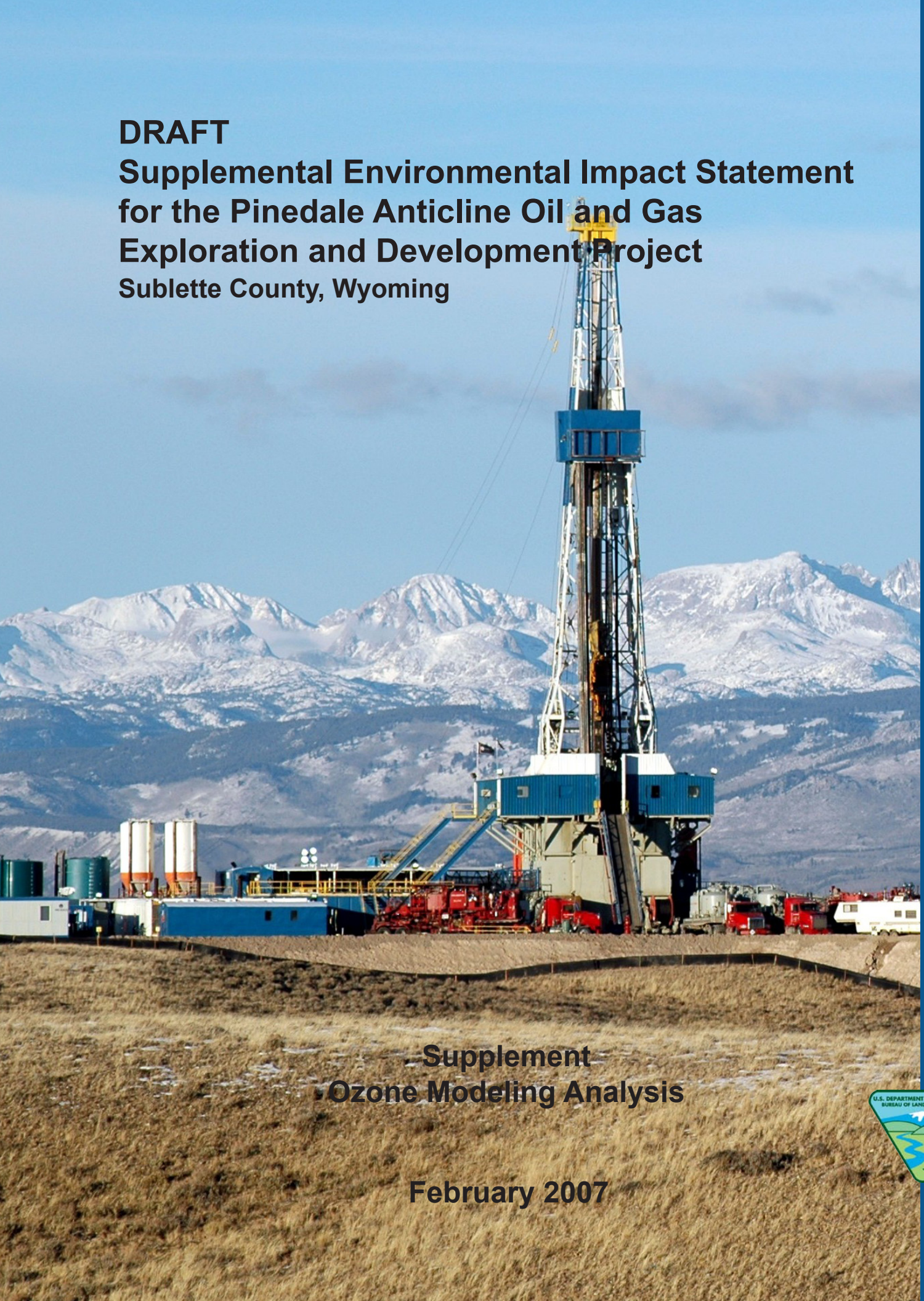

DRAFT
Supplemental Environmental Impact Statement for the Pinedale Anticline Oil and Gas Exploration and Development Project
Sublette County, Wyoming

Supplement
Ozone Modeling Analysis

February 2007

MISSION STATEMENT

It is the mission of the Bureau of Land Managment to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/WY/PL-07/001+1310

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Abbreviations and Acronyms

AQD	Air Quality Division
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CMAQ	Community Multi-scale Air Quality Modeling
EPA	U.S. Environmental Protection Agency
NAAQS	National Ambient Air Quality Standards
NO_x	nitrogen oxide
PAPA	Pinedale Anticline Project Area
ppm	parts per million
SEIS	supplemental environmental impact statement
VOCs	volatile organic compounds
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality
WRAP	Western Regional Air Partnership

Supplement to the Air Quality Impact Analysis TSD

Appendix H - Ozone Modeling Analysis

Ozone Modeling Analysis

1.1 INTRODUCTION

This ozone analysis was prepared as a supplement to the Draft Supplemental Environmental Impact Statement (Draft SEIS) for the Pinedale Anticline Oil and Gas Exploration and Development Project. Ozone is a criteria pollutant as part of the National Ambient Air Quality Standards (NAAQS) established by the U.S. Environmental Protection Agency (EPA). Ground level ozone is formed from air pollutant precursors including volatile organic compounds (VOCs) and nitrogen oxide (NO_x) emissions. The responsibility for implementing the NAAQS in Wyoming is delegated to the Wyoming Department of Environmental Quality-Air Quality Division (WDEQ-AQD), with oversight by the EPA. Atmospheric ozone in excess of the standards is known to have negative human health effects and environmental consequences.

The BLM has performed a modeling analysis to predict ozone impacts using the Western Regional Air Partnership (WRAP) projected 2018 emissions inventory. WRAP is a collaborative effort of tribal governments, state governments, and various federal agencies to develop the technical and policy tools needed by western states to comply with the EPA's regional haze regulations. Specific model runs were not conducted for individual alternatives. The inventory used for modeling includes sources over a broad region based on the WRAP emission inventory. The inventory also includes an estimate of emissions in Sublette County which are greater than the emissions projections from any of the action alternatives in the Draft SEIS. The analysis was performed with the CALGRID photochemical modeling system in combination with one year of windfields determined using the CALMET meteorological model. Included in this supplement is Appendix H to the Air Quality Technical Support Document which details the modeling that was performed.

1.2 AFFECTED ENVIRONMENT

Ozone has been monitored at several sites within Sublette County in the Upper Green River Basin adjacent to the Pinedale Anticline Project Area (PAPA). The locations are within the Jonah Field, at the eastern edge of the PAPA near Boulder, and northwest of Pinedale near Daniel. The Boulder site has been in operation since January 2005, the Jonah Field site began operation in November 2004, and the Daniel site began operation in July 2005.

An area is in compliance with the NAAQS and WAAQS for ozone of 0.08 parts per million (ppm) if the 4th highest 8-hour concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard. Even though the air quality standard (NAAQS and WAAQS) for ozone is 0.08 ppm, an exceedance of the standard would not occur until the 4th highest 8-hour concentration averaged over 3 years is 0.085 ppm or above for the monitored values (due to rounding, see 40 CFR Section 50.10 and Appendix I). The highest four monitored 8-hour values for 2005 and 2006 are shown in Table 1.

The ambient air monitoring stations have recorded elevated ozone levels during their first 2 years of operation (2005 and 2006). The elevated ozone levels have been recorded during the winter months, primarily in the month of February, which is atypical when compared to other areas of the country where ozone levels are elevated. Typically, ozone is thought to be a summertime problem in urban areas. Elevated ozone concentrations are uncommon during the winter months; however, they do not appear to be an anomaly because these conditions were recorded in both February 2005 and February 2006. There are several hypotheses on the cause(s) of these elevated ozone events including stratospheric ozone intrusion, ozone transport from other areas, unique meteorological conditions acting upon local scale emissions, and instrument error.

Table 1
Maximum Monitored 8-hour Ozone Concentrations for 2005 and 2006

		Ozone Concentration (ppm)	
Monitor	**Rank**	**2005**	**2006 [1]**
Jonah Field	1st	0.098	0.093
	2nd	0.089	0.081
	3rd	0.078	0.072
	4th	0.076	0.070
Boulder	1st	0.088	0.081
	2nd	0.081	0.079
	3rd	0.080	0.076
	4th	0.079	0.072
Daniel	1st	0.070	0.082
	2nd	0.066	0.075
	3rd	0.066	0.074
	4th	0.066	0.074

[1] 2006 data represents first through third quarters only (January through September)

These hypotheses have been explored through evaluations of recorded conditions of meteorological data and air pollutant data, both locally and regionally. The evaluations have resulted in the current WDEQ-AQD concern that these elevated ozone concentrations monitored in the winter of 2005 and 2006 are a result of ground-level ozone formation. The WDEQ-AQD and EPA are concerned that unique wintertime meteorological conditions acting upon local scale emissions may be contributing to ozone formation. The WDEQ-AQD has initiated further evaluation of ozone formation in the Upper Green River Basin through a field study and modeling project to better understand the cause of these monitored elevated ozone levels. These efforts are currently being conducted by the WDEQ-AQD and will likely be completed within the next 2 years. The results of those efforts will form the basis for WDEQ-AQD to develop strategies to manage ozone formation in the Upper Green River Basin to ensure that the area remains in compliance with air quality standards (WAAQS and NAAQS).

1.3 ENVIRONMENTAL CONSEQUENCES

CALGRID modeling, based upon 2002 meteorology and 2018 WRAP emissions, yielded the four highest 8-hour concentrations for areas in western and northwestern Wyoming (see Table 2). Ozone concentrations were predicted above the level of the standard at these locations; however, maximum 4th highest 8-hour concentrations are below the air quality standards (NAAQS and WAAQS), based on the 3-year average of the yearly 4th highest daily 8-hour ozone concentrations. These predicted concentrations are similar in magnitude to what has been measured at monitors in the area.

It is important to note that the concentrations predicted with CALGRID represent ozone concentrations that could form as a result of the ambient atmospheric conditions and all projected 2018 emissions present, not just those from the PAPA. The CALGRID modeling also included initial and boundary conditions that were extracted from the WRAP's Community Multi-scale Air Quality (CMAQ) modeling. It is therefore not appropriate to add any background ozone value to these modeled conditions in the project area.

Table 2
Maximum Predicted 8-Hour Ozone Concentrations

Area	Rank	Ozone Concentration (ppm)
Yellowstone National Park (Northeastern Teton County/Western Park County)	1st	0.097
	2nd	0.076
	3rd	0.069
	4th	0.068
Yellowstone National Park (Western Park County)	1st	0.084
	2nd	0.077
	3rd	0.060
	4th	0.059
Northeastern Lincoln County/Western Sublette County	1st	0.118
	2nd	0.088
	3rd	0.073
	4th	0.070
Western Fremont County	1st	0.114
	2nd	0.076
	3rd	0.073
	4th	0.069
Eastern Sublette County/Western Fremont County	1st	0.105
	2nd	0.097
	3rd	0.079
	4th	0.076

The modeling analysis discloses predicted ozone concentrations that are less than the air quality standards for ozone (NAAQS and WAAQS). The highest predicted concentrations from this analysis occur during the summer months. The unexplained elevated ozone concentrations that have been monitored during the winter months near the PAPA are being investigated in a separate analysis by WDEQ-AQD (see Affected Environment, above).

This ozone analysis included emission levels of VOCs and NO_x from cumulative sources in the Pinedale area. Specific model runs were not conducted for individual alternatives.

1.4 MITIGATION

Air Quality modeling predicts elevated levels of ozone in summer months and actual monitoring has shown elevated levels of ozone approaching the level of the air quality standard in the winter months. Therefore, the Operators should continue to use new techniques for controlling NO_x emissions (see Draft SEIS Chapter 4, pages 4-74 through 4-75) as well as VOC emissions to reduce potential ozone impacts including, but not limited to the following:

- use of liquid gathering systems,
- centralization of gathering facilities,
- reduction in truck traffic, and
- proposed revisions to strengthen WDEQ-AQD oil and gas permitting guidance.

The BLM will work cooperatively with WDEQ-AQD and the EPA and the joint Air Quality Stakeholders group to appropriately refine the ozone modeling presented in this supplement, in order to improve the characterization of the effects of terrain on local pollutants.

WDEQ is the regulatory authority to maintain and monitor compliance with state and federal air quality standards. To date, there is no finding of an ozone air quality standard violation. Should the 8-hour ozone standard be violated, the WDEQ and EPA would be required to consider and adopt the mandatory measures needed to bring the area back into compliance. The Operators, BLM, WDEQ, and EPA will work cooperatively through adaptive management to avoid this situation. The BLM will continue to work in consultation with WDEQ-AQD and EPA to review ozone data monitored in the area. If future air monitoring continues to show ozone exceedances that are attributable at least in part to sources in the PAPA, BLM will coordinate with WDEQ-AQD and EPA to define a specific adaptive management strategy to mitigate ozone precursor emissions.

Air Quality Impact Analysis Technical Support Document (Supplement)

Appendix H - Ozone Modeling Analysis

Draft Supplemental
Pinedale Anticline Oil and Gas Exploration and Development Environmental Impact Statement

Prepared for

Bureau of Land Management
Pinedale Field Office
Pinedale, Wyoming

Bureau of Land Management
Wyoming State Office
Cheyenne, Wyoming

February 2007

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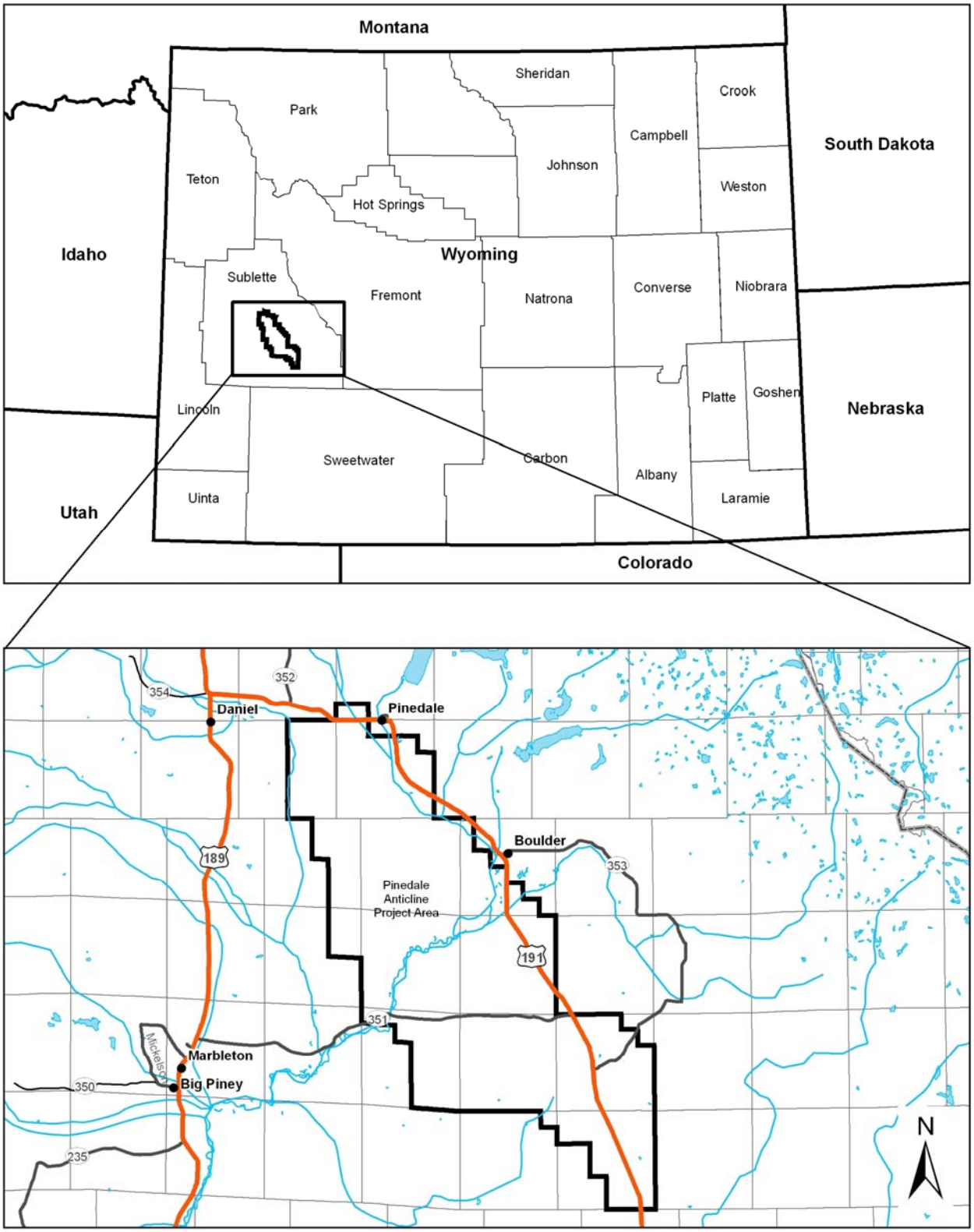
1.0 INTRODUCTION

This appendix to the Air Quality Technical Support Document (Air Quality TSD), was prepared as part of the supplemental ozone modeling analysis to the Draft Supplemental Pinedale Anticline Oil and Gas Exploration and Development Environmental Impact Statement (Draft SEIS). The Air Quality TSD details the project emissions inventories and presents all other analyses which quantify impacts from the proposed project to ambient air quality and Air Quality Related Values (AQRVs).

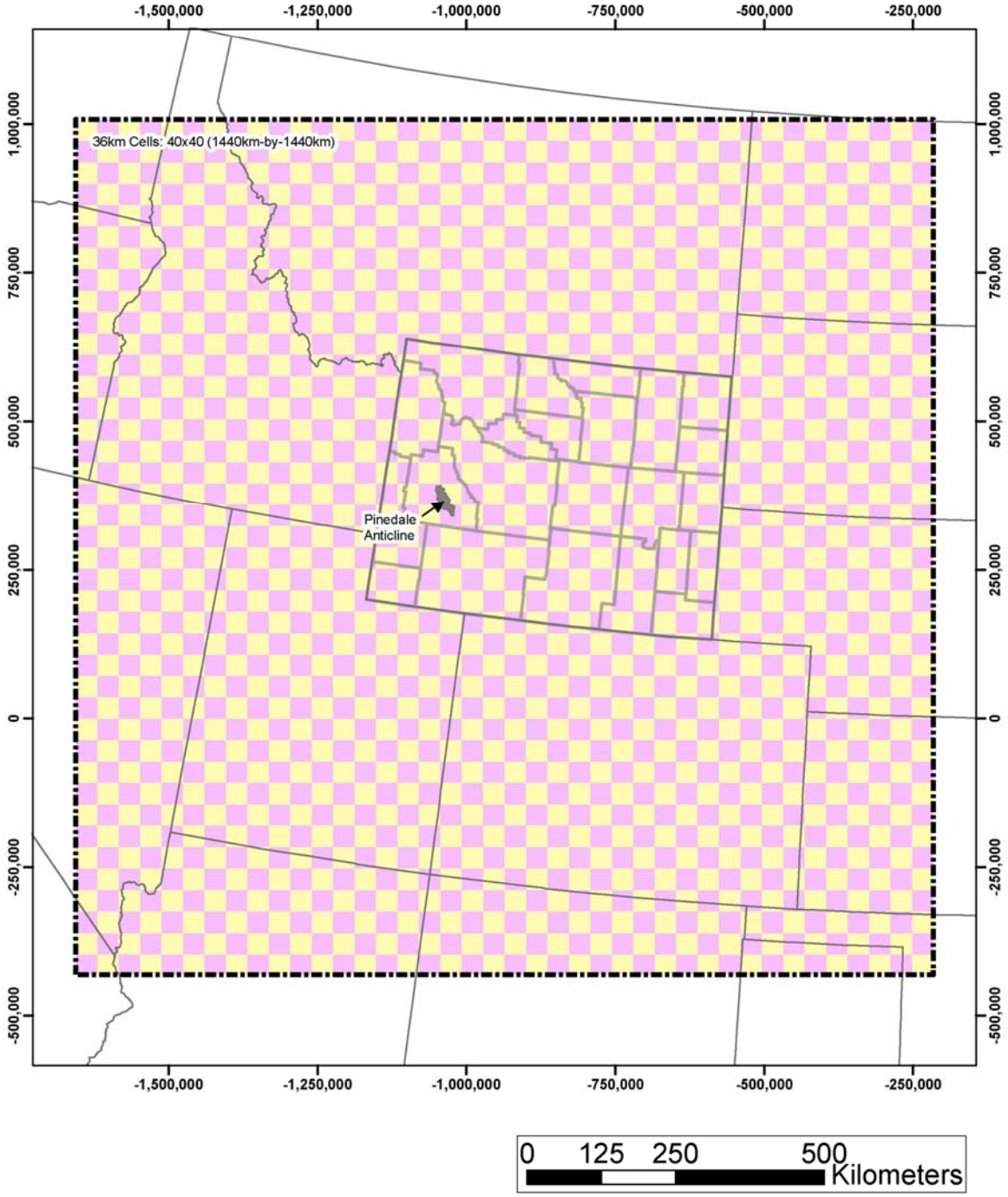
The analysis was prepared by TRC with input and oversight from the lead agency, U.S. Department of Interior, Bureau of Land Management (BLM), and project stakeholders including the U.S. Environmental Protection Agency (EPA), National Park Service (NPS), U.S. Department of Agriculture, Forest Service (USFS), and the Wyoming Department of Environmental Quality - Air Quality Division (WDEQ-AQD). The EPA screening methodology, Scheffe (1988), for ozone analysis, which utilizes nitrogen oxide (NO_x) and volatile organic carbon (VOC) emissions ratios to calculate ozone concentrations, was planned for inclusion in the Draft SEIS. However, BLM, with the agreement of the Air Quality Stakeholder Group, has determined that the CALGRID (Scire, et al., 1989; Yamartino et al., 1992 and Earth Tech, 2005) photochemical modeling system is the most appropriate method for estimating ozone impacts from the PAPA.

This appendix summarizes the CALGRID modeling analysis which estimates ozone impacts from potential air emissions resulting from development and production within the PAPA under all project alternatives and from other documented regional emissions sources within a multi-state study area. The project's location in Sublette County Wyoming is shown on Map 1.1 and the modeling domain (study area) used for the CALGRID analysis is shown on Map 1.2.

Map 1.1
Pinedale Anticline Project Location, Sublette County Wyoming



Map 1.2
Modeling Domain



Map Projection: LCC. Standard Parallels: 33ºN, 45ºN. Center: 40ºN, 97ºW. NWS-84 (Spherical Earth: Radius = 6370 km)

2.0 CALGRID ANALYSIS

2.1 MODELING METHODOLOGY

The CALGRID photochemical modeling system (CALGRID Version 2.45) was used for the ozone modeling analysis. The CALMET meteorological model (CALMET Version 5.726) (Scire et al., 2000) was used in combination with MM5 mesoscale meteorological model output to develop gridded meteorological fields for 1 year (2002). CALGRID was used to estimate hourly ozone impacts for the study area shown on Map 1.2.

The Western Regional Air Partnership (WRAP, 2006) modeling was performed using the Community Multi-scale Air Quality (CMAQ) model as a basis for the CALGRID ozone modeling analysis (http://pah.cert.ucr.edu/aqm/308/emissions.shtml). Over the past several years, the WRAP has developed detailed emissions inventories and performed extensive modeling analyses for ambient air quality impacts and regional haze analyses. The WRAP's CMAQ modeling performed for year 2002 and the WRAP's projected year 2018 emissions inventories were used for the PAPA CALGRID modeling analysis. Specifically, the CMAQ model output concentrations for the WRAP's modeling year 2002 were used to develop hourly boundary conditions for CALGRID for the modeling domain presented on Map 1.2. The WRAP's projected emissions inventories for year 2018 were used to develop hourly gridded emissions for CALGRID to estimate ozone impacts.

2.2 PROJECT ALTERNATIVE EMISSIONS

The WRAP's emissions inventory for projected year 2018 (Base Case 18B-http://vista.cira.colostate.edu/TSS/Results/Emissions.aspx) was reviewed to determine whether or not the projected emissions from oil and gas development in Sublette County, Wyoming included the projected expansions for the PAPA and other large natural gas field projects that have been analyzed under NEPA (National Environmental Policy Act) as Reasonably Foreseeable Development (RFD). Table 2.1 presents a summary of the projected 2018 Sublette County oil and gas emissions from the WRAP inventory compared with the maximum projected emissions from all PAPA Draft SEIS alternatives and other major NEPA RFD natural gas field developments (Jonah Infill, South Piney, and Riley Ridge) in Sublette County.

As shown in Table 2.1, the oil and gas emissions included in the WRAP year 2018 emissions inventory is far greater than the emissions from any of the action alternatives in the Draft SEIS and is also greater than the combined emissions from the action alternatives in the Draft SEIS and RFD. In addition, while the action alternatives in the Draft SEIS and RFD emissions totals include emissions from sources such as large compression facilities and mobile sources, the WRAP oil and gas inventory emissions shown in Table 2.1 do not include these source types. These source types are included in other WRAP inventories such as the point source and mobile source inventories. If these inventories were also included in this comparison, it would show an even larger disparity between WRAP estimated 2018 emissions and the combined emissions estimated for these four projects (Jonah Infill, South Piney, and Riley Ridge).

The large discrepancy in the WRAP estimated emissions compared to the project specific/RFD estimates are due to overly conservative emission factors used in the WRAP inventory. For example, in the WRAP inventory VOC emissions from flaring were estimated as 86 tons for each well completed. Nearly all completions in Sublette County are now "green completions"

requiring no flaring unless an upset or emergency condition is encountered. Overestimates such as this are found throughout the inventory and are due to the use of conservative emission factors. The emissions are based on the limited control measures that were available when the inventory was developed.

Table 2.1 Summary of Western Regional Air Partnership 2018 Oil and Gas Emissions Compared with PAPA and other Sublette County NEPA Analyzed RFD Emissions (tpy)

	Emissions (tpy)			
	NO_x	CO	VOCs	SO_2
Draft SEIS Alternative				
PAPA - Actual 2005	3,988.9	3,174.8	2,737.1	231.8
PAPA - Alternative A - 2007	6,463.2	4,592.5	2,629.9	64.6
PAPA - Alternative B - 2009	5,595.8	4,185.0	2,357.2	70.8
PAPA - Alternative C - Phase I	4,290.6	3,497.6	2,357.2	231.8
PAPA - Alternative C - Phase II	2,217.9	1,872.3	2,357.2	55.0
PAPA - Alternative B - 2026	3,333.6	2,599.2	2,986.2	2.5
Reasonably Foreseeable Development				
RFD - Jonah Infill - Maximum Annual[1]	696.7	4,037.2	14,084.5	34.1
RFD - South Piney - Maximum Annual[2]	736.7	1,380.8	969.4	1.3
RFD - Riley Ridge - Maximum Annual[3]	233.6	159.9	228.9	0.1
Draft SEIS Alternative and RFD				
PAPA - Actual 2005 and RFD Projects	5,655.9	8,752.7	18,019.9	267.3
PAPA - Alternative A - 2007 and RFD	8,130.2	10,170.4	17,912.7	100.2
PAPA - Alternative B - 2009 and RFD	7,262.8	9,762.9	17,640.0	106.3
PAPA - Alternative C - Phase I and RFD	5,957.6	9,075.5	17,640.0	267.3
PAPA - Alternative C - Phase II and RFD	3,884.9	7,450.3	17,640.0	90.5
PAPA - Alternative B - 2026 and RFD	5,000.6	8,177.1	18,269.0	38.0
WRAP - Sublette County 2018 Base B Oil and Gas Area Sources	32,686.0	2,469.0	103,709.0	8.0

[1] Jonah Infill maximum annual emissions taken from the Preferred Alternative in Table 2.3 of the Final Air Quality Technical Support Document for the Jonah Infill Drilling Project Environmental Impact Statement, Volume 1 of 2, January, 2006 (TRC, 2006).
[2] South Piney maximum annual emissions taken from the RFD analysis in the Draft SEIS.
[3] Riley Ridge maximum annual emissions estimated based on a total of 238 wells and per well production emission estimates in the PAPA Draft SEIS. Compression estimates from the original Riley Ridge analysis were also included.

The WRAP 2018 emissions, including the oil and gas inventory and all other inventories, were therefore used as is, without adding any Draft SEIS action alternatives or RFD emissions to the WRAP 2018 Sublette County emissions totals, for the CALGRID modeling to provide a screening estimate of potential ozone formation near the PAPA from any of the action alternatives in the Draft SEIS and from cumulative sources including RFD in Sublette County. Specific model runs were not conducted for individual alternatives.

2.3 METEOROLOGICAL MODEL INPUT AND OPTIONS

The CALMET model was used to develop meteorological fields for the study area shown on Map 1.2. The modeling domain covers the PAPA and includes a geographic area large enough to encompass the major cities that could potentially influence ozone formation near the PAPA.

One year of CALMET hourly meteorological fields were developed and used for the modeling analysis. The year 2002 was selected based on the WRAP's modeling for year 2002 which had produced both the CMAQ concentration fields and MM5 meteorological fields on the regional grid with 36-km spacing (ENVIRON, 2005).

The 1,440 km by 1,440km square CALMET modeling domain was prepared with a uniform 40 x 40 horizontal grid using 36-km resolution, based on a Lambert Conformal Projection defined with a central longitude/latitude at (97°W/40°N) and first and second latitude parallels at 33°N and 45°N. A spherical earth datum with a radius of 6370 km was selected to align with the CMAQ and MM5 WRAP modeling. CALMET was run in the "no-observations" mode, using the MM5 model output in place of discrete observation station data. Ten vertical layers were used, with layer interface heights of 20, 40, 80, 160, 300, 600, 1,000, 1,500, 2,200, and 3,000 meters.

Given the large scale of the modeling domain and the use of 36 km cells, global land use and terrain datasets were used in the development of the CALMET wind fields. The terrain data are from the United States Geological Survey (USGS) GTOPO30 dataset, a 30 arc-second digital elevation model (DEM) with data approximately every 900m. The land use data are from the USGS Global Lambert Azimuthal dataset which is gridded at a 1 km resolution. A sample CALMET model output file is included in Appendix A which details the model switch settings.

2.4 DISPERSION MODEL INPUT AND OPTIONS

The CALGRID model was used to estimate ozone formation from the projected 2018 emissions of NO_x, SO_2, CO, and VOC species. Hourly boundary conditions at the top and along the sides of the CALGRID modeling domain ere extracted from the CMAQ model output of hourly concentrations for year 2002 (Base Period 02B) for the WRAP domain modeled using 36-km grid spacing. Hourly emissions for CALGRID were extracted from WRAP's projected 2018 emissions (Base Case 18B) processed using the same 36-km grid spacing.

Chemical transformations were modeled based on the Carbon Bond 4 (CB4) photochemistry mechanism for ozone formation. A sample CALGRID model output file which details the model switch settings is included in Attachment 1.

2.5 MODEL RESULTS

CALGRID modeling was performed using the 2002 meteorological fields to estimate hourly ozone concentration impacts from all projected 2018 emissions in the WRAP inventory. Hourly ozone concentrations were predicted for each 36-km grid cell in the modeling domain. Concentrations in layer one of the modeling grid (surface layer) were subsequently processed with CALPOST to produce running 8-hour averaged concentrations.

Several maximum daily-peak 8-hour ozone concentrations in the vicinity of the PAPA are shown on Map 2.1. These are the maximum 8-hour ozone concentration values in western and

northwestern Wyoming that could potentially result from emission levels including oil and gas developments in Sublette County Wyoming and that are above the level of the 8-hour National Ambient Air Quality Standard (NAAQS) and Wyoming Ambient Air Quality Standard (WAAQS) of 0.08 parts per million (ppm). These are used as a screening level estimate of ozone impacts from action alternatives in the Draft SEIS.

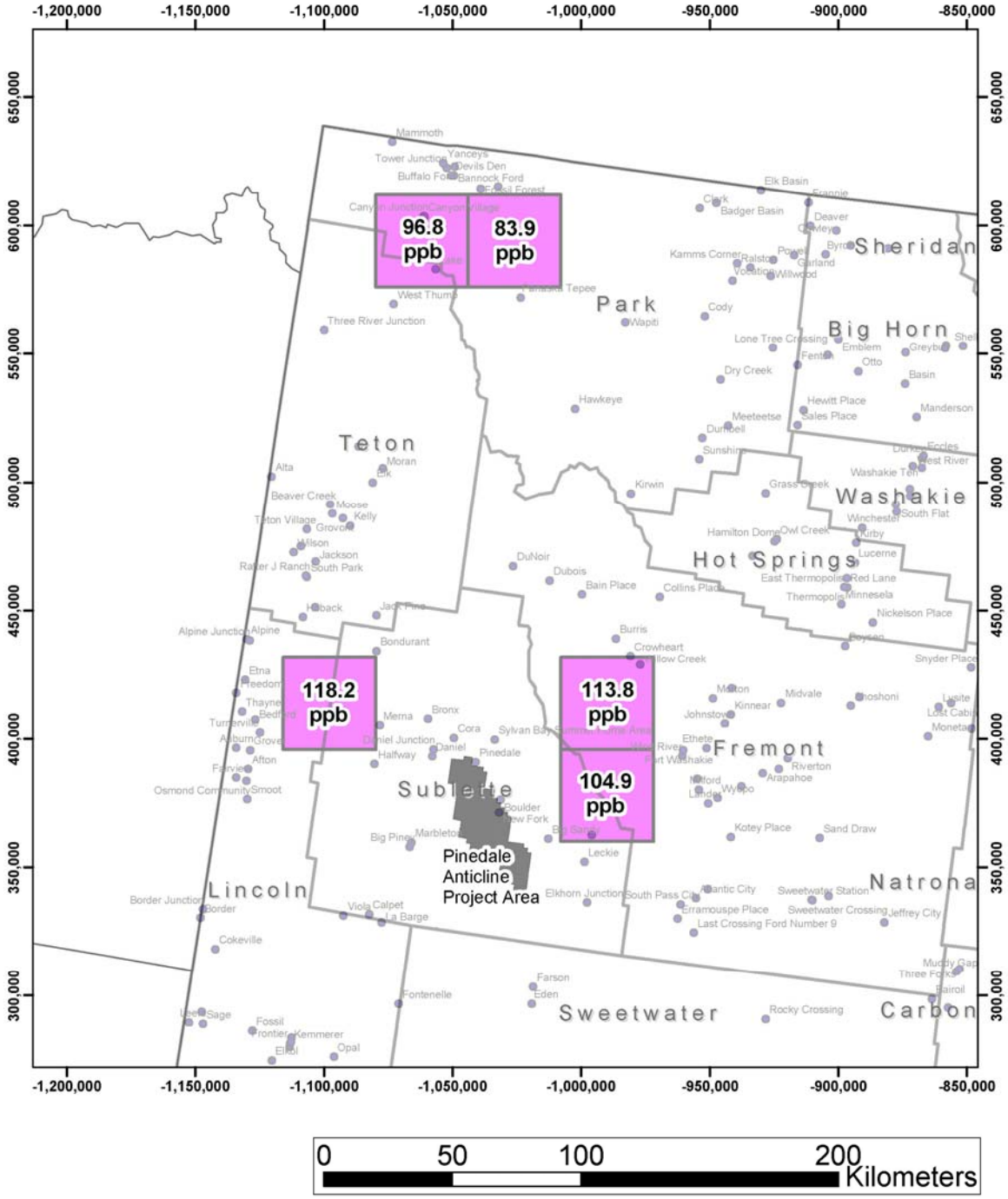
An area is in compliance with the NAAQS and WAAQS for ozone of 0.08 parts per million (ppm) if the 4th highest 8-hour concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard. Even though NAAQS and WAAQS standard for ozone is 0.08 ppm, an exceedance of the standard would not occur until the 4th highest 8-hour concentration averaged over 3 years is 0.085 ppm or above for the monitored values (due to rounding, see 40 CFR Section 50.10 and Appendix I). The 4th highest 8-hour concentrations for the one year of CALGRID modeling are shown on Map 2.2 for the areas where the maximum impacts were predicted above the level of the NAAQS and WAAQS. In addition, the top four values for each of these areas are provided in Table 2.2. As shown on Map 2.1 and in Table 2.2, the modeling analysis discloses predicted ozone concentrations that are less than the air quality standards (NAAQS and WAAQS).

It is important to note that the concentrations predicted with CALGRID represent ozone concentrations that could form as a result of the ambient atmospheric conditions and all projected 2018 emissions present, not just those from the PAPA. The CALGRID modeling also included initial and boundary conditions that were extracted from the WRAP's Community Multi-scale Air Quality (CMAQ) modeling. It is therefore not appropriate to add any background ozone value to these modeled conditions in the project area.

Table 2.2 Maximum Predicted 8-hour Ozone Concentrations (ppb)

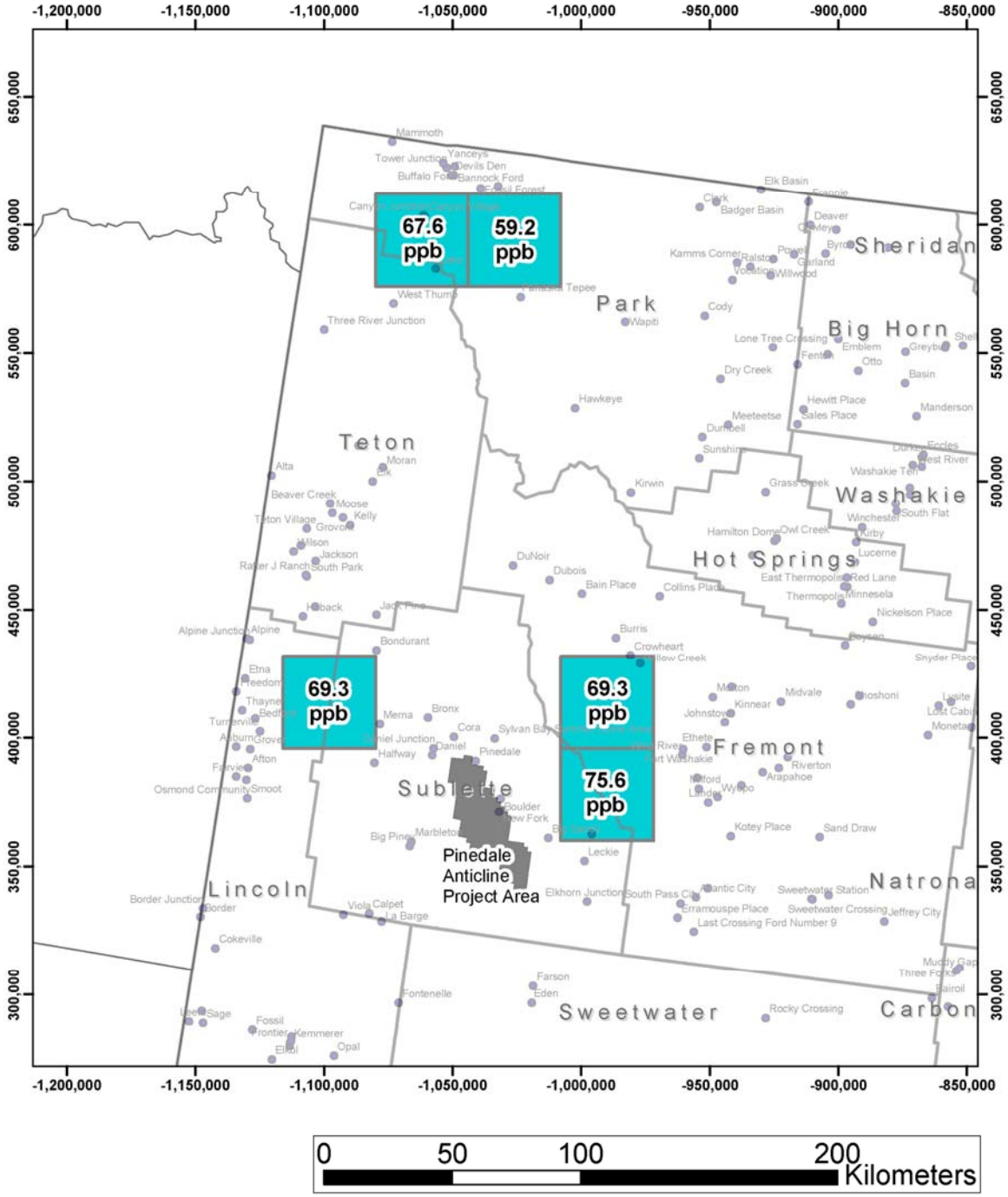
Area	Rank	Ozone Concentration (ppb)	Month, Day, Beginning Hour
Yellowstone National Park (Northeastern Teton County/Western Park County)	1st	96.8	7/12/10
	2nd	75.5	7/13/09
	3rd	69.0	7/14/09
	4th	67.6	7/11/08
Yellowstone National Park (Western Park County)	1st	83.9	7/14/10
	2nd	76.9	7/09/11
	3rd	59.5	5/10/07
	4th	59.2	7/10/09
Northeastern Lincoln County/Western Sublette County	1st	118.2	7/16/10
	2nd	87.5	7/13/10
	3rd	72.5	5/10/09
	4th	69.3	7/14/09
Western Fremont County	1st	113.8	7/05/11
	2nd	75.8	7/03/10
	3rd	73.3	5/10/09
	4th	69.3	5/09/09
Eastern Sublette County/Western Fremont County	1st	104.9	7/05/10
	2nd	97.3	7/06/11
	3rd	78.9	5/10/09
	4th	75.6	7/03/10

Map 2.1
Maximum Predicted 8-Hour Ozone Concentration Values



Map Projection: LCC. Standard Parallels: 33°N, 45°N. Center: 40°N, 97°W. NWS-84 (Spherical Earth: Radius = 6370 km)

Map 2.2
Maximum Predicted Fourth Highest 8-Hour Ozone Concentration Values



Map Projection: LCC. Standard Parallels: 33ºN, 45ºN. Center: 40ºN, 97ºW. NWS-84 (Spherical Earth: Radius = 6370 km)

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Attachment 1

Sample CALMET and CALGRID Input Control Files

CALMET Input Control File

```
Pinedale Anticline.  36 km CALMET run.  MAY 2002
40 x 40 grid points
No-Obs mode.  No diagnostic adjustments.
---------------- Run title (3 lines) ----------------------------------------

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

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT=\calmet\36km\geo\GEO40X40.DAT       !
SURF.DAT      input    * SRFDAT=            *
CLOUD.DAT     input    * CLDDAT=            *
PRECIP.DAT    input    * PRCDAT=            *
WT.DAT        input    * WTDAT=             *

CALMET.LST    output   ! METLST=PDMET_MAY.LST     !
CALMET.DAT    output   ! METDAT=PDMET_MAY.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 = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  0  !
    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 =  9  !

    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=UP_X.DAT *    *END*
-------------------------------------------------------------------------------
Subgroup (c)
----------------------------------------
Overwater station files (one per station)
----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
SEA1.DAT       input     1  * SEADAT=SEA_449.DAT *    *END*
-------------------------------------------------------------------------------
Subgroup (d)
-----------------------------------------------
MM4/MM5/3D.DAT files (consecutive or overlapping)
-----------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
MM51.DAT       input     31 ! M3DDAT= extracted_2002042900-2002050223.txt!    !END!
MM51.DAT       input     32 ! M3DDAT= extracted_2002050300-2002050623.txt!    !END!
```

```
MM51.DAT       input     33 ! M3DDAT= extracted_2002050700-2002051023.txt!    !END!
MM51.DAT       input     34 ! M3DDAT= extracted_2002051100-2002051423.txt!    !END!
MM51.DAT       input     35 ! M3DDAT= extracted_2002051500-2002051823.txt!    !END!
MM51.DAT       input     36 ! M3DDAT= extracted_2002051900-2002052223.txt!    !END!
MM51.DAT       input     37 ! M3DDAT= extracted_2002052300-2002052623.txt!    !END!
MM51.DAT       input     38 ! M3DDAT= extracted_2002052700-2002053023.txt!    !END!
MM51.DAT       input     39 ! M3DDAT= extracted_2002053100-2002060323.txt!    !END!

-------------------------------------------------------------------------------
Subgroup (e)
-------------------------------------------------
IGF-CALMET.DAT files (consecutive or overlapping)
-------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
IGFn.DAT       input     1  * IGFDAT=CALMET0.DAT *    *END*
-------------------------------------------------------------------------------
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=  2002  !
                     Month (IBMO) -- No default       ! IBMO=  5  !
                       Day (IBDY) -- No default       ! IBDY=  1  !
                      Hour (IBHR) -- No default       ! IBHR=  1  !

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

     Base time zone        (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

!END!

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

INPUT GROUP: 2 -- Map Projection and Grid control parameters
--------------

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

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

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

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                    Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                   Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN =  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 = 40N  !
     (RLON0)                    No Default      ! RLON0 = 97W  !

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

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

```
        LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
        PS  :  Projection plane slices through Earth at XLAT1
               (XLAT2 is not used)

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


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

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

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

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


     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 =   40  !
            No. Y grid cells (NY)      No default     ! NY =   40  !

     Grid spacing (DGRIDKM)             No default     ! DGRIDKM = 36. !
                                        Units: km

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

        X coordinate (XORIGKM)          No default     ! XORIGKM = -1656.000 !
        Y coordinate (YORIGKM)          No default     ! YORIGKM = -432.000 !
                                        Units: km


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

        No. of vertical layers (NZ)     No default     ! NZ =  10  !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))     No defaults
                                        Units: m
        ! ZFACE = 0.,20.,40.,80.,160.,300.,600.,1000.,1500.,2200.,3000. !

!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  1  hours)


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


       Specify which levels of the W wind component to print
       (NOTE: W defined at TOP cell face --  10  values)
       (IWOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T & LCALGRD=T)
       -----------------------------------
                                            Defaults: NZ*0
        ! IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !


       Specify which levels of the 3-D temperature field to print
       (ITOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T & LCALGRD=T)
       -----------------------------------
                                            Defaults: NZ*0
        ! ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !

       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 =  0  !

    Print the INTERPOLATED wind components ?
    (IPR0) (0=no, 1=yes)             Default: 0       !  IPR0 =  0  !

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

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

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

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

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

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

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

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

!END!
```

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

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

    NO OBSERVATION MODE             (NOOBS)  Default: 0     ! NOOBS =  2   !
          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 =  0  !

       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5/3D.DAT precip data)
                                    (NPSTA)  No default     ! NPSTA =  0  !

    CLOUD DATA OPTIONS
       Gridded cloud fields:
                                   (ICLOUD)  Default: 0     ! ICLOUD =  3  !
       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 computed from prognostic fields

    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 =  0  !
       (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  =  0  !
   (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  !

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

   Use gridded prognostic wind field model
   output fields as input to the diagnostic
   wind field model (IPROG)              Default: 0      ! IPROG =  14  !
   (0 = No, [IWFCOD = 0 or 1]
    1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
    2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]
    3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]
    4 = Yes, use winds from MM4.DAT file as initial guess field [IWFCOD = 1]
    5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]
    13 = Yes, use winds from MM5/3D.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 = 30. !
                                         Units: km
   Maximum radius of influence over land
   aloft (RMAX2)                         No default      ! RMAX2 = 30. !
                                         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 = 50. !

                                            Units: km
      Relative weighting of the first
      guess field and observations in the
      SURFACE layer (R1)                    No default      ! R1 = 1. !
      (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 = 1. !
      (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= 5.0E-06 !

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

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

      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 =
 5 ,  5 ,  5 ,  5 ,  5 ,  5 ,  5 ,  5 ,  5 ,  5  !

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

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

      Multiplicative scaling factor for
      extrapolation of surface observations
      to upper layers (FEXTR2(NZ))          Default: NZ*0.0
      ! FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0., 0., 0. !
      (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 = 0. !
      Y coordinate of BEGINNING
      of each barrier (YBBAR(NBAR))      ! YBBAR = 0. !

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


DIAGNOSTIC MODULE DATA INPUT OPTIONS

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

      Surface met. station to use for
      the surface temperature (ISURFT)   No default     ! ISURFT =  4  !
      (Must be a value from 1 to NSSTA)
      (Used only if IDIOPT1 = 0)
      --------------------------

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

      Upper air station to use for
      the domain-scale lapse rate (IUPT) No default     ! IUPT   =  2  !
      (Must be a value from 1 to NUSTA)
      (Used only if IDIOPT2 = 0)
      --------------------------

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

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

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

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

   Observed surface wind components
   for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 =  0  !
```

```
          0 = Read WS, WD from a surface
              data file (SURF.DAT)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

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

       LAKE BREEZE INFORMATION

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

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

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

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

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

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

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


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

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

!END!


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

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

    EMPIRICAL MIXING HEIGHT CONSTANTS

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

    SPATIAL AVERAGING OF MIXING HEIGHTS
```

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

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


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 =  2  !
   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 = 3000. !
   (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 =  2   !

      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 = 5  !

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

   Default temperature gradient          Default: -.0098   ! TGDEFB = -0.0098 !
   below the mixing height over          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 = 50. !
        (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 --  0  records in all)


             1     2
         Name   ID            X coord.   Y coord.   Time   Anem.
                               (km)       (km)      zone   Ht.(m)
       -------------------------------------------------------
-------------------
      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 --  0  records in all)

             1     2
         Name    ID      X coord.   Y coord.  Time zone
                           (km)       (km)
        ----------------------------------------------
-------------------
      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 --  0  records in all)
     (NOT INCLUDED IF NPSTA = 0)
```

```
           1          2
        Name   Station    X coord.  Y coord.
                 Code       (km)      (km)
        ------------------------------------


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

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

!END!
```

CALGRID Input Control File

```
                                        CALGRID   Version: 2.45a          Level: 061209
*****************************************************************************************************



 Clock time: 21:02:13
       Date: 01-16-


 Run Title:
    CALGRID run for Pinedale-Anticline 40x40x10 grid
    36 km grid cells / Smoke 3D gridded emissions / CMAQ BCs
    MAY

---------------- RUN TITLE (3 LINES) ------------------------------------------


                         CALGRID MODEL CONTROL FILE

ADDITIONAL USER COMMENTS
------------------------
Uses Hourly CALMET input data
EMISSIONS from SMOKE: egts3d_l.2002ddd.1.RPO_US_36.Base18b.cmaq.cb4p25
BOUNDARY & TOP BCs from CMAQ: CCTM_v45_cb4_ae3_aq_ebi_yamo_mpi.Base02b.CONC
REVISED BEIS2 CB-IV CHEMISTRY
Option configuration:  OTC 2002 Testcase


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

INPUT GROUP: 1 -- GENERAL RUN CONTROL PARAMETERS
--------------

     STARTING DATE:   YEAR (IBYR) -- NO DEFAULT       ! IBYR= 02 !
                     MONTH (IBMO) -- NO DEFAULT       ! IBMO=  5 !
                       DAY (IBDY) -- NO DEFAULT       ! IBDY=  1 !
                      HOUR (IBHR) -- NO DEFAULT       ! IBHR=  0 !

     LENGTH OF RUN (HOURS) (IRLG) -- NO DEFAULT       ! IRLG= 744 !  31 days

     NUMBER OF TIME STEPS
     PER HOUR (NSUBTS)            -- DEFAULT: 3       ! NSUBTS= 3 !
     (TIME STEP (SEC) = 3600./NSUBTS)

     TOTAL NUMBER OF CHEMICAL SPECIES
     (ADVECTED + STEADY-STATE SPECIES) (NSPEC)
                                     DEFAULT: 47      ! NSPEC=40 !

     NUMBER OF CHEMICAL SPECIES
     TO BE ADVECTED (NSA)            DEFAULT: 36      ! NSA=35  !

     NUMBER OF CHEMICAL SPECIES
     TO BE DEPOSITED (NSDD)          DEFAULT: 15      ! NSDD=12 !

     NUMBER OF CHEMICAL SPECIES
     TO BE EMITTED  (NSE)            DEFAULT: 13      ! NSE=14!

     TOTAL NUMBER OF AEROSOL SPECIES
     (ADVECTED - INCLUDES NH3) (NASPEC)
                                     DEFAULT: 6      ! NASPEC=8 !

     NUMBER OF AEROSOL SPECIES
     TO BE DEPOSITED (NASDD)         DEFAULT: 6      ! NASDD=8 !

     NUMBER OF AEROSOL SPECIES
     TO BE EMITTED  (NASE)           DEFAULT: 6      ! NASE=8 !


     TYPE OF CHEMICAL MECHANISM
     IN USE (ICHEM)                  DEFAULT: 1       ! ICHEM=2 !
         1 = SAPRC-90
```

```
    2 = CB4

TYPE OF AEROSOL CHEMISTRY
IN USE (IAERO)                  DEFAULT: 1       ! IAERO=2 !
    1 = ISORROPIA
    2 = CHEMEQ

COLUMNAR OZONE IN DOBSON UNITS
TO BE USED DURING RUN           DEFAULT: 295     ! IOZDU=295 !

METHOD FLAG FOR INTEGRATION OF
CHEMICAL MECHANISM (METHINT)    DEFAULT: 2       ! METHINT=2 !
    1 = HYBRID METHOD
    2 = QSSA METHOD

WHETHER HORIZONTAL ADVECTION
SHOULD BE DONE      (LHORIZ)    DEFAULT: T       ! LHORIZ=T !
    F = NO
    T = YES

WHETHER VERTICAL ADVECTION
SHOULD BE DONE     (LVADV)      DEFAULT: T       ! LVADV=T !
    F = NO
    T = YES

WHETHER VERTICAL DIFFUSION
SHOULD BE DONE     (LVDIFF)     DEFAULT: T      ! LVDIFF=T !
    F = NO
    T = YES

WHETHER CHEMISTRY SHOULD BE
DONE               (LCHEM)      DEFAULT: T       ! LCHEM=T !
    F = NO
    T = YES

WHETHER AEROSOL CHEMISTRY SHOULD BE
DONE               (LAERO)      DEFAULT: T       ! LAERO=T !
    F = NO
    T = YES

TYPE OF SIMULATION DESIRED       DEFAULT: 3      ! ISIMTYPE=3 !

       ISIMTYP = 1 ONLY GAS PHASE SIMULATION
       ISIMTYP = 2 ONLY AEROSOL PHASE SIMULATION
       ISIMTYP = 3 BOTH GAS AND AEROSOL PHASE SIMULATION

INPUT FILE TYPES:

     METEOROLOGICAL VARIABLES (CALMET.DAT) FILE
     ------------------------------------------

                                DEFAULT: 1      ! ITIMET=1 !

       ITIMET = 1 STANDARD HOUR ENDING CALMET.DAT FILE
       ITIMET = 2 NEW HOUR SPANNING METEOROLOGICAL DATA FILE
       ITIMET = 3 USES UAM-V BINARY MET FILES


     INITIAL CONCENTRATION (ICON.DAT) FILE
     -------------------------------------

                                DEFAULT: 1      ! ITICON=3 !

       ITICON = 1 FOR A FORMATTED TEXT FILE CONTAINING ONE
                  CONCENTRATION VALUE PER LAYER PER SPECIES
       ITICON = 2 FOR AN UNFORMATTED FILE CONTAINING A FULL
                  3-D SET OF CONCENTRATIONS FOR EACH SPECIES
                  (NX * NY * NZ * NSA VALUES)
       ITICON = 3 to read a full 3-D set of initial concentrations
                  from a direct access unformatted file (restart
                  only)
```

```
  ITICON = 4 to read a full 3-D set of initial concentrations
             from a direct access unformatted file (restart
             only - this is previous hour backup option)
  ITICON = 5 FOR A UAM-V UNFORMATTED FILE CONTAINING A FULL
             3-D SET OF CONCENTRATIONS FOR EACH SPECIES
             (NX * NY * NZ * NSA VALUES)

NESTED GRID FILE OPTION
-----------------------

                           DEFAULT: 0      ! ITNEST=0 !

  ITNEST = 0 FOR NO NESTED GRID EXTRACTION
  ITNEST = 1 FOR HOURLY NESTED BOUNDARY FILE
  ITNEST = 2 FOR TIMESTEP-BY-TIMESTEP NESTED BOUNDARY FILE



SIDE BOUNDARY CONCENTRATION (BCON.DAT) FILE
-------------------------------------------

                           DEFAULT: 1      ! ITBCON=2 !

  ITBCON = 1 FOR A FORMATTED TEXT FILE CONTAINING BOUNDARY
             TYPES AND TIME-INDEPENDENT BOUNDARY CONDITIONS
             AS A FUNCTION OF HEIGHT FOR EACH ADVECTED SPECIES
  ITBCON = 2 FOR AN UNFORMATTED FILE CONTAINING A FULL
             SET OF BOUNDARY CONDITIONS FOR EACH ADVECTED SPECIES
  ITBCON = 3 A UAM-V LATERAL BOUNDARY CONCENTRATION FILE IS READ
  ITBCON = 4 IF BCON FILE IS NOT USED.  TIME-INDEPENDENT
             BOUNDARY CONDITIONS ARE TAKEN FROM THE INITIAL
             CONCENTRATION FILE.

TOP BOUNDARY CONCENTRATION (TCON.DAT) FILE
------------------------------------------

                           DEFAULT: 1      ! ITTCON=2 !

  ITTCON = 1 FOR A FORMATTED TEXT FILE CONTAINING TIME-INDEPENDENT
             TOP BOUNDARY CONDITIONS FOR EACH ADVECTED SPECIES.
  ITTCON = 2 FOR AN UNFORMATTED FILE CONTAINING AN FULL
             SET OF TIME- AND SPACE-DEPENDENT TOP BOUNDARY
             CONDITIONS FOR EACH ADVECTED SPECIES.
  ITTCON = 3 A UAM-V ASCII TOP CONCENTRATION FILE IS READ
  ITICON = 4 IF TCON FILE IS NOT USED.  THE TOP LAYER OF THE
             INITIAL CONCENTRATION DISTRIBUTION IS USED TO OBTAIN
             TIME-INDEPENDENT TOP BOUNDARY CONDITIONS.

STATIONARY POINT SOURCE EMISSIONS FILE WITH CYCLICAL
OR CONSTANT EMISSIONS (PTEMCYC.DAT)
-----------------------------------------------------

                           DEFAULT: 1      ! ITEM1=2 !

  ITEM1  = 1 IF THE UNFORMATTED, DIRECT-ACCESS PTEMCYC INPUT
             FILE IS USED.
  ITEM1  = 2 IF THE PTEMCYC FILE IS NOT USED.


STATIONARY POINT SOURCE EMISSIONS FILE WITH ARBITRARILY
VARYING EMISSIONS (PTEMARB.DAT)
-------------------------------------------------------

                           DEFAULT: 1      ! ITEM2=3 !

  ITEM2  = 1 IF THE UNFORMATTED PTEMARB INPUT FILE IS
             USED.
  ITEM2  = 2 A UAM-V BINARY ELEVATED POINT SOURCE FILE IS READ
  ITEM2  = 3 A 3-D BINARY POINT SOURCE FILE IS READ
  ITEM2  = 4 IF THE PTEMARB FILE IS NOT USED.
```

```
          MOBILE POINT SOURCE EMISSIONS FILE (PTEMMOB.DAT)
          (CONSTANT EMISSIONS)
          ----------------------------------------------

                                   DEFAULT: 1      ! ITEM3=2 !

            ITEM3  = 1 IF THE UNFORMATTED PTEMMOB INPUT FILE IS
                       USED.
            ITEM3  = 2 IF THE PTEMMOB FILE IS NOT USED.


          AREA SOURCE EMISSIONS FILE (AREM.DAT)
          -------------------------------------

                                   DEFAULT: 1      ! ITEM4=4 !

            ITEM4  = 1 IF THE UNFORMATTED AREM INPUT FILE IS
                       USED.
            ITEM4  = 2 A UAM-V BINARY AREA INPUT FILE IS READ
            ITEM4  = 3 SAME AS 1 EXCEPT A 3-D FILE
            ITEM4  = 4 IF THE AREM FILE IS NOT USED.


          DISTRIBUTION FUNCTION FOR AREA SOURCE EMISSIONS
          -----------------------------------------------
          AREA SOURCE EMISSIONS CAN BE DISTRIBUTED AMONG
          SEVERAL LAYERS ACCORDING USER-SPECIFIED WEIGHTING
          FACTORS

             - FRACTION OF MASS DISTRIBUTED INTO EACH
               USER-DEFINED "EMISSIONS" LAYER (WTEM(NZEM))
               DEFAULTS:  0.75, 0.25                     ! WTEM = 0.90, 0.10 !
               NOTE: NZEM VALUES MUST BE ENTERED AND MUST
                     ADD UP TO 1.0

             - NUMBER OF EMISSIONS LAYERS (NZEM)
               DEFAULT: 2                                ! NZEM = 2 !
               NOTE: UP TO MXNZ LAYERS ARE ALLOWED, WHERE
                     MXNZ IS DEFINED IN THE PARAMETER FILE

             - HEIGHT (M) OF EACH EMISSION LAYER FACE
               (ZFEM(NZEM+1))   DEFAULT: 0.0, 50., 100. ! ZFEM = 0., 50., 100. !
               NOTE: NZEM+1 VALUES MUST BE ENTERED.

             - HOURLY EMISSIONS SCALING COEFFICIENT (HESC)
               (HESC(MXIRLG))    DEFAULT: MXIRLG*1.0
               ! HESC = 24*1.0 !
               NOTE: MXIRLG IS OFTEN SET TO 24 HRS - THE USER NEEDS
               TO CHECK AND MAKE SURE IRLG =< MXIRLG

             (DEFAULT VALUES DISTRIBUTE 75% OF AREA SOURCE MASS
              BELOW 50. M, AND 25% BETWEEN 50-100 M.)


                                                  ! IEM1REC=39  !

          AMBIENT CONCENTRATION OF SODIUM AND CHLORIDE (UG/M3)
          ----------------------------------------------
                                      DEFAULT = 0.05 ! SODIUM = 0.005 !
                                      DEFAULT = 0.05 ! CHLORIDE = 0.005 !

!END!


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

INPUT GROUP: 2 -- GRID CONTROL PARAMETERS
-----------------
```

```
     HORIZONTAL GRID TYPE:

    TYPE OF DOMAIN MAPPING (IGTYPE)  DEFAULT: 1     ! IGTYPE=1 !
     IGTYPE = 1 IS A LAMBERT CONFORMAL MAPPING
                (NATIVE TO REGIONAL)
            = 2 IS A UTM MAPPING
            = 3 IS A LON/LAT MAPPING

     HORIZONTAL GRID DEFINITION:

            NO. X GRID CELLS (NX)    NO DEFAULT      ! NX=40  !
            NO. Y GRID CELLS (NY)    NO DEFAULT      ! NY=40  !

     GRID SPACING IS IN KM FOR IGTYPE = 1,2
     GRID SPACING IS IN DECIMAL DEGREES FOR IGTYPE = 3

            X GRID SPACING  NO DEFAULT   ! DGRDXK=36.0      !
            Y GRID SPACING  NO DEFAULT   ! DGRDYK=36.0      !

     REFERENCE UTM COORDINATES (KM/DEG)
     OF SOUTHWEST CORNER OF GRID POINT (1,1)

        X COORDINATE (XORIGKM)       NO DEFAULT    ! XORIGK= -1656.000  !
        Y COORDINATE (YORIGKM)       NO DEFAULT    ! YORIGK= -432.000  !

            UTM ZONE (IUTMZN)        NO DEFAULT      ! IUTMZN= 0 !

     REFERENCE COORDINATES OF CENTER
     OF THE DOMAIN (USED IN THE
     CALCULATION OF SOLAR ELEVATION ANGLES)

        LATITUDE  (DEG.) (XLAT)      NO DEFAULT    ! XLAT  =  42.1  !
        LONGITUDE (DEG.) (XLONG)     NO DEFAULT    ! XLONG = -108.4 !
        TIME ZONE        (XTZ)       NO DEFAULT    ! XTZ   =   7.   !
        (PST=8, MST=7, CST=6, EST=5)
        REF LAT  (DEG.) (RLAT)       DEFAULT:45.   ! RLAT  =  40.0  !
        REF LON  (DEG.) (RLON)       DEFAULT:-90.  ! RLON  = -97.0  !
       TRUE LAT 1(DEG.) (RLAT)       DEFAULT:30.   ! TLAT1  =  33.0 !
       TRUE LAT 2(DEG.) (RLON)       DEFAULT:60.   ! TLAT2  =  45.0 !
        LLC X INDEX OF NESTED GRID   NO DEFAULT    ! XCNX  =  1.0   !
        LLC Y INDEX OF NESTED GRID   NO DEFAULT    ! YCNY  =  1.0   !
        NUMBER OF X CELLS IN NEST    NO DEFAULT    ! NXN  =  40    !
        NUMBER OF Y CELLS IN NEST    NO DEFAULT    ! NYN  =  40    !
        FINE TO COARSE CELL RATIO    NO DEFAULT    ! NHSC =  1      !

     VERTICAL GRID DEFINITION:

        NO. OF VERTICAL LAYERS IN THE
        CALMET METEOROLOGICAL GRID (NZM)  NO DEFAULT      ! NZM =10!

        VERTICAL CALGRID GRID TYPE (IVGTYP)  DEFAULT: 2   ! IVGTYP=2 !
           IVGTYP = 0 UNIFORM THICKNESS ABOVE AND
                      BELOW DIFFBREAK
           IVGTYP = 1 DYNAMICALLY VARYING LAYERS
           IVGTYP = 2 FOR ARBITRARY FIXED GRID

           ENTER VALUES FOR THE FOLLOWING VARIABLES BASED ON IVGTYP
              IVGTYP         REQUIRED VARIABLES
              ------         ------------------
                0            NZ, NZL, ZMINB, ZMAXB, ZMINA, ZMAXA, ZTOP
                1            NZ, NZL, DZMIN, ZTOP
                2            NZ, ZFACE(NZ+1)
IVGTYP
------
0,1,2    NZ   -- NO. OF VERTICAL LAYERS        NO DEFAULT      ! NZ = 10 !
0,1      NZL  -- NO. LAYERS BELOW DIFFBREAK    NO DEFAULT      * NZL = 6     *
0        ZMINB-- MINIMUM DEPTH (M) OF CELLS    DEFAULT: 20.    * ZMINB=20.   *
                 BELOW DIFFBREAK & ABOVE LAYER #1
0        ZMAXB-- MAXIMUM DEPTH (M) OF CELLS    DEFAULT: 5000.  * ZMINB=5000. *
                 BELOW DIFFBREAK & ABOVE LAYER #1
0        ZMINA-- MINIMUM DEPTH (M) OF CELLS    DEFAULT: 20.    * ZMINA=20.   *
```

```
                ABOVE DIFFBREAK
0        ZMAXA-- MAXIMUM DEPTH (M) OF CELLS    DEFAULT: 5000.  * ZMINA=5000. *
                ABOVE DIFFBREAK
0,1      ZTOP -- TOP OF DOMAIN (M)             NO DEFAULT      * ZTOP =5000. *
  1      DZMIN-- MINIMUM CELL DEPTH (M) FOR    DEFAULT: 20.    * DZMIN=30.   *
                LAYERS ABOVE LAYER #1
    2    ZFACE(NZ+1)-- CELL FACE HEIGHTS (M)   NO DEFAULTS
                IN ARBITRARY VERTICAL GRID
        ! ZFACE = 0.,20.,40.,80.,160.,300.,600.,1000.,1500.,2200.,3000. !

!END!


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

INPUT GROUP: 3 -- GAS AND AEROSOL PHASE SPECIES LIST
--------------

                                                                  DRY
SPECIES        MODELED         ADVECTED         EMITTED         DEPOSITED
 NAME       (0=NO, 1=YES)    (0=NO, 1=YES)   (0=NO, 1=YES)  (0=NO,
                                                              1=COMPUTED-GAS
                                                              2=COMPUTED-PARTICLE
                                                              3=USER-SPECIFIED)

BUILD-UP SPECIES

ACTIVE SPECIES
! NO           =   1        ,       1        ,      1       ,      0      !
! NO2          =   1        ,       1        ,      1       ,      1      !
! O3           =   1        ,       1        ,      0       ,      1      !
! HONO         =   1        ,       1        ,      0       ,      1      !
! HNO3         =   1        ,       1        ,      0       ,      1      !
! PNA          =   1        ,       1        ,      0       ,      0      !
! N2O5         =   1        ,       1        ,      0       ,      0      !
! NO3          =   1        ,       1        ,      0       ,      1      !
! HO2          =   1        ,       1        ,      0       ,      1      !
! CO           =   1        ,       1        ,      1       ,      0      !
! FORM         =   1        ,       1        ,      1       ,      1      !
! ALD2         =   1        ,       1        ,      1       ,      0      !
! PAN          =   1        ,       1        ,      0       ,      1      !
! XO2          =   1        ,       1        ,      0       ,      0      !
! C2O3         =   1        ,       1        ,      0       ,      0      !
! CRO          =   1        ,       1        ,      0       ,      0      !
! MGLY         =   1        ,       1        ,      0       ,      0      !
! PAR          =   1        ,       1        ,      1       ,      0      !
! ETH          =   1        ,       1        ,      1       ,      0      !
! OLE          =   1        ,       1        ,      1       ,      0      !
! TOL          =   1        ,       1        ,      1       ,      0      !
! XYL          =   1        ,       1        ,      1       ,      0      !
! OPEN         =   1        ,       1        ,      0       ,      0      !
! CRES         =   1        ,       1        ,      0       ,      0      !
! TO2          =   1        ,       1        ,      0       ,      0      !
! ROR          =   1        ,       1        ,      0       ,      0      !
! H2O2         =   1        ,       1        ,      0       ,      1      !
! ISOP         =   1        ,       1        ,      1       ,      3      !
! MEOH         =   1        ,       1        ,      0       ,      0      !
! ETOH         =   1        ,       1        ,      0       ,      0      !
! SO2          =   1        ,       1        ,      1       ,      1      !
! SO3          =   1        ,       1        ,      1       ,      0      !
! UNR          =   1        ,       1        ,      1       ,      0      !
! ISOPRD       =   1        ,       1        ,      0       ,      3      !
! NTR          =   1        ,       1        ,      0       ,      0      !
! NH3          =   1        ,       1        ,      1       ,      1      !
! PEC          =   1        ,       1        ,      1       ,      2      !
! PMFINE       =   1        ,       1        ,      1       ,      2      !
! PNO3         =   1        ,       1        ,      1       ,      2      !
! POA          =   1        ,       1        ,      1       ,      2      !
! PMCOARS      =   1        ,       1        ,      1       ,      2      !
! SOA          =   1        ,       1        ,      1       ,      2      !
! GSO4         =   1        ,       1        ,      1       ,      2      !
```

```
STEADY-STATE SPECIES

! OH           =   1        ,       0        ,      0       ,      0      !
! O            =   1        ,       0        ,      0       ,      0      !
! O1D          =   1        ,       0        ,      0       ,      0      !
! XO2N         =   1        ,       0        ,      0       ,      0      !
! H2O          =   1        ,       0        ,      0       ,      0      !

!END!


-------------------------------------------------------------------------------
INPUT GROUP: 4 -- CHEMICAL PARAMETERS FOR DRY DEPOSITION OF GASES
--------------

SPECIES  DIFFUSIVITY  ALPHA REACTIVITY  MESOPHYLL  HENRY'S LAW COEFFICIENT
NAME                  STAR              RESISTANCE
          (CM**2/S)                      (S/CM)      (DIMENSIONLESS)
-------  -----------  ----- ----------   --------- -----------------------
! H2O2 =   0.2402  ,  1.00,    12.0,     0.0      ,     4.E-7          !
! O3   =   0.1594  , 10.00,    12.0,     4.0      ,     2.0            !
! NO2  =   0.1656  ,  1.00,    8.0 ,     5.0      ,     3.5            !
! NO3  =   0.1656  ,  1.00,    8.0 ,     5.0      ,     1.E-6          !
! HNO3 =   0.1628  ,  1.00,    18.0,     0.0      ,     4.E-2          !
! HONO =   0.1100  ,  1.00,    4.0 ,     2.0      ,     4.3E-4         !
! HO2  =   0.2402  ,  1.00,    12.0,     0.0      ,     1.E-6          !
! PAN  =   0.1050  ,  1.00,    4.0 ,     1.0      ,     1.E-2          !
! FORM =   0.2336  ,  1.00,    4.0 ,     0.0      ,     4.E-6          !
! SO2  =   0.1509  ,  1.00E3,  8.0 ,     0.0      ,     4.E-2          !
! NH3  =   0.2336  ,  1.00,    4.0 ,     0.0      ,     4.E-6          !

!END!

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

INPUT GROUP: 5 -- SIZE PARAMETERS FOR DRY DEPOSITION OF PARTICLES
--------------
       *
SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
 NAME             DIAMETER                  DEVIATION
                  (MICRONS)                 (MICRONS)
-------      -------------------        ------------------
! PEC          =   0.48       ,                2.0            !
! PMFINE       =   0.48       ,                2.0            !
! PNO3         =   0.48       ,                2.0            !
! POA          =   0.48       ,                2.0            !
! PMCOARS      =   5.00       ,                2.0            !
! SOA          =   0.48       ,                2.0            !
! GSO4         =   0.48       ,                2.0            !

!END!

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

INPUT GROUP: 6 -- MISCELLANEOUS DRY DEPOSITION PARAMETERS
--------------

     REFERENCE CUTICLE RESISTANCE   (RCUTR)  (S/CM)   !  RCUTR=34.0 !
     REFERENCE GROUND RESISTANCE    (RGR)    (S/CM)   !    RGR= 8.0 !
     REFERENCE POLLUTANT REACTIVITY (REACTR)          ! REACTR= 8.0 !

     VEGETATION STATE IN UNIRRIGATED AREAS (IVEG)     !   IVEG=1    !
        IVEG=1 FOR ACTIVE AND UNSTRESSED VEGETATION
        IVEG=2 FOR ACTIVE AND STRESSED VEGETATION
        IVEG=3 FOR INACTIVE VEGETATION

!END!
```

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

INPUT GROUP: 7 -- OUTPUT OPTIONS FOR GAS AND AEROSOL PHASE SPECIES
--------------
                                                *                          *
     FILE                        DEFAULT VALUE             VALUE THIS RUN
     ----                        -------------             --------------

   CONCENTRATIONS (ICON)               1                   !   ICON = 1 !
   FLUXES (IDRY)                       1                   !   IDRY = 1 !
   WET FLUXES (IWET)                   1                   !   IWET = 0 !
   MASS BUDGET (IMASS)                 1                   !   IMASS = 0 !

   *
    0 = DO NOT CREATE FILE, 1 = CREATE FILE

    OUTPUT to DISK STYLE(FORMAT) OPTIONS
       OUTPUT STYLE (ICPUFF)           DEFAULT: 0         ! ICPUFF = 2 !
   *
    0 = OLD CALGRID (< V2.45), 1 = CALPUFF FORMAT VERSION 2.2, 2 = CALPUFF WITH CALGRID UNITS

    LINE PRINTER OUTPUT OPTIONS:

       PRINT CONCENTRATIONS (ICPRT)    DEFAULT: 0          ! ICPRT = 0 !
       PRINT DRY FLUXES (IFPRT)        DEFAULT: 0          ! IFPRT = 0 !
       PRINT TOP FLUXES (ITPRT)        DEFAULT: 0          ! ITPRT = 0 !
       PRINT DEPOSITION VEL. (IVDPRT)  DEFAULT: 0          ! IVDPRT= 0 !
       (0 = DO NOT PRINT, 1 = PRINT)

       NO. LAYERS OF GRIDDED TOTAL
       (AREA+POINT) EMISSIONS TO PRINT
                              (IEPRT)  DEFAULT: 0          ! IEPRT= 0 !
       (IEPRT MUST BE <= NZ)


       CONCENTRATION PRINT INTERVAL
       (ICFRQ) IN HOURS                DEFAULT: 1          ! ICFRQ = 0 !
       DRY FLUX PRINT INTERVAL
       (IFFRQ) IN HOURS                DEFAULT: 1          ! IFFRQ = 0 !
       TOP FLUX PRINT INTERVAL
       (ITFRQ) IN HOURS                DEFAULT: 1          ! ITFRQ = 0 !
       DEPOSITION VEL. PRINT INTERVAL
       (IVDFRQ) IN HOURS               DEFAULT: 1          ! IVDFRQ = 0 !
       EMISSIONS PRINT INTERVAL
       (IEFRQ) IN HOURS                DEFAULT: 1          ! IEFRQ = 0 !


     SPECIES LIST FOR OUTPUT OPTIONS

            ----- CONCENTRATIONS ---------  ------- DRY FLUXES ------------
SPECIES      PRINTED ?    SAVED ON DISK ?   PRINTED ?      SAVED ON DISK ?
 NAME   (1 VALUE/LAYER)   (1 VALUE/LAYER)
           (0=NO, 1=YES)   (0=NO, 1=YES)  (0=NO, 1=YES)     (0=NO, 1=YES)
------- ---------------- --------------- --------------- ----------------------

! NO    =     10 * 0,     1,9 * 0    ,          0    ,            0     !
! NO2   =     10 * 0,     1,9 * 0    ,          0    ,            0     !
! O3    =    1,8 * 0,1,    10 * 1    ,          0    ,            1     !
! HONO  =     10 * 0,      10 * 0    ,          0    ,            0     !
! HNO3  =     10 * 0,     1,9 * 0    ,          0    ,            0     !
! PNA   =     10 * 0,      10 * 0    ,          0    ,            0     !
! N2O5  =     10 * 0,      10 * 0    ,          0    ,            0     !
! NO3   =     10 * 0,      10 * 0    ,          0    ,            0     !
! HO2   =     10 * 0,      10 * 0    ,          0    ,            0     !
! CO    =     10 * 0,      10 * 0    ,          0    ,            0     !
! FORM  =     10 * 0,     1,9 * 0    ,          0    ,            0     !
! ALD2  =     10 * 0,      10 * 0    ,          0    ,            0     !
! PAN   =     10 * 0,      10 * 0    ,          0    ,            0     !
! XO2   =     10 * 0,      10 * 0    ,          0    ,            0     !
! C2O3  =     10 * 0,      10 * 0    ,          0    ,            0     !
```

```
! CRO   =     10 * 0,      10 * 0    ,          0    ,            0     !
! MGLY  =     10 * 0,      10 * 0    ,          0    ,            0     !
! PAR   =     10 * 0,     1,9 * 0    ,          0    ,            0     !
! ETH   =     10 * 0,      10 * 0    ,          0    ,            0     !
! OLE   =     10 * 0,      10 * 0    ,          0    ,            0     !
! TOL   =     10 * 0,      10 * 0    ,          0    ,            0     !
! XYL   =     10 * 0,      10 * 0    ,          0    ,            0     !
! OPEN  =     10 * 0,      10 * 0    ,          0    ,            0     !
! CRES  =     10 * 0,      10 * 0    ,          0    ,            0     !
! TO2   =     10 * 0,      10 * 0    ,          0    ,            0     !
! ROR   =     10 * 0,      10 * 0    ,          0    ,            0     !
! H2O2  =     10 * 0,      10 * 0    ,          0    ,            0     !
! ISOP  =     10 * 0,     1,9 * 0    ,          0    ,            0     !
! MEOH  =     10 * 0,      10 * 0    ,          0    ,            0     !
! ETOH  =     10 * 0,      10 * 0    ,          0    ,            0     !
! SO2   =    1,8 * 0,1,   1,9 * 0    ,          0    ,            1     !
! SO3   =     10 * 0,     1,9 * 0    ,          0    ,            0     !
! UNR   =     10 * 0,      10 * 0    ,          0    ,            0     !
!ISOPRD =     10 * 0,      10 * 0    ,          0    ,            0     !
! NTR   =     10 * 0,      10 * 0    ,          0    ,            0     !
! NH3      =     10 * 0,      10 * 0    ,          0    ,            0     !
! PEC      =     10 * 0,      10 * 0    ,          0    ,            0     !
! PMFINE   =     10 * 0,      10 * 0    ,          0    ,            0     !
! PNO3     =     10 * 0,      10 * 0    ,          0    ,            0     !
! POA      =     10 * 0,      10 * 0    ,          0    ,            0     !
! PMCOARS  =     10 * 0,      10 * 0    ,          0    ,            0     !
! SOA      =     10 * 0,      10 * 0    ,          0    ,            0     !
! GSO4     =     10 * 0,      10 * 0    ,          0    ,            0     !

!END!


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

INPUT GROUP: 8 -- VERTICAL AND HORIZONTAL DIFFUSIVITY PARAMETERS
--------------


    HORIZONTAL DIFFUSIVITY:

       METHOD FLAG (KHMODE)                  DEFAULT: 3     ! KHMODE= 3 !
          KHMODE = 0 - PBL DIFFUSIVITIES ARE
                       DETERMINED BASED ON STABILITY
                       CLASS (SEE DKHSTB ARRAY)
          KHMODE = 1 - SAME AS ABOVE EXCEPT DIFFUSIVITIES
                       ARE ADJUSTED FOR WIND SPEED
          KHMODE = 2 - USES SMAGORINSKY METHOD
          KHMODE = 3 - ADDS THE RESULTS OF METHODS 1 AND 2

       HORIZONTAL DIFFUSIVITY (M**2/S) ABOVE
       THE DIFFBREAK HEIGHT (DKHUP)           DEFAULT: 0.0  ! DKHUP = 0.0 !
       (USED ONLY IF KHMODE = 0, 1, OR 3)

       HORIZONTAL DIFFUSIVITY (M**2/S) BELOW
       THE DIFFBREAK HEIGHT (DKHSTB(6))  DEFAULTS: 224.,  96., 32.,  0.,  0., 0.
    (USED ONLY IF KHMODE = 0, 1, OR 3)    ! DKHSTB = 224.,96.,32.,0.,0.,0. !
       (NOTE: IF KHMODE = 1 OR 3, THESE
       DKHSTB VALUES ARE SCALED BY WIND SPEED)


    VERTICAL DIFFUSIVITY:

       MINIMUM VERTICAL DIFFUSIVITY (M**2/S)
       (DKZMIN)                               DEFAULT: 1.0  ! DKZMIN = 1.0 !

       VERTICAL DIFFUSIVITY (M**2/S) AT THE
       MODEL TOP (DKZTOP)                     DEFAULT: 0.0  ! DKZTOP = 0.0 !

!END!

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

```
INPUT GROUP: 9 -- Input and Output File Names

Subgroup (a) (New style - with UAM-V MET files)
------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    ! CALMET=../../calmet/36km/pdmet_may.dat !
USURFV.BIN    input    * USURFV=remsad.UMD12km.landuse.bin       *
UHGHTV.BIN    input    * UHGHTV=camx.zp.0812.bin                 *
UWINDV.BIN    input    * UWINDV=camx.uv.0812.bin                 *
UTMPRV.BIN    input    * UTMPRV=camx.tp.0812.bin                 *
UWVAPV.BIN    input    * UWVAPV=camx.rh.0812.bin                 *
UCLDCV.BIN    input    * UCLDCV=camx.cr.0812.bin                 *
URAINV.BIN    input    * URAINV=camx.rn.0812.bin                 *
UVDIFV.BIN    input    * UVDIFV=camx.kv.0812.bin                 *
ICON.DAT      input    ! ICONFL=apr2002.xxx                      !
BCON.DAT      input    ! BCONFL=../../cmaq_bc_36km/tlbc_app/amj2002.lbc !
TCON.DAT      input    ! TCONFL=../../cmaq_bc_36km/tlbc_app/amj2002.tbc !
PTECYC.DAT    input    * PTECYC=caldum1                          *
PTEMRB.DAT    input    ! PTEMRB=../../wrap_smoke_36km/em3d_app/em3d_amj2002.e3d !
PTEMOB.DAT    input    * PTEMOB=caldum2                          *
AREM.DAT      input    * AREMFL=                                 *
VD.DAT        input    ! VDEPFL=vdcarb_new.dat                   !
CALGRD.DAT    output   ! CNCDAT=may2002.con                      !
DRYDEP.DAT    output   ! DRYDEP=may2002.dry                      !
WETDEP.DAT    output   * WETDEP=caldum3                          *
ICONST.DAT    output   ! RESTRT=may2002.xxx                      !
BNEST.DAT     output   ! BNEST=caldum4                           !
GRADS.GRD     output   ! GRADS=grads.gds                         !
MASBUD.DAT    output   ! MASBUD=caldum5                          !
CALGRID.LST   output   ! CGLIST=may2002.lst                        !

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE
--------------------------------------------------------------------------------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (d) must have ONE "END" (surrounded by
           delimiters) at the end of the group
       (3) Subgroups (b) and (c) must have an "END" (surrounded by
           delimiters) at the end of EACH LINE

                        !END!

-------------------------------------------------
name of the standard point source file:
../../wrap_smoke_36km/em3d_app/em3d_amj2002.e3d
name of meteorological file:
../../calmet/36km/pdmet_may.dat
name of initial concentration file:
apr2002.xxx
name of boundary concentration file:
../../cmaq_bc_36km/tlbc_app/amj2002.lbc
name of top concentration file:
../../cmaq_bc_36km/tlbc_app/amj2002.tbc
name of the cylic point source file:

name of the standard point source file:
../../wrap_smoke_36km/em3d_app/em3d_amj2002.e3d
name of the mobile point source file:

name of the area source file:

name of the deposition velocity file:
vdcarb_new.dat
name of the concentration data file:
may2002.con
name of dry deposition velocity file:
may2002.dry
```

```
name of wet deposition velocity file:

name of the restart file:
may2002.xxx
name of the nested grid boundary file:
caldum4
name of the grads output file:
grads.gds
name of the mass budget output file:
caldum5
name of the grid inp file:
may2002.inp
name of the grid list file:
may2002.lst

--------------  INPUT GROUP 1  ---------------

ibyr   =            2
ibmo   =            5
ibdy   =            1
ibhr   =            0
irlg   =          744
nsubts =            3
nspec  =           40
nsa    =           35
nsdd   =           12
nse    =           14
naspec =            8
nasdd  =            8
nase   =            8
nsout  =            0
itimet =            1
iticon =            3
itnest =            0
itclod =            0
itbcon =            2
ittcon =            2
item1  =            2
item2  =            3
item3  =            2
item4  =            4
nzem   =            2
zfem   =     0.000000        50.00000        100.0000
wtem   =    0.9000000       0.1000000
iem1rec=           39
methint=            2
ichem  =            2
iozdu  =          295
SODIUM =    4.9999999E-03
CHLORIDE =    4.9999999E-03
LHORIZ =   T
LVADV  =   T
LVDIFF =   T
LCHEM  =   T
LAERO  =   T
LMESG  =   T
IOMESG =            6

--------------  INPUT GROUP 2  ---------------

igtype  =            1
nx      =           40
ny      =           40
dgrdxk  =     36.00000
dgrdyk  =     36.00000
xorigk  =    -1656.000
yorigk  =    -432.0000
iutmzn  =            0
ivgtyp  =            2
nz      =           10
nzm     =           10
```

```
xlat    =     42.10000
xlong   =    -108.4000
xtz     =     7.000000
rlat    =     40.00000
rlon    =    -97.00000
tlat1   =     33.00000
tlat2   =     45.00000
icnx    =             1
icny    =             1
nhsc    =             1
zface  =     0.000000        20.00000        40.00000        80.00000
   160.0000        300.0000        600.0000        1000.000
   1500.000        2200.000        3000.000

--------------  INPUT GROUP 3  ---------------

SPECIES: NO            NO(j):   1  isplst(-,j) =     1    1    1    0
SPECIES: NO2           NO(j):   2  isplst(-,j) =     1    1    1    1
SPECIES: O3            NO(j):   3  isplst(-,j) =     1    1    0    1
SPECIES: HONO          NO(j):   4  isplst(-,j) =     1    1    0    1
SPECIES: HNO3          NO(j):   5  isplst(-,j) =     1    1    0    1
SPECIES: PNA           NO(j):   6  isplst(-,j) =     1    1    0    0
SPECIES: N2O5          NO(j):   7  isplst(-,j) =     1    1    0    0
SPECIES: NO3           NO(j):   8  isplst(-,j) =     1    1    0    1
SPECIES: HO2           NO(j):   9  isplst(-,j) =     1    1    0    1
SPECIES: CO            NO(j):  10  isplst(-,j) =     1    1    1    0
SPECIES: FORM          NO(j):  11  isplst(-,j) =     1    1    1    1
SPECIES: ALD2          NO(j):  12  isplst(-,j) =     1    1    1    0
SPECIES: PAN           NO(j):  13  isplst(-,j) =     1    1    0    1
SPECIES: XO2           NO(j):  14  isplst(-,j) =     1    1    0    0
SPECIES: C2O3          NO(j):  15  isplst(-,j) =     1    1    0    0
SPECIES: CRO           NO(j):  16  isplst(-,j) =     1    1    0    0
SPECIES: MGLY          NO(j):  17  isplst(-,j) =     1    1    0    0
SPECIES: PAR           NO(j):  18  isplst(-,j) =     1    1    1    0
SPECIES: ETH           NO(j):  19  isplst(-,j) =     1    1    1    0
SPECIES: OLE           NO(j):  20  isplst(-,j) =     1    1    1    0
SPECIES: TOL           NO(j):  21  isplst(-,j) =     1    1    1    0
SPECIES: XYL           NO(j):  22  isplst(-,j) =     1    1    1    0
SPECIES: OPEN          NO(j):  23  isplst(-,j) =     1    1    0    0
SPECIES: CRES          NO(j):  24  isplst(-,j) =     1    1    0    0
SPECIES: TO2           NO(j):  25  isplst(-,j) =     1    1    0    0
SPECIES: ROR           NO(j):  26  isplst(-,j) =     1    1    0    0
SPECIES: H2O2          NO(j):  27  isplst(-,j) =     1    1    0    1
SPECIES: ISOP          NO(j):  28  isplst(-,j) =     1    1    1    3
SPECIES: MEOH          NO(j):  29  isplst(-,j) =     1    1    0    0
SPECIES: ETOH          NO(j):  30  isplst(-,j) =     1    1    0    0
SPECIES: SO2           NO(j):  31  isplst(-,j) =     1    1    1    1
SPECIES: SO3           NO(j):  32  isplst(-,j) =     1    1    1    0
SPECIES: UNR           NO(j):  33  isplst(-,j) =     1    1    1    0
SPECIES: ISOPRD        NO(j):  34  isplst(-,j) =     1    1    0    3
SPECIES: NTR           NO(j):  35  isplst(-,j) =     1    1    0    0
SPECIES: PEC           NO(j):  36  isplst(-,j) =     1    1    1    2
SPECIES: PMFINE        NO(j):  37  isplst(-,j) =     1    1    1    2
SPECIES: PMCOARS       NO(j):  38  isplst(-,j) =     1    1    1    2
SPECIES: POA           NO(j):  39  isplst(-,j) =     1    1    1    2
SPECIES: NH3           NO(j):  40  isplst(-,j) =     1    1    1    1
SPECIES: PNO3          NO(j):  41  isplst(-,j) =     1    1    1    2
SPECIES: SOA           NO(j):  42  isplst(-,j) =     1    1    1    2
SPECIES: GSO4          NO(j):  43  isplst(-,j) =     1    1    1    2
SPECIES: OH            NO(j):  44  isplst(-,j) =     1    0    0    0
SPECIES: O             NO(j):  45  isplst(-,j) =     1    0    0    0
SPECIES: O1D           NO(j):  46  isplst(-,j) =     1    0    0    0
SPECIES: XO2N          NO(j):  47  isplst(-,j) =     1    0    0    0
SPECIES: H2O           NO(j):  48  isplst(-,j) =     1    0    0    0

--------------  INPUT GROUP 4  ---------------

SPECIES: NO            NO(j):   1  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: NO2           NO(j):   2  dryg(-,j) =       0.17      1.00      8.00      5.00      3.50
SPECIES: O3            NO(j):   3  dryg(-,j) =       0.16     10.00     12.00      4.00      2.00
SPECIES: HONO          NO(j):   4  dryg(-,j) =       0.11      1.00      4.00      2.00      0.00
```

```
SPECIES: HNO3          NO(j):   5  dryg(-,j) =       0.16      1.00     18.00      0.00      0.04
SPECIES: PNA           NO(j):   6  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: N2O5          NO(j):   7  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: NO3           NO(j):   8  dryg(-,j) =       0.17      1.00      8.00      5.00      0.00
SPECIES: HO2           NO(j):   9  dryg(-,j) =       0.24      1.00     12.00      0.00      0.00
SPECIES: CO            NO(j):  10  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: FORM          NO(j):  11  dryg(-,j) =       0.23      1.00      4.00      0.00      0.00
SPECIES: ALD2          NO(j):  12  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: PAN           NO(j):  13  dryg(-,j) =       0.10      1.00      4.00      1.00      0.01
SPECIES: XO2           NO(j):  14  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: C2O3          NO(j):  15  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: CRO           NO(j):  16  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: MGLY          NO(j):  17  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: PAR           NO(j):  18  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: ETH           NO(j):  19  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: OLE           NO(j):  20  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: TOL           NO(j):  21  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: XYL           NO(j):  22  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: OPEN          NO(j):  23  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: CRES          NO(j):  24  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: TO2           NO(j):  25  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: ROR           NO(j):  26  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: H2O2          NO(j):  27  dryg(-,j) =       0.24      1.00     12.00      0.00      0.00
SPECIES: ISOP          NO(j):  28  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: MEOH          NO(j):  29  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: ETOH          NO(j):  30  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: SO2           NO(j):  31  dryg(-,j) =       0.15   1000.00      8.00      0.00      0.04
SPECIES: SO3           NO(j):  32  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: UNR           NO(j):  33  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: ISOPRD        NO(j):  34  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: NTR           NO(j):  35  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: PEC           NO(j):  36  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: PMFINE        NO(j):  37  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: PMCOARS       NO(j):  38  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: POA           NO(j):  39  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: NH3           NO(j):  40  dryg(-,j) =       0.23      1.00      4.00      0.00      0.00
SPECIES: PNO3          NO(j):  41  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: SOA           NO(j):  42  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: GSO4          NO(j):  43  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: OH            NO(j):  44  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: O             NO(j):  45  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: O1D           NO(j):  46  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: XO2N          NO(j):  47  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00
SPECIES: H2O           NO(j):  48  dryg(-,j) =    -999.00   -999.00   -999.00   -999.00   -999.00

--------------  INPUT GROUP 5  ---------------

SPECIES: NO            NO(j):   1  dryp(-,j) =    -999.00   -999.00
SPECIES: NO2           NO(j):   2  dryp(-,j) =    -999.00   -999.00
SPECIES: O3            NO(j):   3  dryp(-,j) =    -999.00   -999.00
SPECIES: HONO          NO(j):   4  dryp(-,j) =    -999.00   -999.00
SPECIES: HNO3          NO(j):   5  dryp(-,j) =    -999.00   -999.00
SPECIES: PNA           NO(j):   6  dryp(-,j) =    -999.00   -999.00
SPECIES: N2O5          NO(j):   7  dryp(-,j) =    -999.00   -999.00
SPECIES: NO3           NO(j):   8  dryp(-,j) =    -999.00   -999.00
SPECIES: HO2           NO(j):   9  dryp(-,j) =    -999.00   -999.00
SPECIES: CO            NO(j):  10  dryp(-,j) =    -999.00   -999.00
SPECIES: FORM          NO(j):  11  dryp(-,j) =    -999.00   -999.00
SPECIES: ALD2          NO(j):  12  dryp(-,j) =    -999.00   -999.00
SPECIES: PAN           NO(j):  13  dryp(-,j) =    -999.00   -999.00
SPECIES: XO2           NO(j):  14  dryp(-,j) =    -999.00   -999.00
SPECIES: C2O3          NO(j):  15  dryp(-,j) =    -999.00   -999.00
SPECIES: CRO           NO(j):  16  dryp(-,j) =    -999.00   -999.00
SPECIES: MGLY          NO(j):  17  dryp(-,j) =    -999.00   -999.00
SPECIES: PAR           NO(j):  18  dryp(-,j) =    -999.00   -999.00
SPECIES: ETH           NO(j):  19  dryp(-,j) =    -999.00   -999.00
SPECIES: OLE           NO(j):  20  dryp(-,j) =    -999.00   -999.00
SPECIES: TOL           NO(j):  21  dryp(-,j) =    -999.00   -999.00
SPECIES: XYL           NO(j):  22  dryp(-,j) =    -999.00   -999.00
SPECIES: OPEN          NO(j):  23  dryp(-,j) =    -999.00   -999.00
SPECIES: CRES          NO(j):  24  dryp(-,j) =    -999.00   -999.00
```

```
SPECIES: TO2           NO(j):  25  dryp(-,j) =    -999.00   -999.00
SPECIES: ROR           NO(j):  26  dryp(-,j) =    -999.00   -999.00
SPECIES: H2O2          NO(j):  27  dryp(-,j) =    -999.00   -999.00
SPECIES: ISOP          NO(j):  28  dryp(-,j) =    -999.00   -999.00
SPECIES: MEOH          NO(j):  29  dryp(-,j) =    -999.00   -999.00
SPECIES: ETOH          NO(j):  30  dryp(-,j) =    -999.00   -999.00
SPECIES: SO2           NO(j):  31  dryp(-,j) =    -999.00   -999.00
SPECIES: SO3           NO(j):  32  dryp(-,j) =    -999.00   -999.00
SPECIES: UNR           NO(j):  33  dryp(-,j) =    -999.00   -999.00
SPECIES: ISOPRD        NO(j):  34  dryp(-,j) =    -999.00   -999.00
SPECIES: NTR           NO(j):  35  dryp(-,j) =    -999.00   -999.00
SPECIES: PEC           NO(j):  36  dryp(-,j) =       0.48      2.00
SPECIES: PMFINE        NO(j):  37  dryp(-,j) =       0.48      2.00
SPECIES: PMCOARS       NO(j):  38  dryp(-,j) =       5.00      2.00
SPECIES: POA           NO(j):  39  dryp(-,j) =       0.48      2.00
SPECIES: NH3           NO(j):  40  dryp(-,j) =    -999.00   -999.00
SPECIES: PNO3          NO(j):  41  dryp(-,j) =       0.48      2.00
SPECIES: SOA           NO(j):  42  dryp(-,j) =       0.48      2.00
SPECIES: GSO4          NO(j):  43  dryp(-,j) =       0.48      2.00
SPECIES: OH            NO(j):  44  dryp(-,j) =    -999.00   -999.00
SPECIES: O             NO(j):  45  dryp(-,j) =    -999.00   -999.00
SPECIES: O1D           NO(j):  46  dryp(-,j) =    -999.00   -999.00
SPECIES: XO2N          NO(j):  47  dryp(-,j) =    -999.00   -999.00
SPECIES: H2O           NO(j):  48  dryp(-,j) =    -999.00   -999.00

--------------  INPUT GROUP 6  ---------------

rcutr   =     34.00000
rgr     =     8.000000
reactr  =     8.000000
pconst  =    2.3000000E-08
bmin    =    1.0000000E-07
bmax    =    2.4999999E-06
qswmax  =     600.0000
dconst1 =     2.000000
dconst2 =    0.6666667
dconst3 =    4.7999999E-04
dconst4 =    0.6666667
nint    =             9

--------------  INPUT GROUP 7  ---------------

icon    =             1
idry    =             1
iwet    =             0
imass   =             0
icpuff  =             2
icprt   =             0
ifprt   =             0
itprt   =             0
ivdprt  =             0
ieprt   =             0
icfrq   =             0
iffrq   =             0
itfrq   =             0
ivdfrq  =             0
iefrq   =             0

SPECIES: NO            NO(j):   1  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
SPECIES: NO2           NO(j):   2  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
SPECIES: O3            NO(j):   3  iopwrk(-,j) =  1 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1
SPECIES: HONO          NO(j):   4  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: HNO3          NO(j):   5  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
SPECIES: PNA           NO(j):   6  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: N2O5          NO(j):   7  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: NO3           NO(j):   8  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: HO2           NO(j):   9  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: CO            NO(j):  10  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: FORM          NO(j):  11  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
SPECIES: ALD2          NO(j):  12  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: PAN           NO(j):  13  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

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SPECIES: XO2           NO(j):  14  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: C2O3          NO(j):  15  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: CRO           NO(j):  16  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: MGLY          NO(j):  17  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: PAR           NO(j):  18  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
SPECIES: ETH           NO(j):  19  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: OLE           NO(j):  20  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: TOL           NO(j):  21  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: XYL           NO(j):  22  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: OPEN          NO(j):  23  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: CRES          NO(j):  24  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: TO2           NO(j):  25  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: ROR           NO(j):  26  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: H2O2          NO(j):  27  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: ISOP          NO(j):  28  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
SPECIES: MEOH          NO(j):  29  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: ETOH          NO(j):  30  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: SO2           NO(j):  31  iopwrk(-,j) =  1 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 1
SPECIES: SO3           NO(j):  32  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
SPECIES: UNR           NO(j):  33  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: ISOPRD        NO(j):  34  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: NTR           NO(j):  35  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: PEC           NO(j):  36  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: PMFINE        NO(j):  37  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: PMCOARS       NO(j):  38  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: POA           NO(j):  39  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: NH3           NO(j):  40  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: PNO3          NO(j):  41  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: SOA           NO(j):  42  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: GSO4          NO(j):  43  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: OH            NO(j):  44  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: O             NO(j):  45  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: O1D           NO(j):  46  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: XO2N          NO(j):  47  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
SPECIES: H2O           NO(j):  48  iopwrk(-,j) =  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

--------------  INPUT GROUP 8  ---------------

khmode  =            3
dkhup   =     0.000000
dkhstb  =     224.0000        96.00000        32.00000        0.000000
   0.000000        0.000000
dkzmin  =     1.000000
dkztop  =     0.000000
WARNING RUN DOESNT HAVE AREA SOURCE EMISSIONS:

-----  SETDEC subr. -----
XLAT,XLONG =     41.89269       -108.5755
XTZ,NJUL   =     7.000000              121
DEC,TSTART =     14.79203       -17.36097
SINLD,COSLD=    0.1704809       0.7197267

-----  CHEMI subr. -----

METHINT =            2
XLAT    =     42.10000
XLONG   =    -108.4000
XTZ     =     7.000000
NJUL    =           121

METH    =            2
LAT     =     42.10000
DEC     =     14.79203
NSP1    =            4
NSP2    =           39
NSS     =            4
ICHEM   =            2
XMOL    =     30.00000        46.00000        48.00000        47.00000
   63.00000        100.0000        108.0000        62.00000
   33.00000        28.00000        16.00000        32.00000
   121.0000        100.0000        72.00000        100.0000
```

```
   72.07000        16.00000        32.00000        32.00000
   112.0000        128.0000        100.0000        108.1400
   100.0000        100.0000        34.00000        80.00000
   16.00000        32.00000        64.00000        80.00000
   16.00000        64.00000        78.00000        1.000000
   1.000000        1.000000        1.000000        17.00000
   62.00000        1.000000        96.00000
IAEROF  =             0            0            0            0            0
           0            0            0            0            0            0
           0            0            0            0            0            0
           0            0            0            0            0            0
           0            0            0            0            0            0
           0            0            0            0            0            0
           1            1            1            1            0            0
           1            0

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

 Header record data from the 3D POINT area source emissions file

 FNAME2: 3D
 IGTYP2:      1
 NX2:        40
 NY2:        40
 DELX2:      36.000
 DELY2:      36.000
 XORIG2:  -1656.000
 YORIG2:   -432.000
 IUTMZ2:      0
 NSE2:       22
 IBDAT2:   2083
 IBTIM2:     17
 IEDAT2:   2182
 IETIM2:     17
 VRS2:   1.0
 LABEL2: SMOKE_RD
    SPECIES      MOL. WT.

 NO              30.000
 NO2             46.000
 CO              28.000
 FORM            16.000
 ALD2            32.000
 PAR             16.000
 ETH             32.000
 OLE             32.000
 TOL            112.000
 XYL            128.000
 ISOP            80.000
 SO2             64.000
 SO3             80.000
 UNR             16.000
 NH3             17.000
 PEC              1.000
 PMFINE           1.000
 PNO3            62.000
 POA              1.000
 PMCOARS          1.000
 SOA              1.000
 GSO4            96.000
 IXREM2 =             1            2            3            4            5
           6            7            8            9           10           11
          12           13           14           19           15           16
          20           18           17           21           22

 NSZAVG =            19
 NSZPRT =             4
 NSZOUT =            18
 NDFPRT =             0
 NDFOUT =             2
```

SUMMARY TABLE OF SUBARRAYS CONTAINED WITHIN THE MASTER ARRAY

Master array size: 50000000 (words)
Used in current run: 1710011 (words)

Number	Name	Array Dimensions				Array Size (words)	Beg. Address	End Address
1	FULCON	40	40	10	43	688000	1	688000
2	CONAVG	40	40	19	1	30400	688001	718400
3	COLCON	43	10	1	1	430	718401	718830
4	TOPCON	43	40	40	1	68800	718831	787630
5	UMET	40	40	10	1	16000	787631	803630
6	VMET	40	40	10	1	16000	803631	819630
7	WMET	40	40	10	1	16000	819631	835630
8	TMET	40	40	10	1	16000	835631	851630
9	RHMET	40	40	10	1	16000	851631	867630
10	IPGT	40	40	1	1	1600	867631	869230
11	HTMIX	40	40	1	1	1600	869231	870830
12	USTAR	40	40	1	1	1600	870831	872430
13	XMONIN	40	40	1	1	1600	872431	874030
14	WSTAR	40	40	1	1	1600	874031	875630
15	CLDMET	40	40	1	1	1600	875631	877230
16	CLDFRC	40	40	10	1	16000	877231	893230
17	QSWU	40	40	1	1	1600	893231	894830
18	RIBLK	40	40	10	1	16000	894831	910830
19	CLDATT	40	40	1	1	1600	910831	912430
20	UGRID	40	40	10	1	16000	912431	928430
21	VGRID	40	40	10	1	16000	928431	944430
22	WGRID	11	40	40	1	17600	944431	962030
23	TGRID	40	40	10	1	16000	962031	978030
24	PGRID	40	40	10	1	16000	978031	994030
25	DIFFKH	40	40	10	1	16000	994031	1010030
26	DIFFKZ	11	40	40	1	17600	1010031	1027630
27	Z0	40	40	1	1	1600	1027631	1029230
28	ILANDU	40	40	1	1	1600	1029231	1030830
29	ELEV	40	40	1	1	1600	1030831	1032430
30	XLAI	40	40	1	1	1600	1032431	1034030
31	NEARS	40	40	1	1	1600	1034031	1035630
32	EMAREA	40	40	22	1	35200	1035631	1070830
33	EMTOT	40	40	10	22	352000	1070831	1422830
34	EMCOL	43	10	1	1	430	1422831	1423260
35	QAVE	22	1	1	1	22	1423261	1423282
36	QFDOW	1	1	1	1	1	1423283	1423283
37	SFDOW	1	2	1	1	2	1423284	1423285
38	QFDI	1	1	1	1	1	1423286	1423286
39	SFDI	1	2	1	1	2	1423287	1423288
40	TIEM2	7	1	1	1	7	1423289	1423295
41	EM2DAT	25	1	1	1	25	1423296	1423320
42	TIEM3	9	1	1	1	9	1423321	1423329
43	EM3DAT	2	1	1	1	2	1423330	1423331
44	VD	40	40	20	1	32000	1423332	1455331
45	DRYFLX	40	40	20	1	32000	1455332	1487331
46	WETFLX	40	40	20	1	32000	1487332	1519331
47	TOPFLX	40	40	43	1	68800	1519332	1588131
48	HTFACE	11	40	40	1	17600	1588132	1605731
49	HTGRID	10	40	40	1	16000	1605732	1621731
50	DZCELL	40	40	1	1	1600	1621732	1623331
51	XX	40	1	1	1	40	1623332	1623371
52	YY	40	1	1	1	40	1623372	1623411
53	TMP1	1600	1	1	1	1600	1623412	1625011
54	TMP2	1600	1	1	1	1600	1625012	1626611
55	BC	10	10	60	1	6000	1626612	1632611
56	ADV1	43	10	40	4	68800	1632612	1701411
57	ADV2	43	40	1	1	1720	1701412	1703131
58	ADV3	43	40	4	1	6880	1703132	1710011

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

 Header record data from the unformatted BCON boundary condition file

 FNAMEB: BCON
 IGTYPB:      1
 NXB:        40
 NYB:        40
 DELXB:      36.000
 DELYB:      36.000
 XORIGB:  -1656.000
 YORIGB:   -432.000
 IUTMZB:      0
 NSAB:       43
 IBDATB:   2083
 IBTIMB:     17
 IEDATB:   2182
 IETIMB:     17
 VRSB:   1.0
 LABELB: CONC_RD
    SPECIES

 NO
 NO2
 O3
 HONO
 HNO3
 PNA
 N2O5
 NO3
 HO2
 CO
 FORM
 ALD2
 PAN
 XO2
 C2O3
 CRO
 MGLY
 PAR
 ETH
 OLE
 TOL
 XYL
 OPEN
 CRES
 TO2
 ROR
 H2O2
 ISOP
 MEOH
 ETOH
 SO2
 SO3
 UNR
 ISOPRD
 NTR
 PEC
 PMFINE
 PMCOARS
 POA
 NH3
 PNO3
 SOA
 GSO4


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

 Header record data from the unformatted TCON boundary condition file
```

```
FNAMET: TCON
IGTYPT:      1
NXT:        40
NYT:        40
DELXT:      36.000
DELYT:      36.000
XORIGT:  -1656.000
YORIGT:   -432.000
IUTMZT:      0
NSAT:       43
IBDATT:   2083
IBTIMT:     17
IEDATT:   2182
IETIMT:     17
VRST:   1.0
LABELT: CONC_RD
   SPECIES

NO
NO2
O3
HONO
HNO3
PNA
N2O5
NO3
HO2
CO
FORM
ALD2
PAN
XO2
C2O3
CRO
MGLY
PAR
ETH
OLE
TOL
XYL
OPEN
CRES
TO2
ROR
H2O2
ISOP
MEOH
ETOH
SO2
SO3
UNR
ISOPRD
NTR
PEC
PMFINE
PMCOARS
POA
NH3
PNO3
SOA
GSO4


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

     USER-SPECIFIED DEPOSITION VELOCITY FILE (VD.DAT)


                    DEPOSITION VELOCITY FILE (VD.DAT)
                    ---------------------------------
```

```
     VD.DAT CONTAINS A 24-HOUR DIURNAL CYCLE OF DEPOSITION
 VELOCITIES FOR EACH SPECIES FLAGGED AS USING USER-SPECIFIED VALUES
 IN THE CONTROL FILE (CALGRID.INP).   NOTE: UNITS ARE IN M/S.
                                      -----------------------


 SPECIES
  NAME         DEPOSITION VELOCITIES (M/S)
 -------       ---------------------------

 ! ISOP    =   5*1.2E-2, 4*9.0E-3, 3*7.5E-3, 3*3.0E-3, 3*7.5E-3, 6*1.0E-2 !
 ! ISOPRD  =   5*1.2E-2, 4*9.0E-3, 3*7.5E-3, 3*3.0E-3, 3*7.5E-3, 6*1.0E-2 !

 !END!
 Finished writing header records:    18
 Finished writing header records:    18



<<<  Intermediate subhourly output removed  >>>



  LAST DAY/HOUR PROCESSED:
     Year:  2  Month:  5   Day: 31   Julian day: 151   Hour: 23


  End of run -- Clock Time: 22:53:39
                     Date: 01-16-

        Elapsed Clock Time:     6686.0 (seconds)

                  CPU Time:        0.0 (seconds)
```