829,      -62.951,      1433.0,          0.0 !   !END!
645 ! X =        80.286,      -62.936,      1505.0,          0.0 !   !END!
646 ! X =        81.743,      -62.922,      1464.0,          0.0 !   !END!
647 ! X =        83.200,      -62.907,      1515.0,          0.0 !   !END!
648 ! X =        84.657,      -62.891,      1606.0,          0.0 !   !END!
649 ! X =        86.113,      -62.876,      1869.0,          0.0 !   !END!
650 ! X =        87.570,      -62.860,      1504.0,          0.0 !   !END!
651 ! X =        89.027,      -62.844,      1484.0,          0.0 !   !END!
652 ! X =        90.484,      -62.827,      1493.0,          0.0 !   !END!
653 ! X =        91.941,      -62.811,      1477.0,          0.0 !   !END!
654 ! X =        93.397,      -62.794,      1349.0,          0.0 !   !END!
655 ! X =        94.854,      -62.777,      1340.0,          0.0 !   !END!
656 ! X =        75.898,      -61.130,      1220.0,          0.0 !   !END!
657 ! X =        77.354,      -61.116,      1280.0,          0.0 !   !END!
658 ! X =        78.811,      -61.102,      1402.0,          0.0 !   !END!
659 ! X =        80.267,      -61.087,      1386.0,          0.0 !   !END!
660 ! X =        81.724,      -61.073,      1584.0,          0.0 !   !END!
661 ! X =        83.180,      -61.058,      1523.0,          0.0 !   !END!
662 ! X =        84.637,      -61.042,      1676.0,          0.0 !   !END!
663 ! X =        86.093,      -61.027,      1888.0,          0.0 !   !END!
664 ! X =        87.550,      -61.011,      1523.0,          0.0 !   !END!
665 ! X =        89.006,      -60.995,      1461.0,          0.0 !   !END!
666 ! X =        90.463,      -60.978,      1462.0,          0.0 !   !END!
667 ! X =        91.919,      -60.962,      1355.0,          0.0 !   !END!
668 ! X =        93.376,      -60.945,      1191.0,          0.0 !   !END!
669 ! X =        94.832,      -60.928,      1279.0,          0.0 !   !END!
670 ! X =        74.424,      -59.295,      1331.0,          0.0 !   !END!
671 ! X =        75.880,      -59.281,      1219.0,          0.0 !   !END!
672 ! X =        77.336,      -59.267,      1239.0,          0.0 !   !END!
673 ! X =        78.793,      -59.253,      1218.0,          0.0 !   !END!
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674 ! X =        80.249,      -59.238,      1279.0,          0.0 !   !END!
675 ! X =        81.705,      -59.224,      1461.0,          0.0 !   !END!
676 ! X =        83.161,      -59.209,      1690.0,          0.0 !   !END!
677 ! X =        84.617,      -59.193,      1859.0,          0.0 !   !END!
678 ! X =        86.073,      -59.178,      1558.0,          0.0 !   !END!
679 ! X =        87.530,      -59.162,      1463.0,          0.0 !   !END!
680 ! X =        88.986,      -59.146,      1461.0,          0.0 !   !END!
681 ! X =        90.442,      -59.129,      1345.0,          0.0 !   !END!
682 ! X =        91.898,      -59.113,      1280.0,          0.0 !   !END!
683 ! X =        93.354,      -59.096,      1188.0,          0.0 !   !END!
684 ! X =        94.810,      -59.079,      1340.0,          0.0 !   !END!
685 ! X =        96.266,      -59.061,      1341.0,          0.0 !   !END!
686 ! X =        71.495,      -57.473,      1219.0,          0.0 !   !END!
687 ! X =        72.951,      -57.459,      1281.0,          0.0 !   !END!
688 ! X =        74.407,      -57.446,      1219.0,          0.0 !   !END!
689 ! X =        75.863,      -57.432,      1331.0,          0.0 !   !END!
690 ! X =        77.319,      -57.418,      1390.0,          0.0 !   !END!
691 ! X =        78.774,      -57.404,      1361.0,          0.0 !   !END!
692 ! X =        80.230,      -57.389,      1320.0,          0.0 !   !END!
693 ! X =        81.686,      -57.375,      1381.0,          0.0 !   !END!
694 ! X =        83.142,      -57.360,      1462.0,          0.0 !   !END!
695 ! X =        84.598,      -57.344,      1889.0,          0.0 !   !END!
696 ! X =        86.053,      -57.329,      1727.0,          0.0 !   !END!
697 ! X =        87.509,      -57.313,      1463.0,          0.0 !   !END!
698 ! X =        88.965,      -57.297,      1381.0,          0.0 !   !END!
699 ! X =        90.421,      -57.280,      1333.0,          0.0 !   !END!
700 ! X =        91.877,      -57.264,      1219.0,          0.0 !   !END!
701 ! X =        93.333,      -57.247,      1279.0,          0.0 !   !END!
702 ! X =        94.788,      -57.230,      1279.0,          0.0 !   !END!
703 ! X =        96.244,      -57.212,      1215.0,          0.0 !   !END!
704 ! X =        70.023,      -55.636,      1280.0,          0.0 !   !END!
705 ! X =        71.479,      -55.623,      1236.0,          0.0 !   !END!
706 ! X =        72.934,      -55.610,      1276.0,          0.0 !   !END!
707 ! X =        74.390,      -55.597,      1283.0,          0.0 !   !END!
708 ! X =        75.845,      -55.583,      1284.0,          0.0 !   !END!
709 ! X =        77.301,      -55.569,      1340.0,          0.0 !   !END!
710 ! X =        78.756,      -55.555,      1401.0,          0.0 !   !END!
711 ! X =        80.212,      -55.540,      1446.0,          0.0 !   !END!
712 ! X =        81.667,      -55.526,      1459.0,          0.0 !   !END!
713 ! X =        83.123,      -55.511,      1757.0,          0.0 !   !END!
714 ! X =        84.578,      -55.495,      1827.0,          0.0 !   !END!
715 ! X =        86.034,      -55.480,      1462.0,          0.0 !   !END!
716 ! X =        87.489,      -55.464,      1419.0,          0.0 !   !END!
717 ! X =        88.944,      -55.448,      1402.0,          0.0 !   !END!
718 ! X =        90.400,      -55.431,      1342.0,          0.0 !   !END!
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719 ! X =        91.855,      -55.415,      1280.0,          0.0 !   !END!
720 ! X =        93.311,      -55.398,      1280.0,          0.0 !   !END!
721 ! X =        94.766,      -55.381,      1341.0,          0.0 !   !END!
722 ! X =        96.222,      -55.363,      1280.0,          0.0 !   !END!
723 ! X =        70.007,      -53.787,      1249.0,          0.0 !   !END!
724 ! X =        71.462,      -53.774,      1195.0,          0.0 !   !END!
725 ! X =        72.917,      -53.761,      1279.0,          0.0 !   !END!
726 ! X =        74.372,      -53.748,      1285.0,          0.0 !   !END!
727 ! X =        75.828,      -53.734,      1237.0,          0.0 !   !END!
728 ! X =        77.283,      -53.720,      1340.0,          0.0 !   !END!
729 ! X =        78.738,      -53.706,      1345.0,          0.0 !   !END!
730 ! X =        80.193,      -53.691,      1402.0,          0.0 !   !END!
731 ! X =        81.648,      -53.677,      1776.0,          0.0 !   !END!
732 ! X =        83.103,      -53.662,      1828.0,          0.0 !   !END!
733 ! X =        84.558,      -53.646,      1828.0,          0.0 !   !END!
734 ! X =        86.014,      -53.631,      1828.0,          0.0 !   !END!
735 ! X =        87.469,      -53.615,      1460.0,          0.0 !   !END!
736 ! X =        88.924,      -53.599,      1597.0,          0.0 !   !END!
737 ! X =        90.379,      -53.582,      1463.0,          0.0 !   !END!
738 ! X =        91.834,      -53.566,      1279.0,          0.0 !   !END!
739 ! X =        93.289,      -53.549,      1400.0,          0.0 !   !END!
740 ! X =        94.744,      -53.532,      1281.0,          0.0 !   !END!
741 ! X =        96.199,      -53.514,      1249.0,          0.0 !   !END!
742 ! X =        69.991,      -51.938,      1327.0,          0.0 !   !END!
743 ! X =        71.445,      -51.925,      1280.0,          0.0 !   !END!
744 ! X =        72.900,      -51.912,      1188.0,          0.0 !   !END!
745 ! X =        74.355,      -51.899,      1325.0,          0.0 !   !END!
746 ! X =        75.810,      -51.885,      1347.0,          0.0 !   !END!
747 ! X =        77.265,      -51.871,      1340.0,          0.0 !   !END!
748 ! X =        78.720,      -51.857,      1584.0,          0.0 !   !END!
749 ! X =        80.174,      -51.842,      1426.0,          0.0 !   !END!
750 ! X =        81.629,      -51.828,      1767.0,          0.0 !   !END!
751 ! X =        83.084,      -51.813,      1763.0,          0.0 !   !END!
752 ! X =        84.539,      -51.797,      1523.0,          0.0 !   !END!
753 ! X =        85.994,      -51.782,      1876.0,          0.0 !   !END!
754 ! X =        87.448,      -51.766,      1857.0,          0.0 !   !END!
755 ! X =        88.903,      -51.750,      1584.0,          0.0 !   !END!
756 ! X =        90.358,      -51.733,      1557.0,          0.0 !   !END!
757 ! X =        91.813,      -51.717,      1524.0,          0.0 !   !END!
758 ! X =        93.268,      -51.700,      1372.0,          0.0 !   !END!
759 ! X =        94.722,      -51.683,      1401.0,          0.0 !   !END!
760 ! X =        96.177,      -51.665,      1280.0,          0.0 !   !END!
761 ! X =        53.975,      -50.214,      1572.0,          0.0 !   !END!
762 ! X =        69.974,      -50.089,      1586.0,          0.0 !   !END!
763 ! X =        71.429,      -50.076,      1274.0,          0.0 !   !END!
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764 ! X =        72.883,      -50.063,      1226.0,          0.0 !   !END!
765 ! X =        74.338,      -50.050,      1318.0,          0.0 !   !END!
766 ! X =        75.792,      -50.036,      1340.0,          0.0 !   !END!
767 ! X =        77.247,      -50.022,      1558.0,          0.0 !   !END!
768 ! X =        78.701,      -50.008,      1708.0,          0.0 !   !END!
769 ! X =        80.156,      -49.993,      1706.0,          0.0 !   !END!
770 ! X =        81.610,      -49.979,      1473.0,          0.0 !   !END!
771 ! X =        83.065,      -49.964,      1460.0,          0.0 !   !END!
772 ! X =        84.519,      -49.948,      1764.0,          0.0 !   !END!
773 ! X =        85.974,      -49.933,      1771.0,          0.0 !   !END!
774 ! X =        87.428,      -49.917,      1834.0,          0.0 !   !END!
775 ! X =        88.883,      -49.901,      1833.0,          0.0 !   !END!
776 ! X =        90.337,      -49.884,      1577.0,          0.0 !   !END!
777 ! X =        91.791,      -49.868,      1392.0,          0.0 !   !END!
778 ! X =        93.246,      -49.851,      1349.0,          0.0 !   !END!
779 ! X =        94.700,      -49.834,      1279.0,          0.0 !   !END!
780 ! X =        53.962,      -48.365,      1502.0,          0.0 !   !END!
781 ! X =        55.417,      -48.355,      1589.0,          0.0 !   !END!
782 ! X =        69.958,      -48.240,      1194.0,          0.0 !   !END!
783 ! X =        71.412,      -48.227,      1219.0,          0.0 !   !END!
784 ! X =        72.866,      -48.214,      1420.0,          0.0 !   !END!
785 ! X =        74.321,      -48.201,      1505.0,          0.0 !   !END!
786 ! X =        75.775,      -48.187,      1449.0,          0.0 !   !END!
787 ! X =        77.229,      -48.173,      1340.0,          0.0 !   !END!
788 ! X =        78.683,      -48.159,      1645.0,          0.0 !   !END!
789 ! X =        80.137,      -48.144,      1649.0,          0.0 !   !END!
790 ! X =        81.591,      -48.130,      1425.0,          0.0 !   !END!
791 ! X =        83.045,      -48.114,      1645.0,          0.0 !   !END!
792 ! X =        84.500,      -48.099,      1463.0,          0.0 !   !END!
793 ! X =        85.954,      -48.084,      1790.0,          0.0 !   !END!
794 ! X =        87.408,      -48.068,      1706.0,          0.0 !   !END!
795 ! X =        88.862,      -48.052,      1793.0,          0.0 !   !END!
796 ! X =        90.316,      -48.035,      1706.0,          0.0 !   !END!
797 ! X =        91.770,      -48.019,      1484.0,          0.0 !   !END!
798 ! X =        93.224,      -48.002,      1357.0,          0.0 !   !END!
799 ! X =        55.404,      -46.506,      1555.0,          0.0 !   !END!
800 ! X =        69.942,      -46.391,      1459.0,          0.0 !   !END!
801 ! X =        71.396,      -46.378,      1523.0,          0.0 !   !END!
802 ! X =        72.850,      -46.365,      1204.0,          0.0 !   !END!
803 ! X =        74.303,      -46.352,      1249.0,          0.0 !   !END!
804 ! X =        75.757,      -46.338,      1554.0,          0.0 !   !END!
805 ! X =        77.211,      -46.324,      1535.0,          0.0 !   !END!
806 ! X =        78.665,      -46.310,      1584.0,          0.0 !   !END!
807 ! X =        80.119,      -46.295,      1341.0,          0.0 !   !END!
808 ! X =        81.572,      -46.280,      1509.0,          0.0 !   !END!
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809 ! X =        83.026,      -46.265,      1378.0,          0.0 !   !END!
810 ! X =        84.480,      -46.250,      1615.0,          0.0 !   !END!
811 ! X =        85.934,      -46.235,      1463.0,          0.0 !   !END!
812 ! X =        87.387,      -46.219,      1690.0,          0.0 !   !END!
813 ! X =        88.841,      -46.203,      1767.0,          0.0 !   !END!
814 ! X =        90.295,      -46.186,      1550.0,          0.0 !   !END!
815 ! X =        91.749,      -46.170,      1366.0,          0.0 !   !END!
816 ! X =        56.844,      -44.646,      1553.0,          0.0 !   !END!
817 ! X =        72.833,      -44.516,      1188.0,          0.0 !   !END!
818 ! X =        74.286,      -44.503,      1258.0,          0.0 !   !END!
819 ! X =        75.740,      -44.489,      1279.0,          0.0 !   !END!
820 ! X =        77.193,      -44.475,      1280.0,          0.0 !   !END!
821 ! X =        78.646,      -44.461,      1280.0,          0.0 !   !END!
822 ! X =        80.100,      -44.446,      1381.0,          0.0 !   !END!
823 ! X =        81.553,      -44.431,      1361.0,          0.0 !   !END!
824 ! X =        83.007,      -44.416,      1584.0,          0.0 !   !END!
825 ! X =        84.460,      -44.401,      1483.0,          0.0 !   !END!
826 ! X =        85.914,      -44.386,      1645.0,          0.0 !   !END!
827 ! X =        87.367,      -44.370,      1686.0,          0.0 !   !END!
828 ! X =        88.821,      -44.354,      1768.0,          0.0 !   !END!
829 ! X =        90.274,      -44.337,      1797.0,          0.0 !   !END!
830 ! X =        91.728,      -44.321,      1556.0,          0.0 !   !END!
831 ! X =        71.363,      -42.680,      1194.0,          0.0 !   !END!
832 ! X =        72.816,      -42.667,      1219.0,          0.0 !   !END!
833 ! X =        74.269,      -42.654,      1523.0,          0.0 !   !END!
834 ! X =        91.706,      -42.472,      1459.0,          0.0 !   !END!
835 ! X =        -4.254,     -141.004,      1361.0,          0.0 !   !END!
836 ! X =        -2.783,     -141.005,      1218.0,          0.0 !   !END!
837 ! X =        -5.724,     -139.154,      1463.0,          0.0 !   !END!
838 ! X =        -4.253,     -139.155,      1286.0,          0.0 !   !END!
839 ! X =        -5.723,     -137.305,      1279.0,          0.0 !   !END!
840 ! X =        -7.192,     -135.454,      1385.0,          0.0 !   !END!
841 ! X =       -11.599,     -133.600,      1911.0,          0.0 !   !END!
842 ! X =       -10.129,     -133.602,      1920.0,          0.0 !   !END!
843 ! X =        -8.660,     -133.604,      1651.0,          0.0 !   !END!
844 ! X =        -7.190,     -133.605,      1360.0,          0.0 !   !END!
845 ! X =       -11.597,     -131.751,      1940.0,          0.0 !   !END!
846 ! X =       -10.127,     -131.753,      1691.0,          0.0 !   !END!
847 ! X =        -8.658,     -131.754,      1504.0,          0.0 !   !END!
848 ! X =       -11.594,     -129.901,      1838.0,          0.0 !   !END!
849 ! X =       -10.125,     -129.903,      1711.0,          0.0 !   !END!
850 ! X =        -8.656,     -129.905,      1401.0,          0.0 !   !END!
851 ! X =       -13.060,     -128.050,      1874.0,          0.0 !   !END!
852 ! X =       -11.591,     -128.052,      1593.0,          0.0 !   !END!
853 ! X =       -10.122,     -128.054,      1572.0,          0.0 !   !END!
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854 ! X =        -8.654,     -128.056,      1401.0,          0.0 !   !END!
855 ! X =       -15.994,     -126.195,      1927.0,          0.0 !   !END!
856 ! X =       -14.525,     -126.198,      1950.0,          0.0 !   !END!
857 ! X =       -13.057,     -126.201,      1716.0,          0.0 !   !END!
858 ! X =       -11.589,     -126.203,      1645.0,          0.0 !   !END!
859 ! X =       -10.120,     -126.205,      1401.0,          0.0 !   !END!
860 ! X =       -15.990,     -124.346,      1929.0,          0.0 !   !END!
861 ! X =       -14.522,     -124.349,      1714.0,          0.0 !   !END!
862 ! X =       -13.054,     -124.352,      1495.0,          0.0 !   !END!
863 ! X =       -11.586,     -124.354,      1463.0,          0.0 !   !END!
864 ! X =       -10.118,     -124.356,      1460.0,          0.0 !   !END!
865 ! X =       -17.454,     -122.494,      1975.0,          0.0 !   !END!
866 ! X =       -15.986,     -122.497,      1780.0,          0.0 !   !END!
867 ! X =       -14.519,     -122.500,      1670.0,          0.0 !   !END!
868 ! X =       -13.051,     -122.502,      1523.0,          0.0 !   !END!
869 ! X =       -11.583,     -122.505,      1463.0,          0.0 !   !END!
870 ! X =       -18.917,     -120.642,      2035.0,          0.0 !   !END!
871 ! X =       -17.450,     -120.645,      1889.0,          0.0 !   !END!
872 ! X =       -15.983,     -120.648,      1730.0,          0.0 !   !END!
873 ! X =       -14.515,     -120.651,      1695.0,          0.0 !   !END!
874 ! X =       -13.048,     -120.653,      1706.0,          0.0 !   !END!
875 ! X =       -11.581,     -120.655,      1462.0,          0.0 !   !END!
876 ! X =       -20.380,     -118.789,      2133.0,          0.0 !   !END!
877 ! X =       -18.913,     -118.792,      2011.0,          0.0 !   !END!
878 ! X =       -17.446,     -118.796,      1828.0,          0.0 !   !END!
879 ! X =       -15.979,     -118.799,      1841.0,          0.0 !   !END!
880 ! X =       -14.512,     -118.802,      1744.0,          0.0 !   !END!
881 ! X =       -13.045,     -118.804,      1645.0,          0.0 !   !END!
882 ! X =       -11.578,     -118.806,      1522.0,          0.0 !   !END!
883 ! X =       -20.375,     -116.940,      2072.0,          0.0 !   !END!
884 ! X =       -18.909,     -116.943,      1869.0,          0.0 !   !END!
885 ! X =       -17.442,     -116.946,      1767.0,          0.0 !   !END!
886 ! X =       -15.975,     -116.950,      1706.0,          0.0 !   !END!
887 ! X =       -14.509,     -116.952,      1720.0,          0.0 !   !END!
888 ! X =       -13.042,     -116.955,      1523.0,          0.0 !   !END!
889 ! X =       -11.575,     -116.957,      1584.0,          0.0 !   !END!
890 ! X =       -20.371,     -115.090,      1950.0,          0.0 !   !END!
891 ! X =       -18.904,     -115.094,      1830.0,          0.0 !   !END!
892 ! X =       -17.438,     -115.097,      1767.0,          0.0 !   !END!
893 ! X =       -15.972,     -115.100,      1730.0,          0.0 !   !END!
894 ! X =       -14.505,     -115.103,      1518.0,          0.0 !   !END!
895 ! X =       -13.039,     -115.106,      1523.0,          0.0 !   !END!
896 ! X =       -20.366,     -113.241,      1954.0,          0.0 !   !END!
897 ! X =       -18.900,     -113.245,      1847.0,          0.0 !   !END!
898 ! X =       -17.434,     -113.248,      1767.0,          0.0 !   !END!
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899 ! X =       -15.968,     -113.251,      1531.0,          0.0 !   !END!
900 ! X =       -14.502,     -113.254,      1584.0,          0.0 !   !END!
901 ! X =       -20.361,     -111.392,      1889.0,          0.0 !   !END!
902 ! X =       -18.896,     -111.396,      1828.0,          0.0 !   !END!
903 ! X =       -17.430,     -111.399,      1683.0,          0.0 !   !END!
904 ! X =       -15.964,     -111.402,      1584.0,          0.0 !   !END!
905 ! X =       -20.357,     -109.543,      1889.0,          0.0 !   !END!
906 ! X =       -18.891,     -109.547,      1828.0,          0.0 !   !END!
907 ! X =       -17.426,     -109.550,      1584.0,          0.0 !   !END!
908 ! X =       -21.817,     -107.690,      2035.0,          0.0 !   !END!
909 ! X =       -20.352,     -107.694,      1925.0,          0.0 !   !END!
910 ! X =       -18.887,     -107.697,      1646.0,          0.0 !   !END!
911 ! X =       -17.422,     -107.701,      1641.0,          0.0 !   !END!
912 ! X =       -21.812,     -105.841,      2049.0,          0.0 !   !END!
913 ! X =       -20.347,     -105.845,      1921.0,          0.0 !   !END!
914 ! X =       -18.883,     -105.848,      1646.0,          0.0 !   !END!
915 ! X =       -17.418,     -105.851,      1706.0,          0.0 !   !END!
916 ! X =       -23.271,     -103.987,      2054.0,          0.0 !   !END!
917 ! X =       -21.807,     -103.992,      2100.0,          0.0 !   !END!
918 ! X =       -20.343,     -103.995,      1767.0,          0.0 !   !END!
919 ! X =       -18.878,     -103.999,      1706.0,          0.0 !   !END!
920 ! X =       -23.266,     -102.138,      2190.0,          0.0 !   !END!
921 ! X =       -21.802,     -102.142,      1916.0,          0.0 !   !END!
922 ! X =       -20.338,     -102.146,      1748.0,          0.0 !   !END!
923 ! X =       -18.874,     -102.150,      1766.0,          0.0 !   !END!
924 ! X =       -23.261,     -100.289,      2103.0,          0.0 !   !END!
925 ! X =       -21.797,     -100.293,      1768.0,          0.0 !   !END!
926 ! X =       -20.333,     -100.297,      1706.0,          0.0 !   !END!
927 ! X =       -18.870,     -100.301,      1744.0,          0.0 !   !END!
928 ! X =       -26.182,      -98.431,      2022.0,          0.0 !   !END!
929 ! X =       -24.718,      -98.436,      2182.0,          0.0 !   !END!
930 ! X =       -23.255,      -98.440,      1861.0,          0.0 !   !END!
931 ! X =       -21.792,      -98.444,      1710.0,          0.0 !   !END!
932 ! X =       -20.329,      -98.448,      1692.0,          0.0 !   !END!
933 ! X =       -29.102,      -96.572,      2119.0,          0.0 !   !END!
934 ! X =       -27.639,      -96.577,      2195.0,          0.0 !   !END!
935 ! X =       -26.176,      -96.582,      2237.0,          0.0 !   !END!
936 ! X =       -24.713,      -96.587,      2020.0,          0.0 !   !END!
937 ! X =       -23.250,      -96.591,      1767.0,          0.0 !   !END!
938 ! X =       -21.787,      -96.595,      1706.0,          0.0 !   !END!
939 ! X =       -20.324,      -96.599,      1663.0,          0.0 !   !END!
940 ! X =       -29.095,      -94.723,      2072.0,          0.0 !   !END!
941 ! X =       -27.632,      -94.728,      2059.0,          0.0 !   !END!
942 ! X =       -26.170,      -94.733,      2133.0,          0.0 !   !END!
943 ! X =       -24.707,      -94.737,      1887.0,          0.0 !   !END!
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944 ! X =       -23.244,      -94.742,      1724.0,          0.0 !   !END!
945 ! X =       -21.782,      -94.746,      1749.0,          0.0 !   !END!
946 ! X =       -20.319,      -94.750,      1657.0,          0.0 !   !END!
947 ! X =       -29.088,      -92.874,      1950.0,          0.0 !   !END!
948 ! X =       -27.626,      -92.879,      2079.0,          0.0 !   !END!
949 ! X =       -26.164,      -92.884,      1829.0,          0.0 !   !END!
950 ! X =       -24.701,      -92.888,      1748.0,          0.0 !   !END!
951 ! X =       -29.082,      -91.024,      2133.0,          0.0 !   !END!
952 ! X =       -27.620,      -91.030,      2135.0,          0.0 !   !END!
953 ! X =       -26.158,      -91.035,      1896.0,          0.0 !   !END!
954 ! X =       -29.075,      -89.175,      1868.0,          0.0 !   !END!
955 ! X =       -27.613,      -89.180,      1963.0,          0.0 !   !END!
956 ! X =       -26.152,      -89.185,      1889.0,          0.0 !   !END!
957 ! X =       -24.690,      -89.190,      1828.0,          0.0 !   !END!
958 ! X =       -29.068,      -87.326,      2084.0,          0.0 !   !END!
959 ! X =       -27.607,      -87.331,      2059.0,          0.0 !   !END!
960 ! X =       -26.146,      -87.336,      1879.0,          0.0 !   !END!
961 ! X =       -24.684,      -87.341,      1879.0,          0.0 !   !END!
962 ! X =       -29.061,      -85.477,      1993.0,          0.0 !   !END!
963 ! X =       -27.600,      -85.482,      2087.0,          0.0 !   !END!
964 ! X =       -26.139,      -85.487,      2011.0,          0.0 !   !END!
965 ! X =       -24.679,      -85.492,      1859.0,          0.0 !   !END!
966 ! X =       -23.218,      -85.496,      1767.0,          0.0 !   !END!
967 ! X =       -29.055,      -83.628,      1973.0,          0.0 !   !END!
968 ! X =       -27.594,      -83.633,      2011.0,          0.0 !   !END!
969 ! X =       -26.133,      -83.638,      2011.0,          0.0 !   !END!
970 ! X =       -24.673,      -83.643,      1828.0,          0.0 !   !END!
971 ! X =       -29.048,      -81.779,      1896.0,          0.0 !   !END!
972 ! X =       -27.588,      -81.784,      1965.0,          0.0 !   !END!
973 ! X =       -26.127,      -81.789,      1926.0,          0.0 !   !END!
974 ! X =       -24.667,      -81.794,      1854.0,          0.0 !   !END!
975 ! X =       -31.961,      -79.919,      1999.0,          0.0 !   !END!
976 ! X =       -30.501,      -79.924,      1939.0,          0.0 !   !END!
977 ! X =       -29.041,      -79.930,      1972.0,          0.0 !   !END!
978 ! X =       -27.581,      -79.935,      1889.0,          0.0 !   !END!
979 ! X =       -26.121,      -79.940,      1950.0,          0.0 !   !END!
980 ! X =       -24.661,      -79.944,      1784.0,          0.0 !   !END!
981 ! X =       -31.954,      -78.070,      1922.0,          0.0 !   !END!
982 ! X =       -30.494,      -78.075,      1835.0,          0.0 !   !END!
983 ! X =       -29.035,      -78.081,      2000.0,          0.0 !   !END!
984 ! X =       -27.575,      -78.086,      1828.0,          0.0 !   !END!
985 ! X =       -26.115,      -78.091,      1808.0,          0.0 !   !END!
986 ! X =       -24.656,      -78.095,      1700.0,          0.0 !   !END!
987 ! X =       -31.946,      -76.220,      1792.0,          0.0 !   !END!
988 ! X =       -30.487,      -76.226,      2022.0,          0.0 !   !END!
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 989 ! X =       -29.028,      -76.232,      1802.0,          0.0 !   !END!
 990 ! X =       -27.569,      -76.237,      1889.0,          0.0 !   !END!
 991 ! X =       -34.857,      -74.359,      2096.0,          0.0 !   !END!
 992 ! X =       -33.398,      -74.365,      1882.0,          0.0 !   !END!
 993 ! X =       -31.939,      -74.371,      1779.0,          0.0 !   !END!
 994 ! X =       -30.480,      -74.377,      1759.0,          0.0 !   !END!
 995 ! X =       -29.021,      -74.382,      1811.0,          0.0 !   !END!
 996 ! X =       -27.562,      -74.388,      1645.0,          0.0 !   !END!
 997 ! X =       -34.849,      -72.510,      1937.0,          0.0 !   !END!
 998 ! X =       -33.390,      -72.516,      1808.0,          0.0 !   !END!
 999 ! X =       -31.932,      -72.522,      2072.0,          0.0 !   !END!
1000 ! X =       -30.473,      -72.528,      2020.0,          0.0 !   !END!
1001 ! X =       -29.014,      -72.533,      1828.0,          0.0 !   !END!
1002 ! X =       -27.556,      -72.539,      1706.0,          0.0 !   !END!
1003 ! X =       -36.299,      -70.654,      1950.0,          0.0 !   !END!
1004 ! X =       -34.841,      -70.661,      1767.0,          0.0 !   !END!
1005 ! X =       -33.382,      -70.667,      1848.0,          0.0 !   !END!
1006 ! X =       -31.924,      -70.673,      2026.0,          0.0 !   !END!
1007 ! X =       -30.466,      -70.679,      1828.0,          0.0 !   !END!
1008 ! X =       -29.008,      -70.684,      1774.0,          0.0 !   !END!
1009 ! X =       -27.549,      -70.689,      1645.0,          0.0 !   !END!
1010 ! X =       -39.206,      -68.792,      2121.0,          0.0 !   !END!
1011 ! X =       -37.748,      -68.799,      2047.0,          0.0 !   !END!
1012 ! X =       -36.291,      -68.805,      1828.0,          0.0 !   !END!
1013 ! X =       -34.833,      -68.812,      1784.0,          0.0 !   !END!
1014 ! X =       -33.375,      -68.818,      1767.0,          0.0 !   !END!
1015 ! X =       -31.917,      -68.824,      1864.0,          0.0 !   !END!
1016 ! X =       -30.459,      -68.830,      1828.0,          0.0 !   !END!
1017 ! X =       -29.001,      -68.835,      1768.0,          0.0 !   !END!
1018 ! X =       -27.543,      -68.840,      1645.0,          0.0 !   !END!
1019 ! X =       -39.197,      -66.942,      2012.0,          0.0 !   !END!
1020 ! X =       -37.740,      -66.949,      1822.0,          0.0 !   !END!
1021 ! X =       -36.282,      -66.956,      1707.0,          0.0 !   !END!
1022 ! X =       -34.825,      -66.963,      1821.0,          0.0 !   !END!
1023 ! X =       -33.367,      -66.969,      1713.0,          0.0 !   !END!
1024 ! X =       -31.909,      -66.975,      1773.0,          0.0 !   !END!
1025 ! X =       -30.452,      -66.981,      1615.0,          0.0 !   !END!
1026 ! X =       -28.994,      -66.986,      1609.0,          0.0 !   !END!
1027 ! X =       -27.537,      -66.991,      1638.0,          0.0 !   !END!
1028 ! X =       -40.645,      -65.086,      1919.0,          0.0 !   !END!
1029 ! X =       -39.188,      -65.093,      1839.0,          0.0 !   !END!
1030 ! X =       -37.731,      -65.100,      1712.0,          0.0 !   !END!
1031 ! X =       -36.274,      -65.107,      1874.0,          0.0 !   !END!
1032 ! X =       -34.816,      -65.114,      1828.0,          0.0 !   !END!
1033 ! X =       -33.359,      -65.120,      1830.0,          0.0 !   !END!
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1034 ! X =       -31.902,      -65.126,      1772.0,          0.0 !   !END!
1035 ! X =       -30.445,      -65.132,      1840.0,          0.0 !   !END!
1036 ! X =       -28.988,      -65.137,      1710.0,          0.0 !   !END!
1037 ! X =       -27.530,      -65.142,      1585.0,          0.0 !   !END!
1038 ! X =       -26.073,      -65.147,      1645.0,          0.0 !   !END!
1039 ! X =       -24.616,      -65.152,      1583.0,          0.0 !   !END!
1040 ! X =       -45.007,      -63.214,      1948.0,          0.0 !   !END!
1041 ! X =       -43.550,      -63.222,      1937.0,          0.0 !   !END!
1042 ! X =       -42.093,      -63.229,      1889.0,          0.0 !   !END!
1043 ! X =       -40.636,      -63.237,      1831.0,          0.0 !   !END!
1044 ! X =       -39.179,      -63.244,      1932.0,          0.0 !   !END!
1045 ! X =       -37.722,      -63.251,      1959.0,          0.0 !   !END!
1046 ! X =       -36.265,      -63.258,      1828.0,          0.0 !   !END!
1047 ! X =       -34.808,      -63.265,      1708.0,          0.0 !   !END!
1048 ! X =       -33.351,      -63.271,      1867.0,          0.0 !   !END!
1049 ! X =       -31.895,      -63.277,      1895.0,          0.0 !   !END!
1050 ! X =       -30.438,      -63.282,      1791.0,          0.0 !   !END!
1051 ! X =       -28.981,      -63.288,      1646.0,          0.0 !   !END!
1052 ! X =       -27.524,      -63.293,      1576.0,          0.0 !   !END!
1053 ! X =       -26.067,      -63.298,      1582.0,          0.0 !   !END!
1054 ! X =       -24.610,      -63.303,      1533.0,          0.0 !   !END!
1055 ! X =       -44.996,      -61.364,      1971.0,          0.0 !   !END!
1056 ! X =       -43.540,      -61.373,      1948.0,          0.0 !   !END!
1057 ! X =       -42.083,      -61.380,      2194.0,          0.0 !   !END!
1058 ! X =       -40.627,      -61.388,      2106.0,          0.0 !   !END!
1059 ! X =       -39.170,      -61.395,      2043.0,          0.0 !   !END!
1060 ! X =       -37.713,      -61.402,      1889.0,          0.0 !   !END!
1061 ! X =       -36.257,      -61.409,      2011.0,          0.0 !   !END!
1062 ! X =       -34.800,      -61.415,      1967.0,          0.0 !   !END!
1063 ! X =       -33.344,      -61.422,      1848.0,          0.0 !   !END!
1064 ! X =       -31.887,      -61.428,      1793.0,          0.0 !   !END!
1065 ! X =       -30.431,      -61.433,      1669.0,          0.0 !   !END!
1066 ! X =       -28.974,      -61.439,      1584.0,          0.0 !   !END!
1067 ! X =       -27.518,      -61.444,      1584.0,          0.0 !   !END!
1068 ! X =       -44.986,      -59.515,      2262.0,          0.0 !   !END!
1069 ! X =       -43.530,      -59.523,      2214.0,          0.0 !   !END!
1070 ! X =       -42.073,      -59.531,      2190.0,          0.0 !   !END!
1071 ! X =       -40.617,      -59.539,      2072.0,          0.0 !   !END!
1072 ! X =       -39.161,      -59.546,      2044.0,          0.0 !   !END!
1073 ! X =       -37.705,      -59.553,      2130.0,          0.0 !   !END!
1074 ! X =       -36.248,      -59.560,      2072.0,          0.0 !   !END!
1075 ! X =       -34.792,      -59.566,      1950.0,          0.0 !   !END!
1076 ! X =       -33.336,      -59.573,      1767.0,          0.0 !   !END!
1077 ! X =       -31.880,      -59.579,      1722.0,          0.0 !   !END!
1078 ! X =       -30.424,      -59.584,      1637.0,          0.0 !   !END!
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1079 ! X =       -28.967,      -59.590,      1646.0,          0.0 !   !END!
1080 ! X =       -44.975,      -57.666,      2241.0,          0.0 !   !END!
1081 ! X =       -43.519,      -57.674,      2194.0,          0.0 !   !END!
1082 ! X =       -42.064,      -57.682,      2194.0,          0.0 !   !END!
1083 ! X =       -40.608,      -57.690,      2148.0,          0.0 !   !END!
1084 ! X =       -39.152,      -57.697,      2172.0,          0.0 !   !END!
1085 ! X =       -37.696,      -57.704,      2045.0,          0.0 !   !END!
1086 ! X =       -36.240,      -57.711,      1917.0,          0.0 !   !END!
1087 ! X =       -34.784,      -57.717,      1787.0,          0.0 !   !END!
1088 ! X =       -33.328,      -57.723,      1767.0,          0.0 !   !END!
1089 ! X =       -31.872,      -57.729,      1695.0,          0.0 !   !END!
1090 ! X =       -30.417,      -57.735,      1651.0,          0.0 !   !END!
1091 ! X =       -28.961,      -57.741,      1661.0,          0.0 !   !END!
1092 ! X =       -44.965,      -55.817,      2205.0,          0.0 !   !END!
1093 ! X =       -43.509,      -55.825,      2185.0,          0.0 !   !END!
1094 ! X =       -42.054,      -55.833,      2133.0,          0.0 !   !END!
1095 ! X =       -40.598,      -55.841,      2106.0,          0.0 !   !END!
1096 ! X =       -39.143,      -55.848,      2012.0,          0.0 !   !END!
1097 ! X =       -37.687,      -55.855,      1950.0,          0.0 !   !END!
1098 ! X =       -36.232,      -55.862,      1889.0,          0.0 !   !END!
1099 ! X =       -34.776,      -55.868,      1821.0,          0.0 !   !END!
1100 ! X =       -33.321,      -55.874,      1706.0,          0.0 !   !END!
1101 ! X =       -31.865,      -55.880,      1692.0,          0.0 !   !END!
1102 ! X =       -30.409,      -55.886,      1850.0,          0.0 !   !END!
1103 ! X =       -28.954,      -55.891,      1757.0,          0.0 !   !END!
1104 ! X =       -47.865,      -53.951,      2342.0,          0.0 !   !END!
1105 ! X =       -46.410,      -53.960,      2255.0,          0.0 !   !END!
1106 ! X =       -44.954,      -53.968,      2187.0,          0.0 !   !END!
1107 ! X =       -43.499,      -53.976,      2099.0,          0.0 !   !END!
1108 ! X =       -42.044,      -53.984,      1983.0,          0.0 !   !END!
1109 ! X =       -40.589,      -53.992,      1889.0,          0.0 !   !END!
1110 ! X =       -39.134,      -53.999,      1958.0,          0.0 !   !END!
1111 ! X =       -37.678,      -54.006,      1892.0,          0.0 !   !END!
1112 ! X =       -36.223,      -54.013,      1828.0,          0.0 !   !END!
1113 ! X =       -34.768,      -54.019,      1755.0,          0.0 !   !END!
1114 ! X =       -33.313,      -54.025,      1706.0,          0.0 !   !END!
1115 ! X =       -31.858,      -54.031,      1773.0,          0.0 !   !END!
1116 ! X =       -30.402,      -54.037,      1767.0,          0.0 !   !END!
1117 ! X =       -47.854,      -52.102,      2316.0,          0.0 !   !END!
1118 ! X =       -46.399,      -52.111,      2255.0,          0.0 !   !END!
1119 ! X =       -44.944,      -52.119,      2194.0,          0.0 !   !END!
1120 ! X =       -43.489,      -52.127,      2133.0,          0.0 !   !END!
1121 ! X =       -42.034,      -52.135,      2068.0,          0.0 !   !END!
1122 ! X =       -40.579,      -52.142,      1990.0,          0.0 !   !END!
1123 ! X =       -39.125,      -52.150,      1972.0,          0.0 !   !END!
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1124 ! X =       -37.670,      -52.157,      1892.0,          0.0 !   !END!
1125 ! X =       -36.215,      -52.163,      1767.0,          0.0 !   !END!
1126 ! X =       -34.760,      -52.170,      1767.0,          0.0 !   !END!
1127 ! X =       -33.305,      -52.176,      1758.0,          0.0 !   !END!
1128 ! X =       -31.850,      -52.182,      1848.0,          0.0 !   !END!
1129 ! X =       -50.752,      -50.235,      2533.0,          0.0 !   !END!
1130 ! X =       -49.297,      -50.244,      2441.0,          0.0 !   !END!
1131 ! X =       -47.843,      -50.253,      2194.0,          0.0 !   !END!
1132 ! X =       -46.388,      -50.262,      2194.0,          0.0 !   !END!
1133 ! X =       -44.934,      -50.270,      2194.0,          0.0 !   !END!
1134 ! X =       -43.479,      -50.278,      2072.0,          0.0 !   !END!
1135 ! X =       -42.025,      -50.286,      1967.0,          0.0 !   !END!
1136 ! X =       -40.570,      -50.293,      1876.0,          0.0 !   !END!
1137 ! X =       -39.115,      -50.301,      1828.0,          0.0 !   !END!
1138 ! X =       -37.661,      -50.308,      1792.0,          0.0 !   !END!
1139 ! X =       -36.206,      -50.314,      1889.0,          0.0 !   !END!
1140 ! X =       -34.752,      -50.321,      1868.0,          0.0 !   !END!
1141 ! X =       -33.297,      -50.327,      1879.0,          0.0 !   !END!
1142 ! X =       -31.843,      -50.333,      1804.0,          0.0 !   !END!
1143 ! X =       -30.388,      -50.339,      1767.0,          0.0 !   !END!
1144 ! X =       -49.286,      -48.395,      2503.0,          0.0 !   !END!
1145 ! X =       -47.832,      -48.404,      2304.0,          0.0 !   !END!
1146 ! X =       -46.377,      -48.413,      2133.0,          0.0 !   !END!
1147 ! X =       -44.923,      -48.421,      2026.0,          0.0 !   !END!
1148 ! X =       -43.469,      -48.429,      1950.0,          0.0 !   !END!
1149 ! X =       -42.015,      -48.437,      1858.0,          0.0 !   !END!
1150 ! X =       -40.561,      -48.444,      1862.0,          0.0 !   !END!
1151 ! X =       -39.106,      -48.452,      1944.0,          0.0 !   !END!
1152 ! X =       -37.652,      -48.459,      1889.0,          0.0 !   !END!
1153 ! X =       -36.198,      -48.465,      1890.0,          0.0 !   !END!
1154 ! X =       -34.744,      -48.472,      1835.0,          0.0 !   !END!
1155 ! X =       -33.290,      -48.478,      1950.0,          0.0 !   !END!
1156 ! X =       -31.835,      -48.484,      1702.0,          0.0 !   !END!
1157 ! X =       -30.381,      -48.490,      1665.0,          0.0 !   !END!
1158 ! X =       -46.367,      -46.563,      2088.0,          0.0 !   !END!
1159 ! X =       -44.913,      -46.572,      1949.0,          0.0 !   !END!
1160 ! X =       -43.459,      -46.580,      1938.0,          0.0 !   !END!
1161 ! X =       -42.005,      -46.588,      1951.0,          0.0 !   !END!
1162 ! X =       -40.551,      -46.595,      1950.0,          0.0 !   !END!
1163 ! X =       -39.097,      -46.602,      1881.0,          0.0 !   !END!
1164 ! X =       -37.643,      -46.609,      1889.0,          0.0 !   !END!
1165 ! X =       -36.190,      -46.616,      1895.0,          0.0 !   !END!
1166 ! X =       -34.736,      -46.623,      1826.0,          0.0 !   !END!
1167 ! X =       -33.282,      -46.629,      1855.0,          0.0 !   !END!
1168 ! X =       -31.828,      -46.635,      1851.0,          0.0 !   !END!
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1169 ! X =       -47.809,      -44.706,      2236.0,          0.0 !   !END!
1170 ! X =       -46.356,      -44.714,      2047.0,          0.0 !   !END!
1171 ! X =       -44.902,      -44.723,      2020.0,          0.0 !   !END!
1172 ! X =       -43.449,      -44.731,      2011.0,          0.0 !   !END!
1173 ! X =       -41.995,      -44.739,      1958.0,          0.0 !   !END!
1174 ! X =       -40.542,      -44.746,      1951.0,          0.0 !   !END!
1175 ! X =       -39.088,      -44.753,      1950.0,          0.0 !   !END!
1176 ! X =       -37.635,      -44.760,      1949.0,          0.0 !   !END!
1177 ! X =       -36.181,      -44.767,      1987.0,          0.0 !   !END!
1178 ! X =       -47.798,      -42.857,      2216.0,          0.0 !   !END!
1179 ! X =       -46.345,      -42.865,      2012.0,          0.0 !   !END!
1180 ! X =       -44.892,      -42.874,      1935.0,          0.0 !   !END!
1181 ! X =       -43.439,      -42.882,      1952.0,          0.0 !   !END!
1182 ! X =       -41.986,      -42.889,      1950.0,          0.0 !   !END!
1183 ! X =       -40.532,      -42.897,      1828.0,          0.0 !   !END!
1184 ! X =       -39.079,      -42.904,      1838.0,          0.0 !   !END!
1185 ! X =       -37.626,      -42.911,      1767.0,          0.0 !   !END!
1186 ! X =       -36.173,      -42.918,      1764.0,          0.0 !   !END!
1187 ! X =       -47.787,      -41.008,      2211.0,          0.0 !   !END!
1188 ! X =       -46.334,      -41.016,      2062.0,          0.0 !   !END!
1189 ! X =       -44.881,      -41.024,      1949.0,          0.0 !   !END!
1190 ! X =       -43.429,      -41.033,      1886.0,          0.0 !   !END!
1191 ! X =       -41.976,      -41.040,      1889.0,          0.0 !   !END!
1192 ! X =       -40.523,      -41.048,      1852.0,          0.0 !   !END!
1193 ! X =       -39.070,      -41.055,      1889.0,          0.0 !   !END!
1194 ! X =       -37.617,      -41.062,      1816.0,          0.0 !   !END!
1195 ! X =       -36.164,      -41.069,      1767.0,          0.0 !   !END!
1196 ! X =       -43.419,      -39.183,      1951.0,          0.0 !   !END!
1197 ! X =       -41.966,      -39.191,      1950.0,          0.0 !   !END!
1198 ! X =      -189.333,     -190.576,      1294.0,          0.0 !   !END!
1199 ! X =      -187.853,     -190.611,      1317.0,          0.0 !   !END!
1200 ! X =      -186.373,     -190.645,      1529.0,          0.0 !   !END!
1201 ! X =      -184.893,     -190.679,      1798.0,          0.0 !   !END!
1202 ! X =      -183.413,     -190.712,      1767.0,          0.0 !   !END!
1203 ! X =      -189.290,     -188.727,      1265.0,          0.0 !   !END!
1204 ! X =      -187.810,     -188.762,      1247.0,          0.0 !   !END!
1205 ! X =      -186.331,     -188.796,      1446.0,          0.0 !   !END!
1206 ! X =      -184.851,     -188.830,      1739.0,          0.0 !   !END!
1207 ! X =      -183.371,     -188.863,      1556.0,          0.0 !   !END!
1208 ! X =      -181.891,     -188.897,      1756.0,          0.0 !   !END!
1209 ! X =      -180.411,     -188.930,      1767.0,          0.0 !   !END!
1210 ! X =      -199.603,     -186.630,      1227.0,          0.0 !   !END!
1211 ! X =      -198.124,     -186.666,      1234.0,          0.0 !   !END!
1212 ! X =      -196.644,     -186.702,      1226.0,          0.0 !   !END!
1213 ! X =      -195.165,     -186.738,      1280.0,          0.0 !   !END!
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1214 ! X =      -193.685,     -186.773,      1332.0,          0.0 !   !END!
1215 ! X =      -190.727,     -186.844,      1391.0,          0.0 !   !END!
1216 ! X =      -189.247,     -186.878,      1803.0,          0.0 !   !END!
1217 ! X =      -187.768,     -186.913,      1494.0,          0.0 !   !END!
1218 ! X =      -186.288,     -186.947,      1748.0,          0.0 !   !END!
1219 ! X =      -184.809,     -186.981,      1459.0,          0.0 !   !END!
1220 ! X =      -183.329,     -187.014,      1280.0,          0.0 !   !END!
1221 ! X =      -181.850,     -187.048,      1530.0,          0.0 !   !END!
1222 ! X =      -180.370,     -187.081,      1363.0,          0.0 !   !END!
1223 ! X =      -199.558,     -184.781,      1319.0,          0.0 !   !END!
1224 ! X =      -198.079,     -184.817,      1203.0,          0.0 !   !END!
1225 ! X =      -196.599,     -184.853,      1331.0,          0.0 !   !END!
1226 ! X =      -195.120,     -184.889,      1721.0,          0.0 !   !END!
1227 ! X =      -193.641,     -184.924,      1755.0,          0.0 !   !END!
1228 ! X =      -190.683,     -184.995,      1218.0,          0.0 !   !END!
1229 ! X =      -189.204,     -185.029,      1384.0,          0.0 !   !END!
1230 ! X =      -187.725,     -185.064,      1768.0,          0.0 !   !END!
1231 ! X =      -186.246,     -185.098,      1827.0,          0.0 !   !END!
1232 ! X =      -184.766,     -185.132,      1650.0,          0.0 !   !END!
1233 ! X =      -183.287,     -185.165,      1770.0,          0.0 !   !END!
1234 ! X =      -181.808,     -185.199,      1742.0,          0.0 !   !END!
1235 ! X =      -180.329,     -185.232,      1647.0,          0.0 !   !END!
1236 ! X =      -200.991,     -182.895,      1432.0,          0.0 !   !END!
1237 ! X =      -199.512,     -182.932,      1341.0,          0.0 !   !END!
1238 ! X =      -198.033,     -182.968,      1357.0,          0.0 !   !END!
1239 ! X =      -196.555,     -183.004,      1307.0,          0.0 !   !END!
1240 ! X =      -195.076,     -183.040,      1358.0,          0.0 !   !END!
1241 ! X =      -193.597,     -183.075,      2174.0,          0.0 !   !END!
1242 ! X =      -192.118,     -183.111,      1395.0,          0.0 !   !END!
1243 ! X =      -190.639,     -183.146,      1280.0,          0.0 !   !END!
1244 ! X =      -189.161,     -183.180,      1275.0,          0.0 !   !END!
1245 ! X =      -187.682,     -183.215,      1463.0,          0.0 !   !END!
1246 ! X =      -186.203,     -183.249,      1583.0,          0.0 !   !END!
1247 ! X =      -184.724,     -183.283,      1670.0,          0.0 !   !END!
1248 ! X =      -183.245,     -183.316,      1826.0,          0.0 !   !END!
1249 ! X =      -181.767,     -183.350,      2050.0,          0.0 !   !END!
1250 ! X =      -180.288,     -183.383,      1828.0,          0.0 !   !END!
1251 ! X =      -200.945,     -181.046,      1395.0,          0.0 !   !END!
1252 ! X =      -199.467,     -181.083,      1345.0,          0.0 !   !END!
1253 ! X =      -197.988,     -181.119,      1385.0,          0.0 !   !END!
1254 ! X =      -196.510,     -181.155,      1341.0,          0.0 !   !END!
1255 ! X =      -195.031,     -181.191,      1417.0,          0.0 !   !END!
1256 ! X =      -193.553,     -181.227,      1980.0,          0.0 !   !END!
1257 ! X =      -192.074,     -181.262,      2035.0,          0.0 !   !END!
1258 ! X =      -190.596,     -181.297,      2133.0,          0.0 !   !END!
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1259 ! X =      -189.117,     -181.331,      1447.0,          0.0 !   !END!
1260 ! X =      -187.639,     -181.366,      1742.0,          0.0 !   !END!
1261 ! X =      -186.161,     -181.400,      1800.0,          0.0 !   !END!
1262 ! X =      -184.682,     -181.434,      1897.0,          0.0 !   !END!
1263 ! X =      -183.204,     -181.467,      1816.0,          0.0 !   !END!
1264 ! X =      -181.725,     -181.501,      1812.0,          0.0 !   !END!
1265 ! X =      -180.247,     -181.534,      1764.0,          0.0 !   !END!
1266 ! X =      -200.899,     -179.198,      1584.0,          0.0 !   !END!
1267 ! X =      -199.421,     -179.234,      1676.0,          0.0 !   !END!
1268 ! X =      -197.943,     -179.270,      1777.0,          0.0 !   !END!
1269 ! X =      -196.465,     -179.306,      1464.0,          0.0 !   !END!
1270 ! X =      -194.987,     -179.342,      1540.0,          0.0 !   !END!
1271 ! X =      -193.509,     -179.378,      1536.0,          0.0 !   !END!
1272 ! X =      -192.031,     -179.413,      1949.0,          0.0 !   !END!
1273 ! X =      -190.552,     -179.448,      2013.0,          0.0 !   !END!
1274 ! X =      -189.074,     -179.482,      1875.0,          0.0 !   !END!
1275 ! X =      -187.596,     -179.517,      1344.0,          0.0 !   !END!
1276 ! X =      -186.118,     -179.551,      1829.0,          0.0 !   !END!
1277 ! X =      -184.640,     -179.585,      2072.0,          0.0 !   !END!
1278 ! X =      -183.162,     -179.618,      1952.0,          0.0 !   !END!
1279 ! X =      -181.684,     -179.652,      2000.0,          0.0 !   !END!
1280 ! X =      -180.205,     -179.685,      1873.0,          0.0 !   !END!
1281 ! X =      -200.853,     -177.349,      1280.0,          0.0 !   !END!
1282 ! X =      -199.375,     -177.385,      1471.0,          0.0 !   !END!
1283 ! X =      -197.898,     -177.422,      1462.0,          0.0 !   !END!
1284 ! X =      -196.420,     -177.458,      1889.0,          0.0 !   !END!
1285 ! X =      -194.942,     -177.493,      1755.0,          0.0 !   !END!
1286 ! X =      -193.464,     -177.529,      2115.0,          0.0 !   !END!
1287 ! X =      -191.987,     -177.564,      2113.0,          0.0 !   !END!
1288 ! X =      -190.509,     -177.599,      1945.0,          0.0 !   !END!
1289 ! X =      -189.031,     -177.634,      1844.0,          0.0 !   !END!
1290 ! X =      -187.553,     -177.668,      1729.0,          0.0 !   !END!
1291 ! X =      -186.076,     -177.702,      1869.0,          0.0 !   !END!
1292 ! X =      -184.598,     -177.736,      1908.0,          0.0 !   !END!
1293 ! X =      -183.120,     -177.769,      1976.0,          0.0 !   !END!
1294 ! X =      -181.642,     -177.803,      1998.0,          0.0 !   !END!
1295 ! X =      -200.807,     -175.500,      1424.0,          0.0 !   !END!
1296 ! X =      -199.330,     -175.536,      1538.0,          0.0 !   !END!
1297 ! X =      -197.852,     -175.573,      1375.0,          0.0 !   !END!
1298 ! X =      -196.375,     -175.609,      1510.0,          0.0 !   !END!
1299 ! X =      -194.898,     -175.644,      1459.0,          0.0 !   !END!
1300 ! X =      -193.420,     -175.680,      1592.0,          0.0 !   !END!
1301 ! X =      -191.943,     -175.715,      2114.0,          0.0 !   !END!
1302 ! X =      -190.465,     -175.750,      1859.0,          0.0 !   !END!
1303 ! X =      -188.988,     -175.785,      2074.0,          0.0 !   !END!
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1304 ! X =      -187.510,     -175.819,      1815.0,          0.0 !   !END!
1305 ! X =      -186.033,     -175.853,      1815.0,          0.0 !   !END!
1306 ! X =      -184.556,     -175.887,      1707.0,          0.0 !   !END!
1307 ! X =      -183.078,     -175.921,      2011.0,          0.0 !   !END!
1308 ! X =      -200.761,     -173.651,      1718.0,          0.0 !   !END!
1309 ! X =      -199.284,     -173.688,      1817.0,          0.0 !   !END!
1310 ! X =      -197.807,     -173.724,      1524.0,          0.0 !   !END!
1311 ! X =      -196.330,     -173.760,      2016.0,          0.0 !   !END!
1312 ! X =      -194.853,     -173.796,      1767.0,          0.0 !   !END!
1313 ! X =      -193.376,     -173.831,      1987.0,          0.0 !   !END!
1314 ! X =      -191.899,     -173.866,      1912.0,          0.0 !   !END!
1315 ! X =      -190.422,     -173.901,      2194.0,          0.0 !   !END!
1316 ! X =      -188.945,     -173.936,      2074.0,          0.0 !   !END!
1317 ! X =      -187.468,     -173.970,      1785.0,          0.0 !   !END!
1318 ! X =      -185.990,     -174.004,      1797.0,          0.0 !   !END!
1319 ! X =      -184.513,     -174.038,      2010.0,          0.0 !   !END!
1320 ! X =      -183.036,     -174.072,      1954.0,          0.0 !   !END!
1321 ! X =      -200.715,     -171.802,      1828.0,          0.0 !   !END!
1322 ! X =      -199.239,     -171.839,      1767.0,          0.0 !   !END!
1323 ! X =      -197.762,     -171.875,      1877.0,          0.0 !   !END!
1324 ! X =      -196.285,     -171.911,      1991.0,          0.0 !   !END!
1325 ! X =      -194.809,     -171.947,      1828.0,          0.0 !   !END!
1326 ! X =      -193.332,     -171.982,      2164.0,          0.0 !   !END!
1327 ! X =      -191.855,     -172.017,      1855.0,          0.0 !   !END!
1328 ! X =      -190.378,     -172.052,      2181.0,          0.0 !   !END!
1329 ! X =      -188.902,     -172.087,      1848.0,          0.0 !   !END!
1330 ! X =      -187.425,     -172.121,      1579.0,          0.0 !   !END!
1331 ! X =      -185.948,     -172.155,      1568.0,          0.0 !   !END!
1332 ! X =      -184.471,     -172.189,      1524.0,          0.0 !   !END!
1333 ! X =      -182.994,     -172.223,      1585.0,          0.0 !   !END!
1334 ! X =      -200.670,     -169.953,      1957.0,          0.0 !   !END!
1335 ! X =      -199.193,     -169.990,      1883.0,          0.0 !   !END!
1336 ! X =      -197.717,     -170.026,      2064.0,          0.0 !   !END!
1337 ! X =      -196.240,     -170.062,      2078.0,          0.0 !   !END!
1338 ! X =      -194.764,     -170.098,      1970.0,          0.0 !   !END!
1339 ! X =      -193.288,     -170.133,      1815.0,          0.0 !   !END!
1340 ! X =      -191.811,     -170.168,      2185.0,          0.0 !   !END!
1341 ! X =      -190.335,     -170.203,      2138.0,          0.0 !   !END!
1342 ! X =      -188.858,     -170.238,      2028.0,          0.0 !   !END!
1343 ! X =      -187.382,     -170.272,      1463.0,          0.0 !   !END!
1344 ! X =      -185.905,     -170.306,      1925.0,          0.0 !   !END!
1345 ! X =      -184.429,     -170.340,      1951.0,          0.0 !   !END!
1346 ! X =      -182.953,     -170.374,      1950.0,          0.0 !   !END!
1347 ! X =      -200.624,     -168.105,      2121.0,          0.0 !   !END!
1348 ! X =      -199.148,     -168.141,      1998.0,          0.0 !   !END!
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1349 ! X =      -197.672,     -168.177,      2162.0,          0.0 !   !END!
1350 ! X =      -196.196,     -168.213,      2154.0,          0.0 !   !END!
1351 ! X =      -194.719,     -168.249,      2314.0,          0.0 !   !END!
1352 ! X =      -193.243,     -168.284,      2012.0,          0.0 !   !END!
1353 ! X =      -191.767,     -168.320,      2197.0,          0.0 !   !END!
1354 ! X =      -190.291,     -168.354,      2137.0,          0.0 !   !END!
1355 ! X =      -188.815,     -168.389,      1855.0,          0.0 !   !END!
1356 ! X =      -187.339,     -168.423,      1854.0,          0.0 !   !END!
1357 ! X =      -185.863,     -168.457,      1823.0,          0.0 !   !END!
1358 ! X =      -184.387,     -168.491,      1976.0,          0.0 !   !END!
1359 ! X =      -182.911,     -168.525,      1960.0,          0.0 !   !END!
1360 ! X =      -202.054,     -166.219,      1950.0,          0.0 !   !END!
1361 ! X =      -200.578,     -166.256,      2101.0,          0.0 !   !END!
1362 ! X =      -199.102,     -166.292,      2221.0,          0.0 !   !END!
1363 ! X =      -197.626,     -166.328,      2314.0,          0.0 !   !END!
1364 ! X =      -196.151,     -166.364,      2377.0,          0.0 !   !END!
1365 ! X =      -194.675,     -166.400,      2232.0,          0.0 !   !END!
1366 ! X =      -193.199,     -166.436,      2196.0,          0.0 !   !END!
1367 ! X =      -191.723,     -166.471,      2119.0,          0.0 !   !END!
1368 ! X =      -190.248,     -166.506,      1789.0,          0.0 !   !END!
1369 ! X =      -188.772,     -166.540,      2073.0,          0.0 !   !END!
1370 ! X =      -187.296,     -166.574,      1833.0,          0.0 !   !END!
1371 ! X =      -185.820,     -166.609,      1647.0,          0.0 !   !END!
1372 ! X =      -184.345,     -166.642,      1940.0,          0.0 !   !END!
1373 ! X =      -182.869,     -166.676,      1877.0,          0.0 !   !END!
1374 ! X =      -207.909,     -164.220,      1464.0,          0.0 !   !END!
1375 ! X =      -206.433,     -164.258,      1589.0,          0.0 !   !END!
1376 ! X =      -204.958,     -164.296,      1827.0,          0.0 !   !END!
1377 ! X =      -203.483,     -164.333,      1951.0,          0.0 !   !END!
1378 ! X =      -202.007,     -164.370,      1816.0,          0.0 !   !END!
1379 ! X =      -200.532,     -164.407,      2130.0,          0.0 !   !END!
1380 ! X =      -196.106,     -164.516,      2417.0,          0.0 !   !END!
1381 ! X =      -194.630,     -164.551,      2313.0,          0.0 !   !END!
1382 ! X =      -193.155,     -164.587,      2263.0,          0.0 !   !END!
1383 ! X =      -191.680,     -164.622,      2159.0,          0.0 !   !END!
1384 ! X =      -209.336,     -162.334,      1827.0,          0.0 !   !END!
1385 ! X =      -207.861,     -162.372,      1534.0,          0.0 !   !END!
1386 ! X =      -206.386,     -162.410,      1812.0,          0.0 !   !END!
1387 ! X =      -204.911,     -162.447,      1999.0,          0.0 !   !END!
1388 ! X =      -203.436,     -162.484,      1812.0,          0.0 !   !END!
1389 ! X =      -201.961,     -162.521,      1916.0,          0.0 !   !END!
1390 ! X =      -200.486,     -162.558,      2436.0,          0.0 !   !END!
1391 ! X =      -191.636,     -162.773,      1895.0,          0.0 !   !END!
1392 ! X =      -209.288,     -160.485,      1825.0,          0.0 !   !END!
1393 ! X =      -207.814,     -160.523,      1704.0,          0.0 !   !END!
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1394 ! X =      -206.339,     -160.561,      1650.0,          0.0 !   !END!
1395 ! X =      -204.864,     -160.598,      1601.0,          0.0 !   !END!
1396 ! X =      -203.389,     -160.636,      1898.0,          0.0 !   !END!
1397 ! X =      -201.915,     -160.673,      2118.0,          0.0 !   !END!
1398 ! X =      -200.440,     -160.709,      2267.0,          0.0 !   !END!
1399 ! X =      -209.240,     -158.636,      1883.0,          0.0 !   !END!
1400 ! X =      -207.766,     -158.674,      1708.0,          0.0 !   !END!
1401 ! X =      -206.292,     -158.712,      2107.0,          0.0 !   !END!
1402 ! X =      -204.817,     -158.750,      1960.0,          0.0 !   !END!
1403 ! X =      -203.343,     -158.787,      1945.0,          0.0 !   !END!
1404 ! X =      -201.869,     -158.824,      1811.0,          0.0 !   !END!
1405 ! X =      -200.394,     -158.861,      1882.0,          0.0 !   !END!
1406 ! X =      -209.192,     -156.787,      2017.0,          0.0 !   !END!
1407 ! X =      -207.718,     -156.826,      1798.0,          0.0 !   !END!
1408 ! X =      -206.244,     -156.863,      1921.0,          0.0 !   !END!
1409 ! X =      -204.770,     -156.901,      2119.0,          0.0 !   !END!
1410 ! X =      -210.618,     -154.900,      1568.0,          0.0 !   !END!
1411 ! X =      -209.144,     -154.939,      1674.0,          0.0 !   !END!
1412 ! X =      -207.671,     -154.977,      1743.0,          0.0 !   !END!
1413 ! X =      -206.197,     -155.015,      2133.0,          0.0 !   !END!
1414 ! X =      -204.723,     -155.052,      2133.0,          0.0 !   !END!
1415 ! X =      -209.096,     -153.090,      1798.0,          0.0 !   !END!
1416 ! X =      -207.623,     -153.128,      1972.0,          0.0 !   !END!
1417 ! X =      -206.150,     -153.166,      2254.0,          0.0 !   !END!
1418 ! X =      -204.677,     -153.203,      2527.0,          0.0 !   !END!
1419 ! X =      -207.576,     -151.279,      1880.0,          0.0 !   !END!
1420 ! X =      -206.103,     -151.317,      1828.0,          0.0 !   !END!
1421 ! X =      -204.630,     -151.355,      2245.0,          0.0 !   !END!
1422 ! X =       277.505,      -34.415,      2133.0,          0.0 !   !END!
1423 ! X =       278.231,      -34.389,      2214.0,          0.0 !   !END!
1424 ! X =       278.957,      -34.364,      2428.0,          0.0 !   !END!
1425 ! X =       279.683,      -34.338,      2435.0,          0.0 !   !END!
1426 ! X =       275.296,      -33.566,      2197.0,          0.0 !   !END!
1427 ! X =       276.022,      -33.541,      2011.0,          0.0 !   !END!
1428 ! X =       276.747,      -33.516,      2011.0,          0.0 !   !END!
1429 ! X =       277.473,      -33.491,      2242.0,          0.0 !   !END!
1430 ! X =       278.199,      -33.465,      2384.0,          0.0 !   !END!
1431 ! X =       278.925,      -33.440,      2424.0,          0.0 !   !END!
1432 ! X =       279.650,      -33.414,      2513.0,          0.0 !   !END!
1433 ! X =       275.264,      -32.642,      1950.0,          0.0 !   !END!
1434 ! X =       275.990,      -32.617,      2471.0,          0.0 !   !END!
1435 ! X =       276.715,      -32.592,      2499.0,          0.0 !   !END!
1436 ! X =       277.441,      -32.567,      2511.0,          0.0 !   !END!
1437 ! X =       278.167,      -32.541,      2503.0,          0.0 !   !END!
1438 ! X =       278.892,      -32.516,      2574.0,          0.0 !   !END!
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1439 ! X =       275.232,      -31.718,      1950.0,          0.0 !   !END!
1440 ! X =       275.958,      -31.693,      2464.0,          0.0 !   !END!
1441 ! X =       273.749,      -30.844,      1950.0,          0.0 !   !END!
1442 ! X =       274.474,      -30.819,      2202.0,          0.0 !   !END!
1443 ! X =       275.200,      -30.794,      2399.0,          0.0 !   !END!
1444 ! X =       265.012,      -30.216,      2194.0,          0.0 !   !END!
1445 ! X =       266.463,      -30.167,      2350.0,          0.0 !   !END!
1446 ! X =       267.188,      -30.143,      2248.0,          0.0 !   !END!
1447 ! X =       267.914,      -30.118,      2091.0,          0.0 !   !END!
1448 ! X =       268.639,      -30.094,      2015.0,          0.0 !   !END!
1449 ! X =       269.365,      -30.069,      1994.0,          0.0 !   !END!
1450 ! X =       270.090,      -30.045,      2071.0,          0.0 !   !END!
1451 ! X =       273.717,      -29.920,      2098.0,          0.0 !   !END!
1452 ! X =       264.256,      -29.316,      2243.0,          0.0 !   !END!
1453 ! X =       264.981,      -29.292,      2056.0,          0.0 !   !END!
1454 ! X =       265.707,      -29.267,      2214.0,          0.0 !   !END!
1455 ! X =       266.432,      -29.243,      2341.0,          0.0 !   !END!
1456 ! X =       267.157,      -29.219,      2090.0,          0.0 !   !END!
1457 ! X =       267.883,      -29.194,      1784.0,          0.0 !   !END!
1458 ! X =       268.608,      -29.170,      2011.0,          0.0 !   !END!
1459 ! X =       269.333,      -29.145,      2015.0,          0.0 !   !END!
1460 ! X =       270.059,      -29.120,      2165.0,          0.0 !   !END!
1461 ! X =       270.784,      -29.096,      1841.0,          0.0 !   !END!
1462 ! X =       271.509,      -29.071,      2217.0,          0.0 !   !END!
1463 ! X =       272.235,      -29.046,      2084.0,          0.0 !   !END!
1464 ! X =       272.960,      -29.021,      2133.0,          0.0 !   !END!
1465 ! X =       262.775,      -28.440,      2180.0,          0.0 !   !END!
1466 ! X =       263.500,      -28.416,      2201.0,          0.0 !   !END!
1467 ! X =       264.225,      -28.392,      2316.0,          0.0 !   !END!
1468 ! X =       264.950,      -28.367,      2067.0,          0.0 !   !END!
1469 ! X =       265.676,      -28.343,      1972.0,          0.0 !   !END!
1470 ! X =       266.401,      -28.319,      1793.0,          0.0 !   !END!
1471 ! X =       267.126,      -28.295,      1783.0,          0.0 !   !END!
1472 ! X =       267.851,      -28.270,      2011.0,          0.0 !   !END!
1473 ! X =       268.577,      -28.246,      2121.0,          0.0 !   !END!
1474 ! X =       269.302,      -28.221,      2438.0,          0.0 !   !END!
1475 ! X =       270.027,      -28.196,      2419.0,          0.0 !   !END!
1476 ! X =       270.752,      -28.172,      2368.0,          0.0 !   !END!
1477 ! X =       271.478,      -28.147,      2261.0,          0.0 !   !END!
1478 ! X =       272.203,      -28.122,      2278.0,          0.0 !   !END!
1479 ! X =       262.019,      -27.540,      2017.0,          0.0 !   !END!
1480 ! X =       262.744,      -27.516,      2072.0,          0.0 !   !END!
1481 ! X =       263.469,      -27.492,      2157.0,          0.0 !   !END!
1482 ! X =       264.194,      -27.468,      2063.0,          0.0 !   !END!
1483 ! X =       264.920,      -27.443,      1766.0,          0.0 !   !END!
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1484 ! X =       265.645,      -27.419,      1892.0,          0.0 !   !END!
1485 ! X =       266.370,      -27.395,      2093.0,          0.0 !   !END!
1486 ! X =       267.095,      -27.371,      2209.0,          0.0 !   !END!
1487 ! X =       267.820,      -27.346,      2316.0,          0.0 !   !END!
1488 ! X =       261.988,      -26.616,      1951.0,          0.0 !   !END!
1489 ! X =       262.713,      -26.592,      2063.0,          0.0 !   !END!
1490 ! X =       263.439,      -26.568,      2087.0,          0.0 !   !END!
1491 ! X =       264.164,      -26.544,      1744.0,          0.0 !   !END!
1492 ! X =       264.889,      -26.519,      2070.0,          0.0 !   !END!
1493 ! X =       265.614,      -26.495,      2316.0,          0.0 !   !END!
1494 ! X =       266.339,      -26.471,      2237.0,          0.0 !   !END!
1495 ! X =       261.958,      -25.692,      1900.0,          0.0 !   !END!
1496 ! X =       262.683,      -25.668,      1938.0,          0.0 !   !END!
1497 ! X =       263.408,      -25.644,      1840.0,          0.0 !   !END!
1498 ! X =       264.133,      -25.619,      1829.0,          0.0 !   !END!
1499 ! X =       264.858,      -25.595,      2309.0,          0.0 !   !END!
1500 ! X =       265.583,      -25.571,      2393.0,          0.0 !   !END!
1501 ! X =       266.308,      -25.547,      2342.0,          0.0 !   !END!
1502 ! X =       261.927,      -24.767,      1706.0,          0.0 !   !END!
1503 ! X =       262.652,      -24.743,      1859.0,          0.0 !   !END!
1504 ! X =       263.377,      -24.719,      2096.0,          0.0 !   !END!
1505 ! X =       264.102,      -24.695,      2201.0,          0.0 !   !END!
1506 ! X =       264.827,      -24.671,      2287.0,          0.0 !   !END!
1507 ! X =       265.552,      -24.647,      2480.0,          0.0 !   !END!
1508 ! X =       261.897,      -23.843,      1819.0,          0.0 !   !END!
1509 ! X =       262.622,      -23.819,      1990.0,          0.0 !   !END!
1510 ! X =       263.347,      -23.795,      2194.0,          0.0 !   !END!
1511 ! X =       264.071,      -23.771,      2368.0,          0.0 !   !END!
1512 ! X =       264.796,      -23.747,      2424.0,          0.0 !   !END!
1513 ! X =       261.866,      -22.919,      1975.0,          0.0 !   !END!
1514 ! X =       262.591,      -22.895,      2086.0,          0.0 !   !END!
1515 ! X =       263.316,      -22.871,      2301.0,          0.0 !   !END!
1516 ! X =       204.381,     -188.310,      2072.0,          0.0 !   !END!
1517 ! X =       205.121,     -188.290,      1950.0,          0.0 !   !END!
1518 ! X =       205.861,     -188.270,      2047.0,          0.0 !   !END!
1519 ! X =       206.600,     -188.260,      1954.0,          0.0 !   !END!
1520 ! X =       207.340,     -188.240,      1972.0,          0.0 !   !END!
1521 ! X =       208.080,     -188.220,      1927.0,          0.0 !   !END!
1522 ! X =       208.820,     -188.200,      2050.0,          0.0 !   !END!
1523 ! X =       209.560,     -188.180,      2018.0,          0.0 !   !END!
1524 ! X =       210.300,     -188.160,      2011.0,          0.0 !   !END!
1525 ! X =       211.040,     -188.140,      1828.0,          0.0 !   !END!
1526 ! X =       211.779,     -188.120,      2028.0,          0.0 !   !END!
1527 ! X =       212.519,     -188.100,      2069.0,          0.0 !   !END!
1528 ! X =       204.358,     -187.390,      1950.0,          0.0 !   !END!
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1529 ! X =       205.097,     -187.370,      2072.0,          0.0 !   !END!
1530 ! X =       205.837,     -187.350,      2011.0,          0.0 !   !END!
1531 ! X =       206.577,     -187.330,      1950.0,          0.0 !   !END!
1532 ! X =       207.317,     -187.310,      2026.0,          0.0 !   !END!
1533 ! X =       208.056,     -187.290,      1950.0,          0.0 !   !END!
1534 ! X =       208.796,     -187.270,      2072.0,          0.0 !   !END!
1535 ! X =       209.536,     -187.250,      2012.0,          0.0 !   !END!
1536 ! X =       210.276,     -187.240,      2064.0,          0.0 !   !END!
1537 ! X =       211.016,     -187.220,      1889.0,          0.0 !   !END!
1538 ! X =       211.755,     -187.200,      2071.0,          0.0 !   !END!
1539 ! X =       212.495,     -187.180,      2072.0,          0.0 !   !END!
1540 ! X =       204.334,     -186.460,      2031.0,          0.0 !   !END!
1541 ! X =       205.074,     -186.440,      2113.0,          0.0 !   !END!
1542 ! X =       205.814,     -186.430,      2072.0,          0.0 !   !END!
1543 ! X =       206.553,     -186.410,      2065.0,          0.0 !   !END!
1544 ! X =       207.293,     -186.390,      1895.0,          0.0 !   !END!
1545 ! X =       208.033,     -186.370,      2011.0,          0.0 !   !END!
1546 ! X =       208.772,     -186.350,      2071.0,          0.0 !   !END!
1547 ! X =       209.512,     -186.330,      2072.0,          0.0 !   !END!
1548 ! X =       210.252,     -186.310,      2072.0,          0.0 !   !END!
1549 ! X =       210.991,     -186.290,      2058.0,          0.0 !   !END!
1550 ! X =       211.731,     -186.270,      1950.0,          0.0 !   !END!
1551 ! X =       212.471,     -186.250,      2072.0,          0.0 !   !END!
1552 ! X =       204.311,     -185.540,      2133.0,          0.0 !   !END!
1553 ! X =       205.050,     -185.520,      2133.0,          0.0 !   !END!
1554 ! X =       205.790,     -185.500,      2011.0,          0.0 !   !END!
1555 ! X =       206.530,     -185.480,      2059.0,          0.0 !   !END!
1556 ! X =       207.269,     -185.460,      1950.0,          0.0 !   !END!
1557 ! X =       208.009,     -185.440,      2072.0,          0.0 !   !END!
1558 ! X =       208.749,     -185.430,      2102.0,          0.0 !   !END!
1559 ! X =       209.488,     -185.410,      2011.0,          0.0 !   !END!
1560 ! X =       210.228,     -185.390,      2040.0,          0.0 !   !END!
1561 ! X =       210.967,     -185.370,      2074.0,          0.0 !   !END!
1562 ! X =       211.707,     -185.350,      2072.0,          0.0 !   !END!
1563 ! X =       212.447,     -185.330,      2133.0,          0.0 !   !END!
1564 ! X =       204.288,     -184.610,      2147.0,          0.0 !   !END!
1565 ! X =       205.027,     -184.600,      2047.0,          0.0 !   !END!
1566 ! X =       205.767,     -184.580,      2113.0,          0.0 !   !END!
1567 ! X =       206.506,     -184.560,      2133.0,          0.0 !   !END!
1568 ! X =       207.246,     -184.540,      2011.0,          0.0 !   !END!
1569 ! X =       207.985,     -184.520,      2072.0,          0.0 !   !END!
1570 ! X =       208.725,     -184.500,      2133.0,          0.0 !   !END!
1571 ! X =       209.464,     -184.480,      2011.0,          0.0 !   !END!
1572 ! X =       210.204,     -184.460,      2133.0,          0.0 !   !END!
1573 ! X =       210.943,     -184.440,      2038.0,          0.0 !   !END!
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1574 ! X =       211.683,     -184.420,      2133.0,          0.0 !   !END!
1575 ! X =       212.422,     -184.400,      2134.0,          0.0 !   !END!
1576 ! X =       204.264,     -183.690,      2137.0,          0.0 !   !END!
1577 ! X =       205.004,     -183.670,      2194.0,          0.0 !   !END!
1578 ! X =       205.743,     -183.650,      2133.0,          0.0 !   !END!
1579 ! X =       206.483,     -183.630,      2028.0,          0.0 !   !END!
1580 ! X =       207.222,     -183.610,      2131.0,          0.0 !   !END!
1581 ! X =       207.961,     -183.600,      2133.0,          0.0 !   !END!
1582 ! X =       208.701,     -183.580,      2133.0,          0.0 !   !END!
1583 ! X =       209.440,     -183.560,      2133.0,          0.0 !   !END!
1584 ! X =       210.180,     -183.540,      2116.0,          0.0 !   !END!
1585 ! X =       210.919,     -183.520,      2123.0,          0.0 !   !END!
1586 ! X =       211.659,     -183.500,      2179.0,          0.0 !   !END!
1587 ! X =       212.398,     -183.480,      2133.0,          0.0 !   !END!
1588 ! X =       204.241,     -182.770,      2176.0,          0.0 !   !END!
1589 ! X =       204.980,     -182.750,      2194.0,          0.0 !   !END!
1590 ! X =       205.720,     -182.730,      2194.0,          0.0 !   !END!
1591 ! X =       206.459,     -182.710,      2069.0,          0.0 !   !END!
1592 ! X =       207.198,     -182.690,      2193.0,          0.0 !   !END!
1593 ! X =       207.938,     -182.670,      2193.0,          0.0 !   !END!
1594 ! X =       208.677,     -182.650,      2078.0,          0.0 !   !END!
1595 ! X =       209.416,     -182.630,      2194.0,          0.0 !   !END!
1596 ! X =       210.156,     -182.610,      2157.0,          0.0 !   !END!
1597 ! X =       210.895,     -182.590,      2161.0,          0.0 !   !END!
1598 ! X =       211.634,     -182.580,      2194.0,          0.0 !   !END!
1599 ! X =       212.374,     -182.560,      2175.0,          0.0 !   !END!
1600 ! X =       202.739,     -181.880,      2135.0,          0.0 !   !END!
1601 ! X =       203.478,     -181.860,      2255.0,          0.0 !   !END!
1602 ! X =       204.218,     -181.840,      2136.0,          0.0 !   !END!
1603 ! X =       204.957,     -181.820,      2199.0,          0.0 !   !END!
1604 ! X =       205.696,     -181.800,      2133.0,          0.0 !   !END!
1605 ! X =       206.435,     -181.780,      2143.0,          0.0 !   !END!
1606 ! X =       207.175,     -181.770,      2240.0,          0.0 !   !END!
1607 ! X =       207.914,     -181.750,      2156.0,          0.0 !   !END!
1608 ! X =       208.653,     -181.730,      2210.0,          0.0 !   !END!
1609 ! X =       209.393,     -181.710,      2194.0,          0.0 !   !END!
1610 ! X =       210.132,     -181.690,      2194.0,          0.0 !   !END!
1611 ! X =       210.871,     -181.670,      2222.0,          0.0 !   !END!
1612 ! X =       211.610,     -181.650,      2205.0,          0.0 !   !END!
1613 ! X =       212.350,     -181.630,      2254.0,          0.0 !   !END!
1614 ! X =       213.089,     -181.610,      2237.0,          0.0 !   !END!
1615 ! X =       213.828,     -181.590,      2238.0,          0.0 !   !END!
1616 ! X =       214.567,     -181.570,      2133.0,          0.0 !   !END!
1617 ! X =       215.307,     -181.550,      2254.0,          0.0 !   !END!
1618 ! X =       216.046,     -181.530,      2234.0,          0.0 !   !END!
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1619 ! X =       216.785,     -181.510,      2242.0,          0.0 !   !END!
1620 ! X =       217.524,     -181.490,      2194.0,          0.0 !   !END!
1621 ! X =       218.264,     -181.470,      2296.0,          0.0 !   !END!
1622 ! X =       219.003,     -181.450,      2255.0,          0.0 !   !END!
1623 ! X =       219.742,     -181.430,      2280.0,          0.0 !   !END!
1624 ! X =       220.481,     -181.410,      2255.0,          0.0 !   !END!
1625 ! X =       221.221,     -181.390,      1889.0,          0.0 !   !END!
1626 ! X =       202.716,     -180.950,      2187.0,          0.0 !   !END!
1627 ! X =       203.455,     -180.930,      2255.0,          0.0 !   !END!
1628 ! X =       204.194,     -180.920,      2255.0,          0.0 !   !END!
1629 ! X =       204.933,     -180.900,      2255.0,          0.0 !   !END!
1630 ! X =       205.673,     -180.880,      2259.0,          0.0 !   !END!
1631 ! X =       206.412,     -180.860,      2255.0,          0.0 !   !END!
1632 ! X =       207.151,     -180.840,      2257.0,          0.0 !   !END!
1633 ! X =       207.890,     -180.820,      2133.0,          0.0 !   !END!
1634 ! X =       208.629,     -180.800,      2255.0,          0.0 !   !END!
1635 ! X =       209.369,     -180.780,      2255.0,          0.0 !   !END!
1636 ! X =       210.108,     -180.760,      2242.0,          0.0 !   !END!
1637 ! X =       210.847,     -180.750,      2255.0,          0.0 !   !END!
1638 ! X =       211.586,     -180.730,      2219.0,          0.0 !   !END!
1639 ! X =       212.325,     -180.710,      2255.0,          0.0 !   !END!
1640 ! X =       213.065,     -180.690,      2255.0,          0.0 !   !END!
1641 ! X =       213.804,     -180.670,      2174.0,          0.0 !   !END!
1642 ! X =       214.543,     -180.650,      2255.0,          0.0 !   !END!
1643 ! X =       215.282,     -180.630,      2188.0,          0.0 !   !END!
1644 ! X =       216.021,     -180.610,      2211.0,          0.0 !   !END!
1645 ! X =       216.760,     -180.590,      2216.0,          0.0 !   !END!
1646 ! X =       217.500,     -180.570,      2316.0,          0.0 !   !END!
1647 ! X =       218.239,     -180.550,      2255.0,          0.0 !   !END!
1648 ! X =       218.978,     -180.530,      2315.0,          0.0 !   !END!
1649 ! X =       219.717,     -180.510,      2335.0,          0.0 !   !END!
1650 ! X =       220.456,     -180.490,      2017.0,          0.0 !   !END!
1651 ! X =       221.195,     -180.470,      1889.0,          0.0 !   !END!
1652 ! X =       202.693,     -180.030,      2313.0,          0.0 !   !END!
1653 ! X =       203.432,     -180.010,      2275.0,          0.0 !   !END!
1654 ! X =       204.171,     -179.990,      2316.0,          0.0 !   !END!
1655 ! X =       204.910,     -179.970,      2287.0,          0.0 !   !END!
1656 ! X =       205.649,     -179.950,      2310.0,          0.0 !   !END!
1657 ! X =       206.388,     -179.940,      2195.0,          0.0 !   !END!
1658 ! X =       207.127,     -179.920,      2316.0,          0.0 !   !END!
1659 ! X =       207.866,     -179.900,      2133.0,          0.0 !   !END!
1660 ! X =       208.606,     -179.880,      2315.0,          0.0 !   !END!
1661 ! X =       209.345,     -179.860,      2313.0,          0.0 !   !END!
1662 ! X =       210.084,     -179.840,      2255.0,          0.0 !   !END!
1663 ! X =       210.823,     -179.820,      2195.0,          0.0 !   !END!
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1664 ! X =       211.562,     -179.800,      2273.0,          0.0 !   !END!
1665 ! X =       212.301,     -179.780,      2229.0,          0.0 !   !END!
1666 ! X =       213.040,     -179.760,      2295.0,          0.0 !   !END!
1667 ! X =       213.779,     -179.740,      2194.0,          0.0 !   !END!
1668 ! X =       214.518,     -179.720,      2235.0,          0.0 !   !END!
1669 ! X =       215.257,     -179.700,      2205.0,          0.0 !   !END!
1670 ! X =       215.997,     -179.680,      2255.0,          0.0 !   !END!
1671 ! X =       216.736,     -179.670,      2285.0,          0.0 !   !END!
1672 ! X =       217.475,     -179.650,      2377.0,          0.0 !   !END!
1673 ! X =       218.214,     -179.630,      2278.0,          0.0 !   !END!
1674 ! X =       218.953,     -179.610,      2316.0,          0.0 !   !END!
1675 ! X =       219.692,     -179.590,      2212.0,          0.0 !   !END!
1676 ! X =       220.431,     -179.570,      1950.0,          0.0 !   !END!
1677 ! X =       202.670,     -179.100,      2343.0,          0.0 !   !END!
1678 ! X =       203.409,     -179.090,      2354.0,          0.0 !   !END!
1679 ! X =       204.148,     -179.070,      2377.0,          0.0 !   !END!
1680 ! X =       204.887,     -179.050,      2377.0,          0.0 !   !END!
1681 ! X =       205.626,     -179.030,      2262.0,          0.0 !   !END!
1682 ! X =       206.365,     -179.010,      2316.0,          0.0 !   !END!
1683 ! X =       207.104,     -178.990,      2321.0,          0.0 !   !END!
1684 ! X =       207.843,     -178.970,      2195.0,          0.0 !   !END!
1685 ! X =       208.582,     -178.950,      2237.0,          0.0 !   !END!
1686 ! X =       209.321,     -178.940,      2295.0,          0.0 !   !END!
1687 ! X =       210.060,     -178.920,      2282.0,          0.0 !   !END!
1688 ! X =       210.799,     -178.900,      2316.0,          0.0 !   !END!
1689 ! X =       211.538,     -178.880,      2255.0,          0.0 !   !END!
1690 ! X =       212.277,     -178.860,      2377.0,          0.0 !   !END!
1691 ! X =       213.016,     -178.840,      2332.0,          0.0 !   !END!
1692 ! X =       213.755,     -178.820,      2377.0,          0.0 !   !END!
1693 ! X =       214.494,     -178.800,      2196.0,          0.0 !   !END!
1694 ! X =       215.233,     -178.780,      2255.0,          0.0 !   !END!
1695 ! X =       215.972,     -178.760,      2250.0,          0.0 !   !END!
1696 ! X =       216.711,     -178.740,      2363.0,          0.0 !   !END!
1697 ! X =       217.450,     -178.720,      2377.0,          0.0 !   !END!
1698 ! X =       218.189,     -178.700,      2316.0,          0.0 !   !END!
1699 ! X =       218.928,     -178.680,      2274.0,          0.0 !   !END!
1700 ! X =       219.667,     -178.660,      1968.0,          0.0 !   !END!
1701 ! X =       202.646,     -178.180,      2377.0,          0.0 !   !END!
1702 ! X =       203.385,     -178.160,      2316.0,          0.0 !   !END!
1703 ! X =       204.124,     -178.140,      2377.0,          0.0 !   !END!
1704 ! X =       204.863,     -178.120,      2398.0,          0.0 !   !END!
1705 ! X =       205.602,     -178.110,      2367.0,          0.0 !   !END!
1706 ! X =       206.341,     -178.090,      2339.0,          0.0 !   !END!
1707 ! X =       207.080,     -178.070,      2377.0,          0.0 !   !END!
1708 ! X =       207.819,     -178.050,      2377.0,          0.0 !   !END!
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1709 ! X =       208.558,     -178.030,      2256.0,          0.0 !   !END!
1710 ! X =       209.297,     -178.010,      2327.0,          0.0 !   !END!
1711 ! X =       210.036,     -177.990,      2375.0,          0.0 !   !END!
1712 ! X =       210.775,     -177.970,      2377.0,          0.0 !   !END!
1713 ! X =       211.514,     -177.950,      2312.0,          0.0 !   !END!
1714 ! X =       212.253,     -177.930,      2358.0,          0.0 !   !END!
1715 ! X =       212.992,     -177.910,      2316.0,          0.0 !   !END!
1716 ! X =       213.730,     -177.890,      2301.0,          0.0 !   !END!
1717 ! X =       214.469,     -177.880,      2316.0,          0.0 !   !END!
1718 ! X =       215.208,     -177.860,      2255.0,          0.0 !   !END!
1719 ! X =       215.947,     -177.840,      2313.0,          0.0 !   !END!
1720 ! X =       216.686,     -177.820,      2377.0,          0.0 !   !END!
1721 ! X =       217.425,     -177.800,      2342.0,          0.0 !   !END!
1722 ! X =       218.164,     -177.780,      2375.0,          0.0 !   !END!
1723 ! X =       218.903,     -177.760,      2143.0,          0.0 !   !END!
1724 ! X =       219.642,     -177.740,      1951.0,          0.0 !   !END!
1725 ! X =       202.623,     -177.260,      2438.0,          0.0 !   !END!
1726 ! X =       203.362,     -177.240,      2430.0,          0.0 !   !END!
1727 ! X =       204.101,     -177.220,      2438.0,          0.0 !   !END!
1728 ! X =       204.840,     -177.200,      2438.0,          0.0 !   !END!
1729 ! X =       205.579,     -177.180,      2438.0,          0.0 !   !END!
1730 ! X =       206.318,     -177.160,      2396.0,          0.0 !   !END!
1731 ! X =       207.056,     -177.140,      2319.0,          0.0 !   !END!
1732 ! X =       207.795,     -177.120,      2397.0,          0.0 !   !END!
1733 ! X =       208.534,     -177.110,      2316.0,          0.0 !   !END!
1734 ! X =       209.273,     -177.090,      2377.0,          0.0 !   !END!
1735 ! X =       210.012,     -177.070,      2375.0,          0.0 !   !END!
1736 ! X =       210.751,     -177.050,      2438.0,          0.0 !   !END!
1737 ! X =       211.489,     -177.030,      2322.0,          0.0 !   !END!
1738 ! X =       212.228,     -177.010,      2414.0,          0.0 !   !END!
1739 ! X =       212.967,     -176.990,      2377.0,          0.0 !   !END!
1740 ! X =       213.706,     -176.970,      2286.0,          0.0 !   !END!
1741 ! X =       214.445,     -176.950,      2377.0,          0.0 !   !END!
1742 ! X =       215.184,     -176.930,      2255.0,          0.0 !   !END!
1743 ! X =       215.923,     -176.910,      2404.0,          0.0 !   !END!
1744 ! X =       216.661,     -176.890,      2407.0,          0.0 !   !END!
1745 ! X =       217.400,     -176.870,      2406.0,          0.0 !   !END!
1746 ! X =       218.139,     -176.850,      2239.0,          0.0 !   !END!
1747 ! X =       218.878,     -176.830,      2005.0,          0.0 !   !END!
1748 ! X =       219.617,     -176.810,      1950.0,          0.0 !   !END!
1749 ! X =       202.600,     -176.330,      2133.0,          0.0 !   !END!
1750 ! X =       203.339,     -176.310,      2378.0,          0.0 !   !END!
1751 ! X =       204.078,     -176.290,      2298.0,          0.0 !   !END!
1752 ! X =       204.816,     -176.280,      2188.0,          0.0 !   !END!
1753 ! X =       205.555,     -176.260,      2343.0,          0.0 !   !END!
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1754 ! X =       206.294,     -176.240,      2416.0,          0.0 !   !END!
1755 ! X =       207.033,     -176.220,      2437.0,          0.0 !   !END!
1756 ! X =       207.772,     -176.200,      2444.0,          0.0 !   !END!
1757 ! X =       208.510,     -176.180,      2377.0,          0.0 !   !END!
1758 ! X =       209.249,     -176.160,      2452.0,          0.0 !   !END!
1759 ! X =       209.988,     -176.140,      2420.0,          0.0 !   !END!
1760 ! X =       210.727,     -176.120,      2501.0,          0.0 !   !END!
1761 ! X =       211.465,     -176.100,      2412.0,          0.0 !   !END!
1762 ! X =       212.204,     -176.090,      2499.0,          0.0 !   !END!
1763 ! X =       212.943,     -176.070,      2442.0,          0.0 !   !END!
1764 ! X =       213.682,     -176.050,      2316.0,          0.0 !   !END!
1765 ! X =       214.420,     -176.030,      2399.0,          0.0 !   !END!
1766 ! X =       215.159,     -176.010,      2362.0,          0.0 !   !END!
1767 ! X =       215.898,     -175.990,      2421.0,          0.0 !   !END!
1768 ! X =       216.637,     -175.970,      2412.0,          0.0 !   !END!
1769 ! X =       217.375,     -175.950,      2438.0,          0.0 !   !END!
1770 ! X =       218.114,     -175.930,      2270.0,          0.0 !   !END!
1771 ! X =       202.577,     -175.410,      2042.0,          0.0 !   !END!
1772 ! X =       203.316,     -175.390,      2230.0,          0.0 !   !END!
1773 ! X =       204.054,     -175.370,      2036.0,          0.0 !   !END!
1774 ! X =       204.793,     -175.350,      2068.0,          0.0 !   !END!
1775 ! X =       205.532,     -175.330,      2194.0,          0.0 !   !END!
1776 ! X =       206.270,     -175.310,      2072.0,          0.0 !   !END!
1777 ! X =       207.009,     -175.290,      2281.0,          0.0 !   !END!
1778 ! X =       207.748,     -175.280,      2156.0,          0.0 !   !END!
1779 ! X =       208.486,     -175.260,      2438.0,          0.0 !   !END!
1780 ! X =       209.225,     -175.240,      2286.0,          0.0 !   !END!
1781 ! X =       209.964,     -175.220,      2474.0,          0.0 !   !END!
1782 ! X =       210.703,     -175.200,      2560.0,          0.0 !   !END!
1783 ! X =       211.441,     -175.180,      2456.0,          0.0 !   !END!
1784 ! X =       212.180,     -175.160,      2498.0,          0.0 !   !END!
1785 ! X =       212.919,     -175.140,      2385.0,          0.0 !   !END!
1786 ! X =       213.657,     -175.120,      2399.0,          0.0 !   !END!
1787 ! X =       214.396,     -175.100,      2377.0,          0.0 !   !END!
1788 ! X =       215.135,     -175.080,      2402.0,          0.0 !   !END!
1789 ! X =       215.873,     -175.060,      2438.0,          0.0 !   !END!
1790 ! X =       216.612,     -175.040,      2438.0,          0.0 !   !END!
1791 ! X =       217.350,     -175.020,      2128.0,          0.0 !   !END!
1792 ! X =       218.089,     -175.000,      2153.0,          0.0 !   !END!
1793 ! X =       206.985,     -174.370,      2079.0,          0.0 !   !END!
1794 ! X =       207.724,     -174.350,      2076.0,          0.0 !   !END!
1795 ! X =       208.463,     -174.330,      2141.0,          0.0 !   !END!
1796 ! X =       209.201,     -174.310,      2260.0,          0.0 !   !END!
1797 ! X =       209.940,     -174.290,      2191.0,          0.0 !   !END!
1798 ! X =       210.678,     -174.270,      2355.0,          0.0 !   !END!
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1799 ! X =       211.417,     -174.260,      2266.0,          0.0 !   !END!
1800 ! X =       212.156,     -174.240,      2288.0,          0.0 !   !END!
1801 ! X =       212.894,     -174.220,      2403.0,          0.0 !   !END!
1802 ! X =       213.633,     -174.200,      2316.0,          0.0 !   !END!
1803 ! X =       214.371,     -174.180,      2438.0,          0.0 !   !END!
1804 ! X =       215.110,     -174.160,      2346.0,          0.0 !   !END!
1805 ! X =       215.849,     -174.140,      2438.0,          0.0 !   !END!
1806 ! X =       216.587,     -174.120,      2133.0,          0.0 !   !END!
1807 ! X =       212.131,     -173.310,      2255.0,          0.0 !   !END!
1808 ! X =       212.870,     -173.290,      2377.0,          0.0 !   !END!
1809 ! X =       213.608,     -173.270,      2447.0,          0.0 !   !END!
1810 ! X =       214.347,     -173.250,      2377.0,          0.0 !   !END!
1811 ! X =       215.085,     -173.230,      2374.0,          0.0 !   !END!
1812 ! X =       215.824,     -173.210,      2293.0,          0.0 !   !END!
1813 ! X =       212.846,     -172.370,      2468.0,          0.0 !   !END!
1814 ! X =       213.584,     -172.350,      2417.0,          0.0 !   !END!
1815 ! X =       214.322,     -172.330,      2377.0,          0.0 !   !END!
1816 ! X =       215.061,     -172.310,      2428.0,          0.0 !   !END!
1817 ! X =       215.799,     -172.290,      2219.0,          0.0 !   !END!
1818 ! X =       214.298,     -171.400,      2423.0,          0.0 !   !END!
1819 ! X =       215.036,     -171.390,      2226.0,          0.0 !   !END!
1820 ! X =       215.774,     -171.370,      2133.0,          0.0 !   !END!
1821 ! X =       214.273,     -170.480,      2229.0,          0.0 !   !END!
1822 ! X =       215.012,     -170.460,      2195.0,          0.0 !   !END!
1823 ! X =       214.249,     -169.560,      2157.0,          0.0 !   !END!
1824 ! X =       214.987,     -169.540,      2168.0,          0.0 !   !END!
1825 ! X =       214.224,     -168.630,      2112.0,          0.0 !   !END!
1826 ! X =       214.962,     -168.610,      2133.0,          0.0 !   !END!
1827 ! X =       214.200,     -167.710,      2072.0,          0.0 !   !END!
1828 ! X =       284.486,      113.285,      2407.0,          0.0 !   !END!
1829 ! X =       285.911,      113.337,      2542.0,          0.0 !   !END!
1830 ! X =       287.335,      113.390,      2649.0,          0.0 !   !END!
1831 ! X =       285.843,      115.186,      3168.0,          0.0 !   !END!
1832 ! X =       287.267,      115.238,      3169.0,          0.0 !   !END!
1833 ! X =       287.199,      117.087,      3227.0,          0.0 !   !END!
1834 ! X =       287.131,      118.935,      3268.0,          0.0 !   !END!
1835 ! X =       285.640,      120.732,      3295.0,          0.0 !   !END!
1836 ! X =       287.063,      120.784,      3261.0,          0.0 !   !END!
1837 ! X =       285.572,      122.580,      3273.0,          0.0 !   !END!
1838 ! X =       286.995,      122.633,      3029.0,          0.0 !   !END!
1839 ! X =       284.082,      124.377,      3169.0,          0.0 !   !END!
1840 ! X =       285.504,      124.429,      3121.0,          0.0 !   !END!
1841 ! X =       286.927,      124.481,      3108.0,          0.0 !   !END!
1842 ! X =       282.592,      126.174,      3010.0,          0.0 !   !END!
1843 ! X =      -195.153,     -277.952,      1900.0,          0.0 !   !END!
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1844 ! X =      -192.909,     -278.006,      1835.0,          0.0 !   !END!
1845 ! X =      -190.665,     -278.058,      1800.0,          0.0 !   !END!
1846 ! X =      -188.420,     -278.110,      1768.0,          0.0 !   !END!
1847 ! X =      -186.176,     -278.161,      1401.0,          0.0 !   !END!
1848 ! X =      -183.932,     -278.212,      1191.0,          0.0 !   !END!
1849 ! X =      -181.687,     -278.262,      1581.0,          0.0 !   !END!
1850 ! X =      -179.443,     -278.312,      1753.0,          0.0 !   !END!
1851 ! X =      -177.199,     -278.361,      1768.0,          0.0 !   !END!
1852 ! X =      -174.954,     -278.409,      1715.0,          0.0 !   !END!
1853 ! X =      -172.710,     -278.456,      1515.0,          0.0 !   !END!
1854 ! X =      -170.465,     -278.503,      1278.0,          0.0 !   !END!
1855 ! X =      -168.221,     -278.550,       988.0,          0.0 !   !END!
1856 ! X =      -165.976,     -278.596,       667.0,          0.0 !   !END!
1857 ! X =      -163.732,     -278.641,       617.0,          0.0 !   !END!
1858 ! X =      -161.488,     -278.685,      1280.0,          0.0 !   !END!
1859 ! X =      -159.243,     -278.729,      1030.0,          0.0 !   !END!
1860 ! X =      -156.999,     -278.773,      1432.0,          0.0 !   !END!
1861 ! X =      -154.754,     -278.815,      1889.0,          0.0 !   !END!
1862 ! X =      -152.510,     -278.857,      1427.0,          0.0 !   !END!
1863 ! X =      -150.265,     -278.899,      1927.0,          0.0 !   !END!
1864 ! X =      -148.021,     -278.940,      1785.0,          0.0 !   !END!
1865 ! X =      -145.776,     -278.980,       756.0,          0.0 !   !END!
1866 ! X =      -143.532,     -279.020,      1050.0,          0.0 !   !END!
1867 ! X =      -141.287,     -279.059,      1504.0,          0.0 !   !END!
1868 ! X =      -139.042,     -279.097,      1771.0,          0.0 !   !END!
1869 ! X =      -136.798,     -279.135,      1950.0,          0.0 !   !END!
1870 ! X =       -96.394,     -279.710,      1828.0,          0.0 !   !END!
1871 ! X =       -94.149,     -279.736,       853.0,          0.0 !   !END!
1872 ! X =       -91.904,     -279.761,      1647.0,          0.0 !   !END!
1873 ! X =      -195.087,     -275.178,      1834.0,          0.0 !   !END!
1874 ! X =      -192.843,     -275.231,      1828.0,          0.0 !   !END!
1875 ! X =      -190.600,     -275.284,      1803.0,          0.0 !   !END!
1876 ! X =      -188.356,     -275.336,      1778.0,          0.0 !   !END!
1877 ! X =      -186.113,     -275.387,      1343.0,          0.0 !   !END!
1878 ! X =      -183.869,     -275.438,      1708.0,          0.0 !   !END!
1879 ! X =      -181.626,     -275.488,      1525.0,          0.0 !   !END!
1880 ! X =      -179.382,     -275.537,      1768.0,          0.0 !   !END!
1881 ! X =      -177.139,     -275.586,      1765.0,          0.0 !   !END!
1882 ! X =      -174.895,     -275.634,      1638.0,          0.0 !   !END!
1883 ! X =      -172.651,     -275.682,      1355.0,          0.0 !   !END!
1884 ! X =      -170.408,     -275.729,      1309.0,          0.0 !   !END!
1885 ! X =      -168.164,     -275.775,      1576.0,          0.0 !   !END!
1886 ! X =      -165.920,     -275.821,      1429.0,          0.0 !   !END!
1887 ! X =      -163.677,     -275.866,      1231.0,          0.0 !   !END!
1888 ! X =      -161.433,     -275.911,      1164.0,          0.0 !   !END!
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1889 ! X =      -159.189,     -275.954,      1265.0,          0.0 !   !END!
1890 ! X =      -156.945,     -275.998,      1298.0,          0.0 !   !END!
1891 ! X =      -154.702,     -276.040,      1220.0,          0.0 !   !END!
1892 ! X =      -152.458,     -276.083,      1418.0,          0.0 !   !END!
1893 ! X =      -150.214,     -276.124,      1243.0,          0.0 !   !END!
1894 ! X =      -147.970,     -276.165,       609.0,          0.0 !   !END!
1895 ! X =      -145.727,     -276.205,       675.0,          0.0 !   !END!
1896 ! X =      -143.483,     -276.245,      1583.0,          0.0 !   !END!
1897 ! X =      -141.239,     -276.284,      1255.0,          0.0 !   !END!
1898 ! X =      -138.995,     -276.322,      1219.0,          0.0 !   !END!
1899 ! X =      -136.751,     -276.360,      2073.0,          0.0 !   !END!
1900 ! X =      -134.508,     -276.397,      2316.0,          0.0 !   !END!
1901 ! X =       -94.117,     -276.961,      1280.0,          0.0 !   !END!
1902 ! X =       -91.873,     -276.986,       914.0,          0.0 !   !END!
1903 ! X =       -89.629,     -277.011,      1190.0,          0.0 !   !END!
1904 ! X =      -195.021,     -272.404,      1794.0,          0.0 !   !END!
1905 ! X =      -192.778,     -272.457,      1807.0,          0.0 !   !END!
1906 ! X =      -190.535,     -272.509,      1828.0,          0.0 !   !END!
1907 ! X =      -188.293,     -272.561,      1788.0,          0.0 !   !END!
1908 ! X =      -186.050,     -272.612,      1768.0,          0.0 !   !END!
1909 ! X =      -183.807,     -272.663,      1695.0,          0.0 !   !END!
1910 ! X =      -181.564,     -272.713,      1753.0,          0.0 !   !END!
1911 ! X =      -179.321,     -272.763,      1760.0,          0.0 !   !END!
1912 ! X =      -177.078,     -272.811,      1727.0,          0.0 !   !END!
1913 ! X =      -174.836,     -272.860,      1707.0,          0.0 !   !END!
1914 ! X =      -172.593,     -272.907,      1707.0,          0.0 !   !END!
1915 ! X =      -170.350,     -272.954,      1715.0,          0.0 !   !END!
1916 ! X =      -168.107,     -273.000,      1737.0,          0.0 !   !END!
1917 ! X =      -165.864,     -273.046,      1729.0,          0.0 !   !END!
1918 ! X =      -163.621,     -273.091,      1737.0,          0.0 !   !END!
1919 ! X =      -161.378,     -273.136,      1162.0,          0.0 !   !END!
1920 ! X =      -159.135,     -273.180,      1252.0,          0.0 !   !END!
1921 ! X =      -156.892,     -273.223,      1171.0,          0.0 !   !END!
1922 ! X =      -154.649,     -273.266,       898.0,          0.0 !   !END!
1923 ! X =      -152.406,     -273.308,       934.0,          0.0 !   !END!
1924 ! X =      -150.163,     -273.349,      1180.0,          0.0 !   !END!
1925 ! X =      -147.920,     -273.390,      1394.0,          0.0 !   !END!
1926 ! X =      -145.677,     -273.430,      1569.0,          0.0 !   !END!
1927 ! X =      -143.434,     -273.470,      1605.0,          0.0 !   !END!
1928 ! X =      -141.191,     -273.509,      1696.0,          0.0 !   !END!
1929 ! X =      -138.948,     -273.547,      1637.0,          0.0 !   !END!
1930 ! X =       -96.328,     -274.160,      1767.0,          0.0 !   !END!
1931 ! X =       -94.085,     -274.186,      1706.0,          0.0 !   !END!
1932 ! X =       -91.842,     -274.211,      1180.0,          0.0 !   !END!
1933 ! X =       -89.599,     -274.236,      1649.0,          0.0 !   !END!
```

```
1934 ! X =      -165.808,     -270.272,      1691.0,          0.0 !   !END!
1935 ! X =      -163.566,     -270.317,      1330.0,          0.0 !   !END!
1936 ! X =      -161.324,     -270.361,       731.0,          0.0 !   !END!
1937 ! X =      -159.081,     -270.405,      1277.0,          0.0 !   !END!
1938 ! X =      -156.839,     -270.448,      1440.0,          0.0 !   !END!
1939 ! X =      -154.597,     -270.491,      1361.0,          0.0 !   !END!
1940 ! X =      -152.355,     -270.533,      1271.0,          0.0 !   !END!
1941 ! X =      -150.112,     -270.575,      1402.0,          0.0 !   !END!
1942 ! X =      -147.870,     -270.615,      1431.0,          0.0 !   !END!
1943 ! X =      -145.628,     -270.656,      1617.0,          0.0 !   !END!
1944 ! X =      -143.386,     -270.695,      2075.0,          0.0 !   !END!
1945 ! X =      -141.143,     -270.734,      2063.0,          0.0 !   !END!
1946 ! X =      -138.901,     -270.772,      1830.0,          0.0 !   !END!
1947 ! X =       -94.053,     -271.411,      1706.0,          0.0 !   !END!
1948 ! X =       -91.811,     -271.436,      1706.0,          0.0 !   !END!
1949 ! X =      -165.752,     -267.497,      1650.0,          0.0 !   !END!
1950 ! X =      -163.510,     -267.542,      1112.0,          0.0 !   !END!
1951 ! X =      -161.269,     -267.587,       992.0,          0.0 !   !END!
1952 ! X =      -159.027,     -267.630,      1148.0,          0.0 !   !END!
1953 ! X =      -156.786,     -267.674,      1386.0,          0.0 !   !END!
1954 ! X =      -154.545,     -267.716,      1828.0,          0.0 !   !END!
1955 ! X =      -150.062,     -267.800,      1889.0,          0.0 !   !END!
1956 ! X =      -147.820,     -267.841,      1859.0,          0.0 !   !END!
1957 ! X =       -91.780,     -268.661,      1662.0,          0.0 !   !END!
1958 ! X =       -89.538,     -268.686,       914.0,          0.0 !   !END!
1959 ! X =      -158.973,     -264.856,      1038.0,          0.0 !   !END!
1960 ! X =      -156.733,     -264.899,      1383.0,          0.0 !   !END!
1961 ! X =       -96.231,     -265.835,      1645.0,          0.0 !   !END!
1962 ! X =       -93.958,     -263.086,      1584.0,          0.0 !   !END!
1963 ! X =       -91.717,     -263.111,      1584.0,          0.0 !   !END!
1964 ! X =       -89.447,     -260.361,      1584.0,          0.0 !   !END!
1965 ! X =       -87.178,     -257.611,      1022.0,          0.0 !   !END!
1966 ! X =       -84.910,     -254.859,      1523.0,          0.0 !   !END!
1967 ! X =       -82.644,     -252.108,      1261.0,          0.0 !   !END!
1968 ! X =       -82.616,     -249.333,       914.0,          0.0 !   !END!
1969 ! X =       -82.588,     -246.558,      1170.0,          0.0 !   !END!
1970 ! X =       -80.353,     -246.580,      1031.0,          0.0 !   !END!
1971 ! X =       -80.325,     -243.806,      1341.0,          0.0 !   !END!
1972 ! X =       -75.855,     -243.849,      1401.0,          0.0 !   !END!
1973 ! X =       -78.064,     -241.053,      1248.0,          0.0 !   !END!
1974 ! X =       -73.545,     -235.545,       977.0,          0.0 !   !END!

-------------
    a
     Data for each receptor are treated as a separate input subgroup
```

and therefore must end with an input group terminator.

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

APPENDIX E – CALPOST CONTROL FILE INPUTS

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

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

File                       Default File Name
----                       -----------------
Conc/Dep Flux File         MODEL.DAT          ! MODDAT = CONCN1.DAT !
Relative Humidity File     VISB.DAT           ! VISDAT = VISB.DAT !
Background Data File       BACK.DAT           * BACKDAT = *
Transmissometer or         VSRN.DAT           * VSRDAT = *
Nephelometer Data File      or
DATSAV Weather Data File    or
Prognostic Weather  File

Single-point Met File      SURFACE.DAT        ! MET1DAT = SURFACE.SFC !
 (Used ONLY to identify CALM hours for plume model
  output averaging when MCALMPRO option is used)


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

File                       Default File Name
----                       -----------------
List File                  CALPOST.LST        ! PSTLST = Hntr1_101_post\VISIB\VISIB.LST !

Pathname for Timeseries Files   (blank)       ! TSPATH = Hntr1_101_post\VISIB\ !
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)             ! PLPATH = Hntr1_101_post\VISIB\ !
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String (U) to augment default filenames
(activate with exclamation points only if
```

```
 providing NON-BLANK character string)

Timeseries          TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT
Peak Value          PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

                                          * TSUNAM = *

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

                                          ! TUNAM = v !

Exceedance Plot      EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT
                 or  EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD

                                          * XUNAM = *

Echo Plot
(Specific Days)
           yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.DAT
     or    yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD

                                          ! EUNAM = v !

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


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

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

--------------------------------------------------------------------------------
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 132 characters in length
```

```
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and context-specific strings, where
             ASPEC = Species Name
              CONC = CONC Or WFLX Or DFLX Or TFLX
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                hh = Hour(ending) in LST
             szzzz = LST time zone shift (EST is -0500)
              yyyy = Year(LST)
                mm = Month(LST)
                dd = day of month (LST)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
          must contain at least 1 non-blank character.

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

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

     Option to run all periods found
     in the met. file(s)  (METRUN)        Default: 0   ! METRUN = 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 = 2000 !
                       Month  (ISMO)  --    No default   ! ISMO = 12 !
                       Day    (ISDY)  --    No default   ! ISDY = 31 !
     Starting time:    Hour   (ISHR)  --    No default   ! ISHR = 23 !
                       Minute (ISMIN) --    No default   ! ISMIN = 0 !
                       Second (ISSEC) --    No default   ! ISSEC = 0 !

     Ending date:      Year   (IEYR)  --    No default   ! IEYR = 2001 !
                       Month  (IEMO)  --    No default   ! IEMO = 12 !
                       Day    (IEDY)  --    No default   ! IEDY = 31 !
     Ending time:      Hour   (IEHR)  --    No default   ! IEHR = 23 !
                       Minute (IEMIN) --    No default   ! IEMIN = 0 !
                       Second (IESEC) --    No default   ! IESEC = 0 !
```

```
     (These are only used if METRUN = 0)

     All times are in the base time zone of the CALPUFF simulation.
     CALPUFF Dataset Version 2.1 contains the zone, but earlier versions
     do not, and the zone must be specified here.  The zone is the
     number of hours that must be ADDED to the time to obtain UTC (or GMT).
     Identify the Base Time Zone for the CALPUFF simulation
                            (BTZONE) -- No default   * BTZONE = *

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


      Source of NO2 when ASPEC=NO2 (above) or LVNO2=T (Group 2) may be
      from CALPUFF NO2 concentrations OR from a fraction of CALPUFF NOx
      concentrations.  Specify the fraction of NOx that is treated as NO2
      either as a constant or as a table of fractions that depend on the
      magnitude of the NOx concentration:
```

```
                          (NO2CALC) -- Default: 1   ! NO2CALC = 1 !
      0 =  Use NO2 directly (NO2 must be in file)
      1 =  Specify a single NO2/NOx ratio (RNO2NOX)
      2 =  Specify a table NO2/NOx ratios (TNO2NOX)
           (NOTE: Scaling Factors must NOT be used with NO2CALC=2)

    Single NO2/NOx ratio (0.0 to 1.0) for treating some
    or all NOx as NO2, where [NO2] = [NOX] * RNO2NOX
    (used only if NO2CALC = 1)
                          (RNO2NOX) -- Default: 1.0 ! RNO2NOX = 1 !

    Table of NO2/NOx ratios that vary with NOx concentration.
    Provide 14 NOx concentrations (ug/m**3) and the corresponding
    NO2/NOx ratio, with NOx increasing in magnitude.  The ratio used
    for a particular NOx concentration is interpolated from the values
    provided in the table.  The ratio for the smallest tabulated NOx
    concentration (the first) is used for all NOx concentrations less
    than the smallest tabulated value, and the ratio for the largest
    tabulated NOx concentration (the last) is used for all NOx
    concentrations greater than the largest tabulated value.
    (used only if NO2CALC = 2)

     NOx concentration(ug / m3)
                          (CNOX)    -- No default
       * CNOX = *

     NO2/NOx ratio for each NOx concentration:
                          (TNO2NOX) -- No default
       * TNO2NOX = *


Source information
------------------

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

```
Plume Model Output Processing Options
-------------------------------------

  Output from models other than CALPUFF and CALGRID can be written in
  the CONC.DAT format and processed by CALPOST.  Plume models such as
  AERMOD typically do not treat CALM hours, and do not include such hours
  in multiple-hour averages, with specific rules about how many calm hours
  can be removed from an average.  This treatment is known as CALM
  PROCESSING.  Calm periods are identified from wind speeds in the
  meteorological data file for the application, which must be identified
  in Input Group 0 as the single-point meteorological data file MET1DAT.
         0 =  Option is not used for CALPUFF/CALGRID output files
         1 =  Apply CALM processing procedures to multiple-hour averages
                        (MCALMPRO) -- Default: 0   ! MCALMPRO = 0 !

  Format of Single-point Met File
         1 =  AERMOD/AERMET SURFACE file
                         (MET1FMT) -- Default: 1   ! MET1FMT = 1 !


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

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

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

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

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                               OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
```

```
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
                                                ! NDRECP = -1 !


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

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

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

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

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

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


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

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

!END!


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

    Specific gridded receptors are excluded from CALPOST processing
```

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

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

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

    (NGXRECP) -- Default: 1
* NGXRECP = *

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

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

    Test visibility options specified to see
    if they conform to FLAG 2008 configuration?
                          (MVISCHECK) -- Default: 1   ! MVISCHECK = 1 !
         0 =  NO checks are made
         1 =  Technical options must conform to FLAG 2008 visibility guidance
                ASPEC = VISIB
                LVNO2 = T
                NO2CALC = 1
                RNO2NOX = 1.0
                MVISBK = 8
                M8_MODE = 5

    Some of the data entered for use with the FLAG 2008 configuration
    are specific to the Class I area being evaluated. These values can
    be checked within the CALPOST user interface when the name of the
    Class I area is provided.
```

```
    Name of Class I Area (used for QA purposes only)
                           (AREANAME) -- Default: User  ! AREANAME = Canyonlands NP !


    Particle growth curve f(RH) for hygroscopic species
                              (MFRH) -- Default: 4   ! MFRH = 4 !

         1 =  IWAQM (1998) f(RH) curve (originally used with MVISBK=1)
         2 =  FLAG (2000) f(RH) tabulation
         3 =  EPA (2003) f(RH) tabulation
         4 =  IMPROVE (2006) f(RH) tabulations for sea salt, and for small and
              large SULFATE and NITRATE particles;
              Used in Visibility Method 8 (MVISBK = 8 with M8_MODE = 1, 2, or 3)

    Maximum relative humidity (%) used in particle growth curve
                             (RHMAX) -- Default: 98  ! RHMAX = 95 !

    Modeled species to be included in computing the light extinction
     Include SULFATE?          (LVSO4) -- Default: T   ! LVSO4 = T !
     Include NITRATE?          (LVNO3) -- Default: T   ! LVNO3 = T !
     Include ORGANIC CARBON?   (LVOC)  -- Default: T   ! LVOC = T !
     Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC = T !
     Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF = T !
     Include ELEMENTAL CARBON? (LVEC)  -- Default: T   ! LVEC = T !
     Include NO2 absorption?   (LVNO2) -- Default: F   ! LVNO2 = T !
              With Visibility Method 8 -- Default: T
                                          FLAG (2008)

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

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

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 !
              NO2 GAS          (EENO2) -- Default: .1755 ! EENO2 = 0.1755 !
    Visibility Method 8:
              AMMONIUM SULFATE (EESO4S)   Set Internally (small)
              AMMONIUM SULFATE (EESO4L)   Set Internally (large)
              AMMONIUM NITRATE (EENO3S)   Set Internally (small)
              AMMONIUM NITRATE (EENO3L)   Set Internally (large)
              ORGANIC CARBON   (EEOCS)    Set Internally (small)
              ORGANIC CARBON   (EEOCL)    Set Internally (large)
              SEA SALT         (EESALT)   Set Internally

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

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


    Method used for background light extinction
                              (MVISBK) -- Default: 8   ! MVISBK = 8 !
                                          FLAG (2008)

         1 =  Supply single light extinction and hygroscopic fraction
              - Hourly F(RH) adjustment applied to hygroscopic background
                and modeled sulfate and nitrate
         2 =  Background extinction from speciated PM concentrations (A)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - F(RH) factor is capped at F(RHMAX)
         3 =  Background extinction from speciated PM concentrations (B)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - Receptor-hour excluded if RH>RHMAX
```

```
     - Receptor-day excluded if fewer than 6 valid receptor-hours
4 =  Read hourly transmissometer background extinction measurements
     - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
     - Hour excluded if measurement invalid (missing, interference,
       or large RH)
     - Receptor-hour excluded if RH>RHMAX
     - Receptor-day excluded if fewer than 6 valid receptor-hours
5 =  Read hourly nephelometer background extinction measurements
     - Rayleigh extinction value (BEXTRAY) added to measurement
     - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
     - Hour excluded if measurement invalid (missing, interference,
       or large RH)
     - Receptor-hour excluded if RH>RHMAX
     - Receptor-day excluded if fewer than 6 valid receptor-hours
6 =  Background extinction from speciated PM concentrations
     - FLAG (2000) monthly RH adjustment factor applied to observed and
       and modeled sulfate and nitrate
7 =  Use observed weather or prognostic weather information for
     background extinction during weather events; otherwise, use Method 2
     - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
     - F(RH) factor is capped at F(RHMAX)
     - During observed weather events, compute Bext from visual range
       if using an observed weather data file, or
     - During prognostic weather events, use Bext from the prognostic
       weather file
     - Use Method 2 for hours without a weather event
8 =  Background extinction from speciated PM concentrations using
     the IMPROVE (2006) variable extinction efficiency formulation
     (MFRH must be set to 4)
     - Split between small and large particle concentrations of
       SULFATES, NITRATES, and ORGANICS is a function of concentration
       and different extinction efficiencies are used for each
     - Source-induced change in visibility includes the increase in
       extinction of the background aerosol due to the change in the
       extinction efficiency that now depends on total concentration.
     - Fsmall(RH) and Flarge(RH) adjustments for small and large
       particles are applied to observed and modeled sulfate and
       nitrate concentrations
     - Fsalt(RH) adjustment for sea salt is applied to background
       sea salt concentrations
     - F(RH) factors are capped at F(RHMAX)
```

```
          - RH for Fsmall(RH), Flarge(RH), and Fsalt(RH) may be obtained
            from hourly data as in Method 2 or from the FLAG monthly RH
            adjustment factor used for Method 6 where EPA F(RH) tabulation
            is used to infer RH, or monthly Fsmall, Flarge, and Fsalt RH
            adjustment factors can be directly entered.
            Furthermore, a monthly RH factor may be applied to either hourly
            concentrations or daily concentrations to obtain the 24-hour
            extinction.
            These choices are made using the M8_MODE selection.

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

Additional inputs used for MVISBK = 6,8:
----------------------------------------
 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 = *

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

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

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

 (IDWSTA)   -- No default   * IDWSTA = *
 (TZONE)    -- No default   * TZONE = *

Additional inputs used for MVISBK = 2,3,6,7,8:
----------------------------------------------
 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 = 0.07,0.07,0.07,0.07,0.07,0.07,0.07,0.07,0.07,0.07,0.07,0.07 !
 (BKNO3)  -- No default     ! BKNO3 = 0.06,0.06,0.06,0.06,0.06,0.06,0.06,0.06,0.06,0.06,0.06,0.06 !
 (BKPMC)  -- No default     ! BKPMC = 0.89,0.89,0.89,0.89,0.89,0.89,0.89,0.89,0.89,0.89,0.89,0.89 !
 (BKOC)   -- No default     ! BKOC = 0.23,0.23,0.23,0.23,0.23,0.23,0.23,0.23,0.23,0.23,0.23,0.23 !
 (BKSOIL) -- No default     ! BKSOIL = 0.14,0.14,0.14,0.14,0.14,0.14,0.14,0.14,0.14,0.14,0.14,0.14 !
 (BKEC)   -- No default     ! BKEC = 0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01 !

Additional inputs used for MVISBK = 8:
--------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) may be computed using hourly RH values and hourly
 modeled concentrations, or using monthly RH values inferred from
 the RHFAC adjustment factors and either hourly or daily modeled
 concentrations, or using monthly RHFSML, RHFLRG, and RHFSEA adjustment
 factors and either hourly or daily modeled concentrations.

 (M8_MODE) -- Default: 5     ! M8_MODE = 5 !
              FLAG (2008)

      1 = Use hourly RH values from VISB.DAT file with hourly
          modeled and monthly background concentrations.
      2 = Use monthly RH from monthly RHFAC and EPA (2003) f(RH) tabulation
          with hourly modeled and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      3 = Use monthly RH from monthly RHFAC with EPA (2003) f(RH) tabulation
```

```
            with daily modeled and monthly background concentrations.
            (VISB.DAT file is NOT needed).
         4 = Use monthly RHFSML, RHFLRG, and RHFSEA with hourly modeled
            and monthly background concentrations.
            (VISB.DAT file is NOT needed).
         5 = Use monthly RHFSML, RHFLRG, and RHFSEA with daily modeled
            and monthly background concentrations.
            (VISB.DAT file is NOT needed).

     Background extinction coefficients are computed from monthly
     CONCENTRATIONS of sea salt (BKSALT).  Month 1 is January.
     (ug/m**3)

     (BKSALT) -- No default     ! BKSALT = 0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01,0.01 !

     Extinction coefficients for hygroscopic species (modeled and
     background) can be computed using monthly RH adjustment factors
     in place of an hourly RH factor (VISB.DAT file is NOT needed).
     Enter the 12 monthly factors here (RHFSML,RHFLRG,RHFSEA).
     Month 1 is January.  (Used if M8_MODE = 4 or 5)

     Small ammonium sulfate and ammonium nitrate particle sizes
     (RHFSML) -- No default     ! RHFSML = 3.03,2.77,2.17,1.86,1.76,1.4,1.52,1.78,1.81,1.87,2.38,2.77 !

     Large ammonium sulfate and ammonium nitrate particle sizes
     (RHFLRG) -- No default     ! RHFLRG = 2.32,2.16,1.78,1.58,1.51,1.28,1.36,1.53,1.55,1.58,1.93,2.17 !

     Sea salt particles
     (RHFSEA) -- No default     ! RHFSEA = 3.3,3.04,2.33,1.99,1.87,1.48,1.63,1.9,1.94,2,2.64,3.07 !

    Additional inputs used for MVISBK = 2,3,5,6,7,8:
    ------------------------------------------------
     Extinction due to Rayleigh scattering is added (1/Mm)
                            (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 9 !

!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 = 1 !
                    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-pd averages           (L1PD) -- Default: T   ! L1PD = F !
    (pd = averaging period of model output)

    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 = T !

    User-specified averaging time in hours, minutes, seconds
    - results for this averaging time are reported if it is not zero

                           (NAVGH) -- Default: 0   ! NAVGH = 0 !
                           (NAVGM) -- Default: 0   ! NAVGM = 0 !
```

```
                        (NAVGS) -- Default: 0   ! NAVGS = 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 = T !

   3) Top 'N' table for each averaging time selected
      [List file or Plot file]
                        (LTOPN) -- Default: F   ! LTOPN = T !

        -- Number of 'Top-N' values at each receptor
           selected (NTOP must be <= 4)
                         (NTOP) -- Default: 4   ! NTOP = 2 !

        -- Specific ranks of 'Top-N' values reported
           (NTOP values must be entered)
                 (ITOP(4) array) -- Default:     ! ITOP = 1,8 !
                                    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.
   [TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT files]
                       (LTIME) -- Default: F   ! LTIME = F !

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

     -- Days selected for output
                  (IECHO(366)) -- Default: 366*0
        ! IECHO = 366*0 !
```

(366 values must be entered)

Plot output options

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

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

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

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

Auxiliary Output Files (for subsequent analyses)

Visibility

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

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

0 = Do Not create file

```
           1 =  Create file of DAILY (24 hour) Delta-Deciview
           2 =  Create file of DAILY (24 hour) Extinction Change (%)
           3 =  Create file of HOURLY Delta-Deciview
           4 =  Create file of HOURLY Extinction Change (%)


Additional Debug Output
-----------------------

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

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

APPENDIX F – POSTUTIL CONTROL FILE INPUTS

```
---------------- 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 = PU_BASECASE_02.LST !
 Data File       MODEL.DAT          ! UTLDAT = PU_CONC_BASECASE_02.DAT !


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

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

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

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

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


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

                                  Default: 0       ! METFM = 0 !


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

    Number of meteorological data file time-periods (NMET)
                                  Default: 0       ! NMET = 12 !


 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 = F !
        T = lower case
        F = UPPER CASE

!END!

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

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

NMET CALMET Data Files (METFM=0):

Input File      Default File Name
```

```
----------      -----------------
   1                              ! UTLMET = ..\..\..\Calmet\2002\Jan_02.DAT  ! !END!
   2                              ! UTLMET = ..\..\..\Calmet\2002\Feb_02.DAT  ! !END!
   3                              ! UTLMET = ..\..\..\Calmet\2002\Mar_02.DAT  ! !END!
   4                              ! UTLMET = ..\..\..\Calmet\2002\Apr_02.DAT  ! !END!
   5                              ! UTLMET = ..\..\..\Calmet\2002\May_02.DAT  ! !END!
   6                              ! UTLMET = ..\..\..\Calmet\2002\Jun_02.DAT  ! !END!
   7                              ! UTLMET = ..\..\..\Calmet\2002\Jul_02.DAT  ! !END!
   8                              ! UTLMET = ..\..\..\Calmet\2002\Aug_02.DAT  ! !END!
   9                              ! UTLMET = ..\..\..\Calmet\2002\Sep_02.DAT  ! !END!
   10                              ! UTLMET = ..\..\..\Calmet\2002\Oct_02.DAT  ! !END!
   11                              ! UTLMET = ..\..\..\Calmet\2002\Nov_02.DAT  ! !END!
   12                              ! UTLMET = ..\..\..\Calmet\2002\Dec_02.DAT  ! !END!



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

Input File      Default File Name
----------      -----------------
* MET1D = *


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

Input File      Default File Name
----------      -----------------
* M2D = *


Input File      Default File Name
----------      -----------------
   1                              ! MODDAT=CONC_BASECASE_02.DAT ! !END!



-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*
                                    or   * MET1D  = name * *END*
                                    or   * M2DRHU = name * *END*
                                 (and)   * M2DTMP = name * *END*
                                 (and)   * M2DRHO = name * *END*

       and NFILES lines of the form     * MODDAT = name * *END*
       where the * should be replaced with an exclamation point,
```

```
       the special delimiter character.

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

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

     Starting date:    Year  (ISYR) --    No default   ! ISYR = 2002 !
                       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 = 8760 !

     Number of species to process from CALPUFF runs
                            (NSPECINP) -- No default   ! NSPECINP = 9 !

     Number of species to write to output file
                            (NSPECOUT) -- No default   ! NSPECOUT = 9 !

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


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

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

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

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

```
Ammonia-Limiting Method Option to recompute the HNO3/NO3 concentration
partition prior to performing other actions is controlled by MNITRATE.
This option will NOT alter any deposition fluxes contained in the CALPUFF
file(s).  Three partition selections are provided.  The first two are
typically used in sequence (POSTUTIL is run more than once).  The first
selection (MNITRATE=1) computes the partition for the TOTAL (all sources)
concentration fields (SO4, NO3, HNO3; NH3), and the second (MNITRATE=2)
uses this partition (from the previous application of POSTUTIL) to
compute the partition for individual source groups.  The third selection
(MNITRATE=3) can be used instead in a single POSTUTIL application if a
file of background concentrations is provided (BCKGALM in Input Group 0).

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

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

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

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

SOURCE OF AMMONIA:

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

in the chemical equilibrium calculation.

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

What is the input source of Ammonia?
(NH3TYP) No Default ! NH3TYP = 3 !

0 = No background will be used.
ONLY NH3 or TNH3 from the concentration files listed in Subgroup (2a&2b) as a processed species will be used.
(Cannot be used with MNITRATE=3)

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

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

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

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

OPTION	NH3 or TNH3 CONC	BCKNH3 or BCKTNH3	TNH3/BCKGALM or BCKTNH3
0	X	0	0
1	X	X	0
2	X	0	X
3	0	X	0
4	0	0	X

Default monthly (12 values) background ammonia concentration (ppb) used for HNO3/NO3 partition (need to choose one or the other):

```
      Gaseous NH3 (BCKNH3)            Default: -999
      ! BCKNH3 = 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1 !

      Total TNH3  (BCKTNH3)           Default: -999
      ! BCKTNH3 = -999 !

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

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

INPUT GROUP: 2 -- Species Processing Information
--------------

-------------
Subgroup (2a)
-------------

  The following NSPECINP species will be processed:

! ASPECI =          SO2 !         !END!
! ASPECI =          SO4 !         !END!
! ASPECI =          NOX !         !END!
! ASPECI =          HNO3 !         !END!
! ASPECI =          NO3 !         !END!
! ASPECI =          EC !         !END!
! ASPECI =          SOA !         !END!
! ASPECI =          PMF !         !END!
! ASPECI =          PMC !         !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 =          EC !         !END!
! ASPECO =          SOA !         !END!
! ASPECO =          PMF !         !END!
```

```
! ASPECO =          PMC !         !END!


-------------
Subgroup (2c)
-------------

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

* CSPECCMP = *

-------------
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)
               --------------      --------------
```