4. USER'S INSTRUCTIONS

4.1 OPTHILL

When the subgrid scale complex terrain (CTSG) option of the CALPUFF model is invoked, two groups of additional data must be prepared by the user and entered into the CALPUFF control file: non-gridded receptor information and sub-grid scale terrain information. The purpose of the optimizer program OPTHILL is to provide the user with the means for calculating the set of terrain data that best characterizes each feature.

4.1.1 CTSG Terrain Information

CTSG requires information on the location, orientation, size, and shape of each terrain feature being modeled (see Section 4.2.1). The variables that provide this information are:

xc, yc	coordinates (km) of the center of the hill
thetah	orientation (deg) of major axis of hill (clockwise from north)
zgrid	height (m) of "zero-plane" of grid above mean sea level
relief	height (m) of crest of hill above the "zero-plane" elevation
expo (1)	hill-shape exponent for major axis
expo (2)	hill-shape exponent for minor axis
scale(1)	horizontal length scale (m) along major axis
scale(2)	horizontal length scale (m) along minor axis
axmax(1)	maximum allowed axis length (m) for major axis
axmax(2)	maximum allowed axis length (m) for minor axis

The profile of the terrain along each axis of the feature is prescribed by the following equation:

$$ht(x) = \left[\frac{1 - (x/axmax)^{expo}}{1 + (x/scale)^{expo}}\right] * relief \qquad (4.1\text{-}1)$$

where ht is the height of the profile above the base of the feature, at a distance x from the peak (Figure 4.1-1).

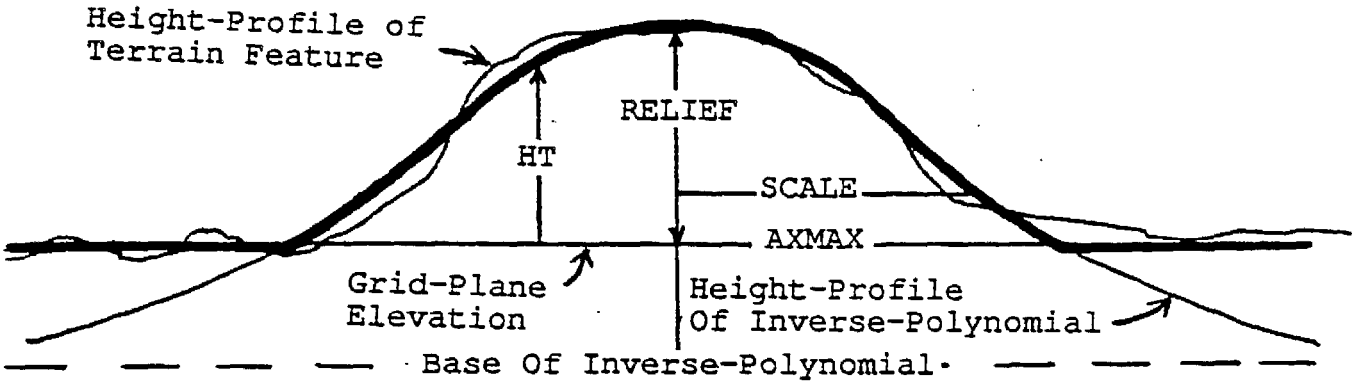


Figure 4.1-1. Profile of a terrain feature along one of its two axes. A best-fit inverse polynomial function describes this profile to CTSG.

The terrain profile-optimizing program (OPTHILL) is provided to compute the hill shape exponent (EXPO) and horizontal terrain length scale (SCALE) parameters from a user-entered terrain profile. The OPTHILL program performs computations for one axis (i.e., major or minor axis) of the terrain feature at a time. Therefore, two runs of OPTHILL are necessary for each subgrid scale terrain feature.

The following procedure is recommended to determine the terrain inputs for the CALPUFF CTSG algorithm.

a. Identify the sub-grid terrain features to be modeled.

   Such features will generally be small enough that they could be contained within one grid-square. This does not mean that they cannot straddle two or more squares. The features should be prominent, and possibly lie near source regions so that the additional computations required by CTSG are warranted in resolving important pollutant impact areas.

b. Decide on the orientation of the feature.

   The orientation of the feature is generally evident if the feature is longer in one direction than another. If there is no dominant direction to the feature, model it as a symmetric feature, and choose an orientation of north.

c. Obtain height-profiles along each axis of the feature.

   Choose an approximate center for the feature and draw axes through it (one axis should lie along the direction of orientation). Along each axis, measure the distance between approximate intersections of the axis with marked contours. The distances so measured should extend from the contour furthest to the south to the same contour furthest to the north (for a north-south axis). Divide each of these distances by two, and tabulate the results.

d. Identify the total elevation of the feature.

Take the peak elevation directly from the map.

e. Identify the elevation at the base of the feature.

Generally, the base of the feature will be that point at which the feature becomes indistinguishable from terrain variations around it.

f. Convert all elevations that were tabulated to heights above the base of the feature.

g. Use optimizer program (OPTHILL) to obtain shape parameters.

The "relief" parameter is just the peak elevation less the base elevation. The "axmax" value for each axis should be representative of the maximum extent of the feature along each axis at the elevation of the base of the feature. With these two variables fixed for each axis, the height-profile data from step c. can be put through OPTHILL to obtain "expo" and "scale" for each axis.

OPTHILL requires a single input file (OPTHILL.INP) which contains the user's inputs describing the terrain profile, each height, and maximum axis length. The computed volumes of EXPO and SCALE for one axis of the hill are listed in the output list file (OPTHILL.LST). Table 4.1-1 summarizes the OPTHILL input and output file contents. The format and contents of the OPTHILL control file are variables explained in Table 4.1-2.

4.1.2 Example OPTHILL Application

The OPTHILL program is an optimization that takes a value of "relief" and "axmax," and a sequence of pairs of (x,ht) values along an axis, and returns a value of "expo" and "scale" that prescribes the profile function that best matches the (x,ht) pairs. Its use is illustrated by the following example.

Table 4.1-1

OPTHILL Input and Output Files

Unit	File Name	Type	Format	Description
5	OPTHILL.INP	input	formatted	Control file containing user inputs
6	OPTHILL.LST	output	formatted	List file (line parameter output file)

Table 4.1-2

OPTHILL Control File Inputs (OPTHILL.INP)

Record	Variable No.	Variable Name	Columns	Type of Format	Description
1	1	TITLE(15)	1-60	15A4	60 character title
2	1	RELIEF	*	real	Height (m) of the crest of the hill above the grid elevation
3	1	AXMAX	*	real	Maximum allowed axis length (m) for the axis (major or minor) being evaluated
4	1	-	*	-	This record is skipped by the program. May contain optional text data
(Record repeated for each distance-height pair)					
5	1	DIST	*	real	Distance-height pairs describing the profile of the terrain. Units: m
5	2	HGT	*	real	

*Entered in Fortran free format.

Figure 4.1-2 shows the terrain surrounding the site of EPA's "Full-Scale Plume Study" (FSPS) that was performed in the Truckee River Valley near Reno, NV, as part of the Complex Terrain Model Development Program. Nocturnal flow in this valley is frequently channeled by the high terrain to the north and south of the Tracy power plant. Elevations typical of nocturnal plume heights (4600-4800 ft. MSL) are emphasized on the figure. Given the predominant flow to the east during stable conditions, there is potential for plume impact on the feature just northeast of the plant. This feature, marked by axes in Figure 4.1-2, was named "Beacon Hill" during the study.

Following the procedures outlined above, axes were drawn over the feature and distances between fixed contour elevations were tabulated. After subtracting the elevation above sea level of the base of the feature (the floor of the river valley), these data were entered into two files. Figure 4.1-3 displays the contents of both files. The files (names axis1.inp and axis2.inp) contain "relief" and the value for "axmax" for each axis of the hill, followed by five pairs of (x,ht) values. The first record of each file is reserved for comments to identify the data. Values for "relief" and "axmax" are free-format, and should be entered anywhere in the open space provided on the next two lines. Pairs of (x,ht) should be entered right after the next comment record.

OPTHILL must be invoked separately for each of the two axes of the hill. This is accomplished by renaming one input file (e.g., axis1.inp) to the OPTHILL input control file name (OPTHILL.INP), executing the program, renaming the output file (OPTHILL.LST) to a new name (e.g., axis1.lst), and then repeating these steps for the second axis of the hill. The output files produced by OPTHILL for the current example are presented in Figure 4.1-4 and 4.1-5. The output file lists the final values of the profile parameters, and it also lists the profile data provided by the user along with the corresponding data computed from the profile parameters.

With these results, hill information that is independent of the choice of coordinate system and the modeling grid for the wind model can be specified:

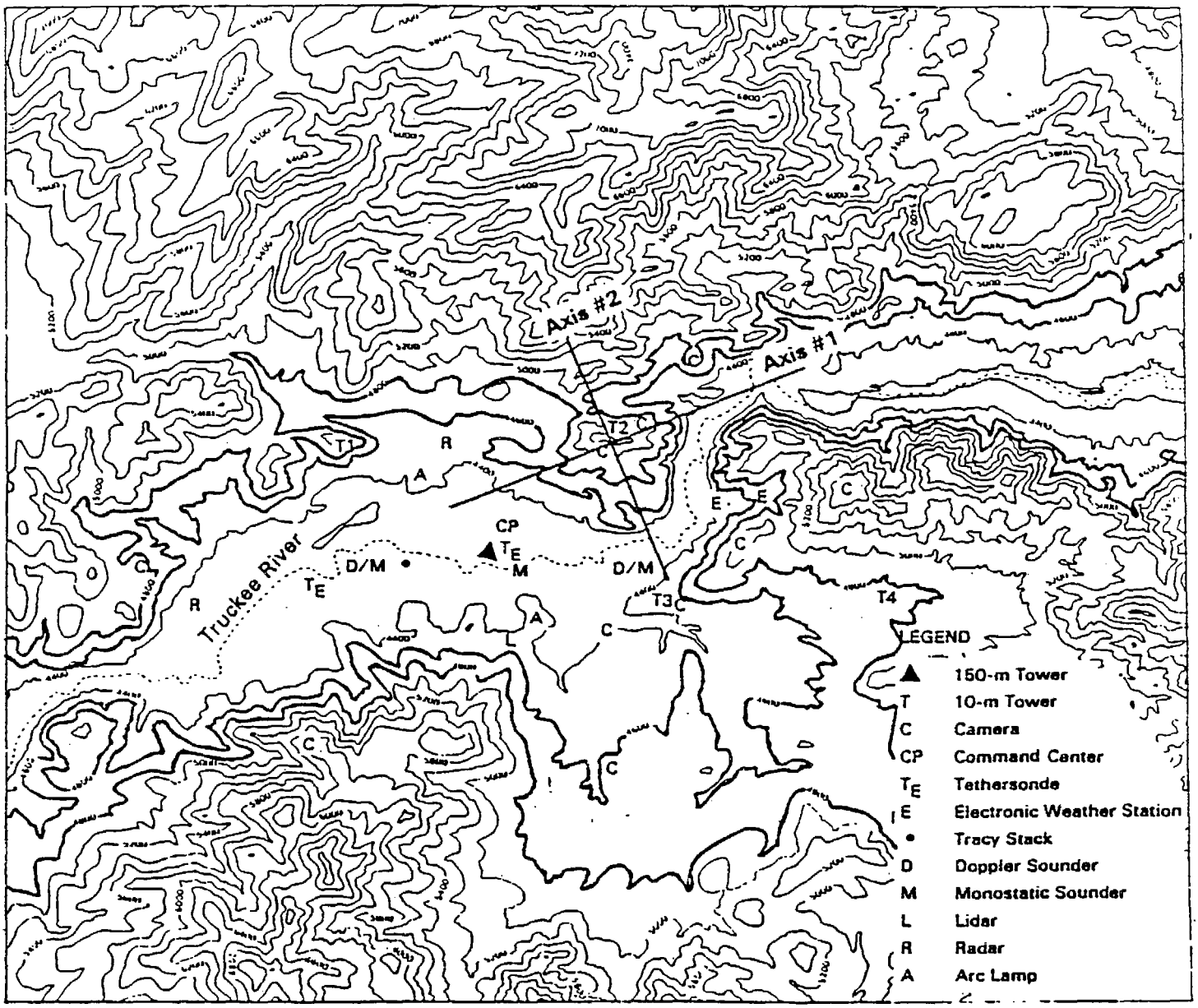


Figure 4.1-2. Map of terrain surrounding the site of the FSPS, illustrating the selection and characterization of a terrain feature for CTSG modeling.

```
Optimal SCALE and EXPO factors -- Axis #1 of example problem
300.          - Height (m) of hill crest above "zero-plane" elevation (RELIEF)
2000.         - Maximum allowed length (m) for this axis (AXMAX)
--------------- Distance-height pairs describing hill profile ---------------
564.,  239.   - Dist.(m) from crest, terrain ht (m) above "zero-plane" elev.
826.,  178.     (Repeated for each dist.-height pair)
1062., 150.
1193., 117.
1508.,  56.
```

(a) OPTHILL.INP for Axis #1 of the hill.

```
Optimal SCALE and EXPO factors -- Axis #2 of example problem
300.            Height (m) of hill crest above "zero-plane" elevation (RELIEF)
1500.           Maximum allowed length (m) for this axis (AXMAX)
--------------- Distance-height pairs describing hill profile ---------------
302.,  239.   - Dist.(m) from crest, terrain ht (m) above "zero-plane" elev.
551.,  178.     (Repeated for each dist.-height pair)
708.,  150.
970.,  117.
1311.,  56.
```

(b) OPTHILL.INP for Axis #2 of the hill.

Figure 4.1-3. Sample OPTHILL input files for (a) Axis #1 and (b) Axis #2 of the hill is in the example.

```
*** Optimal SCALE and EXPO factors -- Axis #1 of example problem ***

    EVOL TIME LIMIT=   60.  SECONDS     SKIP= 10

NUMBER OF PARAMETERS FOR THIS STUDY :  4

PARAMETER  START VALUE  STEP CONTROL  LOWER LIMIT  UPPER LIMIT
---------  -----------  ------------  -----------  -----------

 1 RELIEF  0.3000E+03   0.0000E+00    0.3000E+03   0.3000E+03
 2 AXMAX   0.2000E+04   0.0000E+00    0.2000E+04   0.2000E+04
 3 EXPO    0.2000E+01   0.2000E+01    0.1000E+00   0.1000E+02
 4 SCALE   0.2000E+04   0.1000E+04    0.2000E+02   0.2000E+06

CALCULATIONS STARTED

RETURN VALUE: 2     NORMAL RETURN                    FUNCTION VALUE:      0.50303

PARAMETER VALUES:
                RELIEF  =     300.00000
                AXMAX   =    2000.00000
                EXPO    =       1.90651
                SCALE   =    1522.94500

   Distance     Height     Fitted Value

      564.0       239.0       237.4
      826.0       178.0       186.4
     1062.0       150.0       139.9
     1193.0       117.0       115.5
     1508.0        56.0        63.0
```

Figure 4.1-4. Content of output file produced by OPTHILL in processing axis #1 of sample hill.

```
*** Optimal SCALE and EXPO factors -- Axis #2 of example problem ***

    EVOL TIME LIMIT=   60.  SECONDS     SKIP= 10


NUMBER OF PARAMETERS FOR THIS STUDY :  4

PARAMETER  START VALUE  STEP CONTROL  LOWER LIMIT  UPPER LIMIT
---------  -----------  ------------  -----------  -----------


 1 RELIEF  0.3000E+03   0.0000E+00    0.3000E+03   0.3000E+03
 2 AXMAX   0.1500E+04   0.0000E+00    0.1500E+04   0.1500E+04
 3 EXPO    0.2000E+01   0.2000E+01    0.1000E+00   0.1000E+02
 4 SCALE   0.1500E+04   0.7500E+03    0.1500E+02   0.1500E+06


CALCULATIONS STARTED



RETURN VALUE: 2     NORMAL RETURN                    FUNCTION VALUE:        2.17504

PARAMETER VALUES:
                RELIEF  =     300.00000
                AXMAX   =    1500.00000
                EXPO    =       1.23912
                SCALE   =    2895.90200

   Distance     Height     Fitted Value

      302.0       239.0        244.0
      551.0       178.0        189.1
      708.0       150.0        154.7
      970.0       117.0         99.5
     1311.0        56.0         33.5
```

Figure 4.1-5. Content of output file produced by OPTHILL in processing axis #2 of sample hill.

xc,yc (m)	(depends on choice of coordinates)
thetah (deg)	69°
zgrid (m)	(depends on grid for wind model)
relief (m)	300.
expo (1)	1.91
expo (2)	1.24
scale (1) (m)	1523.
scale (2) (m)	2896.
axmax (1) (m)	2000.
axmax (2) (m)	1500.

Note that scale(2) is almost twice scale(1), even though axis 1 corresponds to the longer axis of the hill. This can occur because the "scale" parameter is a property of the entire inverse-polynomial function (Equation 4.1-1), rather than just the portion of the function that is fit to the profile of the terrain. In Figure 4.1-1, the shape of the terrain might best conform to the upper 10% of the polynomial function, in which case the "scale" parameter would exceed "axmax." In this example application of the OPTHILL program, we see that axmax(2) is substantially less than axmax(1), whereas scale(2) exceeds scale(1), indicating that a comparatively <u>smaller</u> portion of the polynomial function represents the terrain profile along the minor axis.

4.2 CALPUFF Model Input Files

4.2.1 User Control File (CALPUFF.INP)

The selection and control of CALPUFF options are determined by user-specified inputs contained in a file called the control file. This file, CALPUFF.INP, contains all the information necessary to define a model run (e.g., starting date, run length, grid specifications, technical options, output options, etc.).

It is designed to beflexible and easy-to-use. The control file is read by a set of Fortran text processing routines contained within CALPUFF which allow the user considerable flexibility in designing and customizing the input file. An unlimited amount of optional descriptive text can be inserted within the control file to make it self-documenting. For example, the definition, allowed values, units, and default value of each input variable can be included within the control file.

The control file processor searches for pairs of special delimiter characters (!). All text outside the delimiters is assumed to be user comment information and is echoed back but otherwise ignored by the input module. Only data within the delimiter characters is processed. The input data consists of a leading delimiter followed by the variable name, equals sign, input value or values, and a terminating delimiter (e.g., !XX = 12.5 !). The variable name can be lower or upper case, or a mixture of both (i.e., XX, xx, Xx are all equivalent). The variable can be a real, integer or logical array or scalar. The use of repetition factors for arrays is allowed (e.g., ! XARRAY = 3 * 1.5 ! instead of ! XARRAY = 1.5, 1.5, 1.5 !). Different values must be separated by commas. Spaces within the delimiter pair are ignored. Exponential notation (E format) for real numbers is allowed. However, the optional plus sign should be omitted (e.g., enter +1.5E+10 as 1.5E10). The data may be extended over more than one line. The line being continued must end with a comma. Each leading delimiter must be paired with a terminating delimiter. All text between the delimiters is assumed to be data, so no user comment information is allowed to appear

within the delimiters. The inclusion in the control file of any variable that is being assigned its default value is optional.

The control file is organized into 15 major Input Groups and a variable number of subgroups within several of the major Input Groups. The first three lines of the input file consist of a run title. As shown in Table 4.2.1, the major Input Groups are defined along functional lines (e.g., technical options, output options, subgrid scale, complex terrain inputs, etc.). Each subgroup contains a set of data such as source variables, subgrid scale hill descriptions, or discrete receptor information. The number of subgroups varies with the number of sources, hills, etc., in the model run.

The major Input Groups must appear in order, i.e., Input Group 1 followed by Input Group 2, etc. However, the variables within an Input Group may appear in any order. The variable names in each Input Group are independent, so that the same name can be repeated in different Input Groups (e.g., as shown in the sample control file, species names (SO2, SO4) are use in several Input Groups). Each Input Group and subgroup must end with an Input Group terminator consisting of the word END between two delimiters (i.e., !END!). Every major Input Group, even blank Input Groups (i.e., one in which no variables are included) must end with an Input Group terminator in order to signal the end of that Input Group and the beginning of another.

The control file module has a list of variable names and array dimensions for each Input Group. Checks are performed to ensure that the proper variable names are used in each Input Group, and that no array dimensions are exceeded. Error messages result if an unrecognized variable name is encountered or too many values are entered for a variable.

A standard control file is provided along with the CALPUFF test case run as shown in Figure 4.2.1. It is recommended that a copy of the standard control file be permanently stored as a backup. Working copies of the control file may be made and then edited and customized by the user for a particular application.

Table 4.2.1. Input Groups in the CALPUFF Control File

Input Group	Description
*	Run title First three lines of control file (up to 80 characters/line)
1	General run control parameters Starting date and hour, run length, time step. Number of species.
2	Technical options Control variables determining methods for treating chemistry, wet deposition, dry deposition, dispersion, plume rise, complex terrain, and near-field puff sampling methods
3	Species list Species names, flags for determining which species are modeled, advected, emitted, and dry deposited
4	Grid control parameters Specification of meteorological, computational, and sampling grids, number of cells, vertical layers, and reference coordinates.
5	Output options Printer control variables, disk output control variables
6a,b,c	Subgrid scale complex terrain (CTSG) inputs Information describing subgrid scale hill location, shape and height. Complex terrain receptor locations and elevations.
7	Dry deposition parameters - Gases Pollutant diffusivity, dissociation constant, reactivity, mesophyll resistance, Henry's law coefficient
8	Dry deposition parameters - Particles Geometric mass mean diameter, geometric standard deviation

Table 4.2.1. Input Groups in the CALPUFF Control File - Concluded

Input Group	Description
9	Miscellaneous dry deposition parameters Reference cuticle and ground resistances, reference pollutant reactivity, vegetation state
10	Wet deposition parameters Scavenging coefficients for each pollutant and precipitation type (liquid and frozen precipitation)
11	Chemistry parameters Control variables for input of ozone data, background ozone and ammonia concentrations, nighttime transformation rates
12	Dispersion parameters Vertical dispersion constants, dispersion rate above the boundary layer, crossover distance to time-dependent dispersion coefficients, land use associated with urban dispersion
13a,b,c	Point source parameters Point source data including source location, stack parameters and emissions, and building dimensions
14a,b	Area source parameters Area source data including source location, effective height, elevation, initial sigmas and emission rates
15a,b	Non-gridded (discrete) receptor information Receptor coordinates and ground elevation

```
CALPUFF test run -- 2 hour simulation
10 x 10 meteorological grid
2 point sources
--------------- Run title (3 lines) ------------------------------------------

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

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

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

     Starting date:   Year (IBYR) -- No default       ! IBYR=80 !
                     Month (IBMO) -- No default       ! IBMO=07 !
                       Day (IBDY) -- No default       ! IBDY=01 !
                      Hour (IBHR) -- No default       ! IBHR=00 !

     Length of run (hours) (IRLG) -- No default       ! IRLG=2 !

     Number of chemical species (NSPEC)
                                  Default: 5          ! NSPEC=1  !

     Number of chemical species
     to be emitted  (NSE)         Default: 3          ! NSE=1  !

!END!


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

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


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

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

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

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 1 and 2.

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

   Chemical mechanism flag (MCHEM)       Default: 1     ! MCHEM = 1 !
      0 = chemical transformation not
          modeled
      1 = transformation rates computed
          internally (MESOPUFF II scheme)
      2 = user-specified transformation
          rates used

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

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

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

      1 = dispersion coefficients computed from values of
          sigma u, sigma w read from SIGMA.DAT file
      2 = dispersion coefficients sigma u, sigma w computed
          internally from micrometeorological variables (u*, w*, L, etc.)
      3 = PGT dispersion coefficients for RURAL areas (computed using
          the ISCST multi-segment approximation) and MP coeffients in
          URBAN areas
      4 = same as 3 except PGT coefficients computed using
          the MESOPUFF II eqns.

!END!
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 2 concluded.

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

INPUT GROUP: 3 -- Species list
-------------

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

BUILD-UP SPECIES

! SO2          =   1        ,      1        ,      0             !
! SO4          =   0        ,      0        ,      0             !
! NOX          =   0        ,      0        ,      0             !
! HNO3         =   0        ,      0        ,      0             !
! NO3          =   0        ,      0        ,      0             !

!END!


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

INPUT GROUP: 4 -- Grid control parameters
-------------


METEOROLOGICAL GRID:

           No. X grid cells (NX)      No default     ! NX=10 !
           No. Y grid cells (NY)      No default     ! NY=10 !
         No. vertical layers (NZ)     No default     ! NZ= 5 !

          Grid spacing (DGRIDKM)      No default     ! DGRIDKM=4.0 !
                                      Units: km

              Cell face heights
                 (ZFACE(nz+1))        No defaults
                                      Units: m

                    ! ZFACE = 0.0, 20.0, 180., 420., 780., 1220.  !
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 3 and 4.

```
          Reference coordinates
        of SOUTHWEST corner of
             grid point (1,1):

        X coordinate (XORIGKM)      No default     ! XORIGKM= 168.000 !
        Y coordinate (YORIGKM)      No default     ! YORIGKM=3839.000 !
                                    Units: km

            UTM zone (IUTMZN)       No default     ! IUTMZN= 11 !

  Reference coordinates of CENTER
       of the domain (used in the
   calculation of solar elevation
                        angles)

          Latitude  (deg.) (XLAT)   No default    ! XLAT  =  34.0  !
         Longitude (deg.) (XLONG)   No default    ! XLONG = 118.0  !
           Time zone        (XTZ)   No default    ! XTZ   =   8.   !
   (PST=8, MST=7, CST=6, EST=5)
```

COMPUTATIONAL GRID:

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

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

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


   X index of UR corner (IECOMP)      No default     ! IECOMP = 10 !
            (1 <= IECOMP <= NX)

   Y index of UR corner (JECOMP)      No default     ! JECOMP = 10 !
            (1 <= JECOMP <= NY)
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 4 continued.

```
SAMPLING GRID (GRIDDED RECEPTORS):

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

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

        X index of LL corner (IBSAMP)       No default     ! IBSAMP = 1 !
         (IBCOMP <= IBSAMP <= IECOMP)

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


        X index of UR corner (IESAMP)       No default     ! IESAMP = 10 !
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)       No default     ! JESAMP = 10 !
         (JBCOMP <= JESAMP <= JECOMP)


        Nesting factor of the sampling
        grid (MESHDN)                       No default     ! MESHDN = 1 !
        (MESHDN is an integer >= 1)


!END!

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

INPUT GROUP:. 5 -- Output Options
--------------

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

   Concentrations (ICON)              1                  !   ICON = 0 !
   Dry Fluxes (IDRY)                  1                  !   IDRY = 0 !
   Wet Fluxes (IWET)                  1                  !   IWET = 0 !

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

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 4 concluded and Input Group 5.

```
LINE PRINTER OUTPUT OPTIONS:

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

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

    Messages tracking progress of    Default: 1        !  IMESG = 1 !
    run written to the screen ?
    (IMESG) -- 0=no, 1=yes

    Fortran unit for screen output   Default: 0        ! IOMESG = 0 !
    (IOMESG)


  SPECIES LIST FOR OUTPUT OPTIONS

            -------- CONCENTRATIONS ---------   ----------- DRY FLUXES -----------   --------- WET FLUXES ----------
SPECIES
 NAME          PRINTED ?       SAVED ON DISK ?    PRINTED ?       SAVED ON DISK ?    PRINTED ?     SAVED ON DISK ?
-------      ---------------------------------   ---------------------------------   ------------------------------

! SO2    =       1       ,       1       ,       0       ,       0       ,       0       ,       0       !
! SO4    =       0       ,       0       ,       0       ,       0       ,       0       ,       0       !
! NOX    =       0       ,       0       ,       0       ,       0       ,       0       ,       0       !
! HNO3   =       0       ,       0       ,       0       ,       0       ,       0       ,       0       !
! NO3    =       0       ,       0       ,       0       ,       0       ,       0       ,       0       !

!END!


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

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

--------------
Subgroup (6a)
--------------
    Number of terrain featues (NHILLS)      Default: 0     ! NHILLS = 2 !

    Number of special complex terrain
    receptors  (NCTRECS)                    Default: 0     ! NCTRECS = 5 !
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 5 concluded and Input Group 6.

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

                    1 **
    HILL INFORMATION

HILL              XC     YC    THETAH    ZGRID    RELIEF    EXPO 1    EXPO 2    SCALE 1    SCALE 2    AMAX1    AMAX2
 NO.              (km)   (km)  (deg.)    (m)      (m)       (m)       (m)       (m)        (m)        (m)      (m)
----              ----   ----  ------    -----    ------    ------    ------    -------    -------    -----    -----
 1   ! HILL =     2.5    2.0     69.     1310.     300.      1.91      1.24      1523.      2896.      2000.    1500. !  !END
 2   ! HILL =     5.0    0.0     46.     1310.     230.      1.50      1.50      3000.      1000.      4000.    2000. !  !END

--------------
Subgroup (6c)
--------------
                                      1  **
    COMPLEX TERRAIN RECEPTOR INFORMATION

          XRCT     YRCT      ZRCT          IHH
          (km)     (km)      (m)
         ------   -----    ------         ----
! CTREC =  2.5      1.0      1430.          1      !  !END!
! CTREC =  1.0      1.5      1430.          1      !  !END!
! CTREC =  2.5      2.0      1580.          1      !  !END!
! CTREC =  5.0      0.0      1525.          2      !  !END!
! CTREC =  4.5      0.0      1430.          2      !  !END!

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

          XRCT, YRCT = Coordinates of the complex terrain receptors
          ZRCT    = Height of the ground (MSL) at the complex terrain
                    receptor
          IHH     = Hill number associated with each complex terrain receptor
    **
     NOTE: Data for each hill and CTSG receptor are treated as a separate
           input subgroup and therefore must end with an input group terminator.
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 6 concluded.

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

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

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

! SO2  =      0.1509     ,     1.00E3    ,      8.0    ,          0.0          ,          4.e-2          !
! NOX  =      0.1656     ,     1.00      ,      8.0    ,          5.0          ,          3.5            !
! HNO3 =      0.1628     ,     1.00      ,     18.0    ,          0.0          ,          8.e-8          !

!END!

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

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

SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
 NAME             DIAMETER                   DEVIATION
                  (microns)                  (microns)
-------      ------------------         ------------------
! SO4    =          0.48          ,          2.00     !
! NO3    =          0.48          ,          2.00     !



!END!

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

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

     Reference cuticle resistance   (RCUTR)  (s/cm)   !  RCUTR=17.0 !
     Reference ground resistance    (RGR)    (s/cm)   !    RGR= 5.0 !
     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!
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Groups 7, 8, and 9.

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

INPUT GROUP: 10 -- Wet Deposition Parameters
--------------

                                                        -1
                    Scavenging Coefficient -- Units: (sec)

     Pollutant        Liquid Precip.        Frozen Precip.
     ---------        --------------        --------------
   !   SO2      =        3.0e-5      ,          0.0        !
   !   SO4      =       10.0e-5      ,          3.0e-5     !
   !   NOX      =        0.0         ,          0.0        !
   !  HNO3      =        6.0e-5      ,          0.0        !
   !   NO3      =       10.0e-5      ,          3.0e-5     !

!END!

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

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

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

     Background ozone concentration
     (BCKO3) in ppb                    Default: 80.        ! BCKO3 = 80. !
     (Used only if MCHEM = 1 and
      MOZ = 0 or (MOZ = 1 and all hourly

     Background ammonia concentration
     (BCKNH3) in ppb                   Default: 10.       ! BCKNH3 = 10. !

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

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

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

!END!
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Groups 10 and 11.

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

INPUT GROUP: 12 -- Dispersion parameters
--------------

     Distance (km) beyond which the time-dependent
     dispersion equations are used to determine
     sigma y and sigma z (TMDEP)              Default: 10.    ! TMDEP = 10. !

     Stability class used to determine plume
     growth rates for puffs above the boundary
     layer (JSUP)                             Default: 6     ! JSUP = 6 !

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

     Vertical dispersion constant for neutral/
     unstable conditions (k2 in Eqn. 2.7-4)
     (CONK2)                                  Default: 0.1   ! CONK1 = 0.01 !

     Range of land use categories for which
     urban dispersion is assumed
     (IURB1, IURB2)                           Default: 100,  ! IURB1 = 100 !
                                                       199   ! IURB2 = 199 !

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

INPUT GROUPS: 13a & 13b -- Point source parameters
----------------------

---------------
Subgroup (13a)
---------------

     Number of point sources with
     constant emission parameters   (NPT1)  No default  !  NPT1 = 3 !

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

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

!END!
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Groups 12 and 13.

```
--------------
Subgroup (13b)
--------------
                                                                    a
          POINT SOURCE DATA FOR SOURCES WITH CONSTANT EMISSION PARAMETERS
          ---------------------------------------------------------------
                                                                                  b          c
Source      X UTM       Y UTM       Stack      Base       Stack      Exit       Exit      Bldg.    Emission
 No.     Coordinate  Coordinate    Height   Elevation   Diameter   Velocity    Temp.   Downwash     Rates
           (km)        (km)         (m)        (m)        (m)       (m/s)   (deg. K)                (g/s)
------   ----------  ----------   ------     ------    --------   --------  --------  --------   ---------

  1   ! X =  196.1,    3866.2,      5.5,       0.0,       2.0,       4.5,      273.,      0    ,     1.2  !  !END!
  2   ! X =  172.0,    3859.2,     20.5,       0.0,       2.2,       3.5,      283.,      1    ,     0.9  !  !END!
  3   ! X =  180.1,    3869.2,     85.0,       0.0,       4.5,      12.0,      450.,      1    ,    22.9  !  !END!

--------

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

    b
     NOTE: 0 = No building downwash modeled, 1 = downwash modeled

    c
     "NSPEC" emission rates must be entered (one for every pollutant).
      Enter emission rate of zero for secondary pollutants.

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

          BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
          -------------------------------------------------------
Source
 No.      Effective building width and height (in meters) every 10 degrees
------    ---------------------------------------------------------------

  2       ! WIDTH  = 36 * 12.0 !
  2       ! HEIGHT = 36 * 22.5 !
!END!
  3       ! WIDTH  = 20 * 0.0, 45.5, 48.5, 52.5, 13 * 0.0 !
  3       ! HEIGHT = 20 * 0.0, 78.0, 78.0, 78.0, 13 * 0.0 !
!END!
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 13 concluded.

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

INPUT GROUPS: 14a & 14b -- Area source parameters
----------------------

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

     Number of area sources with
     constant emission parameters (NAR1)     No default  !  NAR1 = 2 !

     Gridded area source data
     used ? (GRIDAR)                         No default  !  GRIDAR = 0 !
        0 = no
        1 = yes (gridded area source
            emissions read from the file:
            AREM.DAT)

     The following parameters apply to the data in the
     gridded area source emissions file (AREM.DAT)

       - Effective height of emissions
         (AEFFHT) in meters                  No default  ! AEFFHT = 10.0 !

       - Initial sigma y (ASIGYI) in
         meters                              No default  ! ASIGYI = 3000. !

       - Initial sigma z (ASIGZI) in
         meters                              No default  ! ASIGZI = 10. !

!END!
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 14.

```
--------------
Subgroup (14b)
--------------
                                                                        a
          AREA SOURCE DATA FOR SOURCES WITH CONSTANT EMISSION PARAMETERS
          ------------------------------------------------------------
                                                                              b
      X UTM      Y UTM      Effect.    Base      Initial    Initial    Emission
   Coordinate Coordinate   Height   Elevation  Sigma y    Sigma z     Rates
     (km)       (km)         (m)       (m)       (m)        (m)      (g/s)
   ---------- ----------   ------   ------   --------   --------   --------

! X =  201.1,    3886.2,     12.0,     0.0,    120.0,      20.0,      1.2  !  !END!
! X =  182.0,    3889.2,     25.0,     0.0,    550.0,      50.0,      0.9  !  !END!

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

    b
     "NSPEC" emission rates must be entered (one for every pollutant).
      Enter emission rate of zero for secondary pollutants.


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

INPUT GROUPS: 15a & 15b -- Non-gridded (discrete) receptor information
----------------------

--------------
Subgroup (15a)
--------------

     Number of non-gridded receptors (NREC)  No default  !  NREC = 3 !

!END!
```

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 14 concluded and Input Group 15.

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

NON-GRIDDED (DISCRETE) RECEPTOR DATA[a]

Receptor No.	X UTM Coordinate (km)	Y UTM Coordinate (km)	Ground Elevation (m)	
1	! X = 180.1,	3859.2,	22.0	! !END!
2	! X = 195.1,	3862.2,	65.0	! !END!
3	! X = 212.5,	3877.2,	105.0	! !END!

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

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

Figure 4.2.1. Sample CALPUFF Control File (CALPUFF.INP). Input Group 15 concluded.

CALPUFF Control File Inputs - Input Group 1

General Run Control Parameters

Variable	Type	Description	Default Value
IBYR	integer	Starting year of the CALPUFF run (two digits)	-
IBMO	integer	Starting month	-
IBDY	integer	Starting day	-
IBHR	integer	Starting hour (00-23)	-
IRLG	integer	Length of the run (hours)	-
NSPEC	integer	Total number of species modeled	5
NSE	integer	Number of species emitted	3

CALPUFF Control File Inputs - Input Group 2

Technical Options

Variable	Type	Description	Default Value
MGAUSS	integer	Control variable determining the vertical distribution used in the near field (0 = uniform, 1 = Gaussian)	1
MCTSG	integer	CALPUFF subgrid scale complex terrain module (CTSG) flag (0 = CTSG not modeled, 1 = CTSG modeled)	0
MSLUG	integer	Near-field puffs are modeled as elongated "slugs"? (0 = no, 1 = yes)	1
MTRANS	integer	Transitional plume rise modeled? (0 = only final rise computed, 1 = transitional rise computed). Note: Transitional plume rise is always computed for sources subject to building downwash effects.	1
MSHEAR	integer	Vertical wind shear above stack top modeled in plume rise? (0 = no, 1 = yes)	1
MCHEM	integer	Chemical mechanism flag 0 = chemical transformation not modeled 1 = transformation rates computed internally (MESOPUFF II scheme) 2 = user specified transformation rates used (If MCHEM = 2, the user must prepare a file (CHEM.DAT) with a diurnal cycle of transformation rates)	1
MWET	integer	Wet removal modeled? (0 = no, 1 = yes)	1
MDRY	integer	Dry deposition modeled? (0 = no, 1 = yes) Note: The method used to determine dry deposition velocities is specified by the user on a species-by-species basis in Input Group 3.	1

CALPUFF Control File Inputs - Input Group 2 - Continued

Technical Options

Variable	Type	Description	Default Value
MDISP	integer	Method used to compute the horizontal and vertical dispersion coefficients 1 = computed from values of σ_v and σ_w from the SIGMA.DAT file 2 = computed from σ_v and σ_w which are calculated internally from the micrometeorological variables (u_*, w_*, L, etc.) 3 = PGT dispersion coefficients used in RURAL areas (computed using the ISCST multi-segment approximation) and MP coefficients used in URBAN areas 4 = same as 3 except PGT coefficients computed using the MESOPUFF II equations	3

Control File Inputs - Input Group 3

Species List

Input Group 3 consists of a table containing three integer flags for each species. These flags indicate if a pollutant is modeled (0=no, 1=yes), emitted (0=no, 1=yes), and dry deposited (0=no, 1=yes, treated as a gas with the resistance model, 2=yes, treated as a particle with the resistance model, or 3=yes, user-specified deposition velocities used).

The chemical transformation scheme in CALPUFF is designed to simulate the conversion of $SO_2 \longrightarrow SO_4^{=}$ and $NO_x \longrightarrow HNO_3 \longleftrightarrow NO_3^{-}$. Therefore, the five pollutants in CALPUFF are labeled as SO_2, $SO_4^{=}$, NO_x, HNO_3, and NO_3^{-}. However, by setting the appropriate flags controlling the various technical options (chemical transformation, deposition, etc.), other reactive or non-reactive pollutants can be simulated even through the pollutant labels will refer to the SO_x/NO_x system of pollutants.

The user has control over which species are to be emitted and dry deposited in a particular run. If the dry deposition flag is set equal to 3 for any pollutant, a file called VD.DAT must be made available to the model. This file contains a diurnal cycle of 24 user-specified deposition velocities for each pollutant flagged (see Section 4.2.5).

The format of the species list table is:

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

INPUT GROUP: 3 -- Species list
--------------

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

BUILD-UP SPECIES

! SO2          =  1        ,     1        ,     1           !
! SO4          =  1        ,     1        ,     2           !
! NOX          =  1        ,     1        ,     1           !
! HNO3         =  1        ,     0        ,     1           !
! NO3          =  1        ,     0        ,     2           !

!END!
```

CALPUFF Control File Inputs - Input Group 4

Grid Control Parameters

Variable	Type	Description	Default Value
NX	integer	Number of grid cells in the X direction of the meteorological grid	-
NY	integer	Number of grid cells in the Y direction of the meteorological grid	-
DGRID	real	Grid spacing (km) of the meteorological grid	-
XORIGKM	real	Reference UTM X coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	-
YORIGKM	real	Reference UTM Y coordinate (km) of the southwest corner of grid cell (1,1) of the meteorological grid	-
IUTMZN	integer	UTM zone of coordinates	-
XLAT	real	Reference latitude (deg.) of the center of the modeling domain (used in solar elevation angle calculations)	
XLONG	real	Reference longitude (deg.) of the center of the modeling domain	-
XTZ	real	Reference time zone of the center of the modeling domain(PST=8, MST=7, CST=6, EST=5)	
NZ	integer	Number of vertical layers	-
ZFACE	real array	Cell face heights (m) for the meteorological grid (NZ + 1 values must be entered). Note: Cell center (grid point) height of layer "i" is (ZFACE(i+1) + ZFACE(i)/2).	-
IBCOMP	integer	X index of lower left corner of the computational grid (1 ≤ IBCOMP ≤ NX)	-
JBCOMP	integer	Y index of lower left corner of the computational grid (1 ≤ JBCOMP ≤ NY)	-

CALPUFF Control File Inputs - Input Group 4 - Continued

Grid Control Parameters

Variable	Type	Description	Default Value
IECOMP	integer	X index of upper right corner of the computational grid (1 ≤ IECOMP ≤ NX)	-
JBCOMP	integer	Y index of upper right corner of the computational grid (1 ≤ JECOMP ≤ NY)	-
LSAMP	logical	Flag indicating if an array of gridded receptors (i.e., sampling grid) is used (T = yes, F = no)	-
IBSAMP	integer	X index of lower left corner of the sampling grid (IBCOMP ≤ IBSAMP ≤ IECOMP)	-
JBSAMP	integer	Y index of lower left corner of the sampling grid (JBCOMP ≤ JBSAMP ≤ JECOMP)	-
IESAMP	integer	X index of upper right corner of the sampling grid (IBCOMP ≤ IESAMP ≤ IECOMP)	-
JESAMP	integer	Y index of upper right corner of the sampling grid (JBCOMP ≤ JESAMP ≤ JECOMP)	-
MESHDN	integer	Nesting factor of the sampling grid (MESHDN ≥ 1) The grid spacing of the sampling grid is DGRIDKM/MESHDN.	-

CALPUFF Control File Inputs - Input Group 5

Output Options

Variable	Type	Description	Default Value
ICON	integer	Control variable for creation of an output disk file (CONC.DAT) containing concentrations fields (species stored in this file are controlled by the output species table described below). (0 = do not create CONC.DAT, 1 = create CONC.DAT)	1
IDRY	integer	Control variable for creation of an output disk file (DFLX.DAT) containing dry flux fields (the species stored in this file are controlled by the output species table in Input Group 5 described below). (0 = do not create DFLX.DAT, 1 = create DFLX.DAT)	1
IWET	integer	Control variable for creation of an output disk file (WFLX.DAT) containing wet flux fields. (The species stored in this file are controlled by the output species table in Input Group 5 described below). (0 = do not create WFLX.DAT, 1 = create WFLX.DAT)	1
ICPRT	integer	ffntrol variable for printing of concentration ffffds to the output list file (CALPUFF.LST). (0 = do not print any concentrations, 1 = print concentrations indicated in output species table)	0
IDPRT	integer	Control variable for printing of dry flux fields to the output list file (CALPUFF.LST). (0 = do not print any dry fluxes, 1 = print dry fluxes indicated in output species table)	0
IWPRT	integer	Control variable for printing of wet flux fields to the output list file (CALPUFF.LST). (0 = do not print any wet fluxes, 1 = print wet fluxes indicated in output species table)	0
ICFRQ	integer	Printing interval for the concentration fields. Concentrations are printed every "ICFRQ" hours. (Used only if ICPRT = 1).	1
IDFRQ	integer	Printing interval for the dry flux fields. Dry fluxes are printed every "IDFRQ" hours. (Used only if IDPRT = 1).	1

CALPUFF Control File Inputs - Input Group 5 - Continued

Output Options

Variable	Type	Description	Default Value
IWFRQ	integer	Printing interval for the wet flux fields. Wet fluxes are printed every "IWFRQ" hours. (Used only if IWPRT = 1).	1
IMESG	integer	Control variable determining if messages tracking the progress of the run are written to the screen (0 = not written, 1 = written)	1
IDMESG	integer	Fortran unit number of the screen	0

CALPUFF Control File Inputs - Input Group 5

Output Options

In addition to the variable described above, Input Group 5 also contains a table of species with a series of flags indicating if the pollutant's concentration and wet/dry flux fields are to be printed to the output list file (CALPUFF.LST) or stored in the output disk files (CONC.DAT, DFLX.DAT, and WFLX.DAT).

The format of the species output table is shown below. A value of 0 indicated "no", and a value of 1 indicates "yes".

SPECIES LIST FOR OUTPUT OPTIONS

SPECIES NAME		CONCENTRATIONS PRINTED ?	CONCENTRATIONS SAVED ON DISK ?	DRY FLUXES PRINTED ?	DRY FLUXES SAVED ON DISK ?	WET FLUXES PRINTED ?	WET FLUXES SAVED ON DISK ?
! SO2	=	1 ,	1 ,	0 ,	0 ,	0 ,	0 !
! SO4	=	0 ,	0 ,	0 ,	0 ,	0 ,	0 !
! NOX	=	0 ,	0 ,	0 ,	0 ,	0 ,	0 !
! HNO3	=	0 ,	0 ,	0 ,	0 ,	0 ,	0 !
! NO3	=	0 ,	0 ,	0 ,	0 ,	0 ,	0 !

!END!

CALPUFF Control File Inputs - Input Group 6

Subgrid Scale Complex Terrain (CTSG) Inputs

Variable	Type	Description	Default Value
		(Input Group 6a - General CTSG Parameters)	
NHILLS	integer	Number of subgrid scale terrain features	0
NCTRECS	integer	Number of special subgrid scale complex terrain receptors	0
		(Input Group 6b - Hill Information)	
XC	real	X coordinate (km) of the center of the hill on the subgruid scale meteorological grid	-
YC	real	Y coordinate (km) of the center of the hill on the meteorological grid	-
THETAH	real	Orientation for the major axis of the hill (in degrees) clockwise from north	-
ZGRID	real	Height (m) of the "zero-plane" of the grid above mean sea level	-
RELIEF	real	Height (m) of the crest of the hill above the grid elevation	-
EXPO1	real	Hill shape exponent for the major axis of the hill	-
EXPO2	real	Hill shape exponent for the minor axis of the hill	-
SCALE1	real	Horizontal length scale of the hillalong the major axis	-
SCALE2	real	Horizontal length scale of the hill along the minor axis	-
AMAX1	real	Maximum allowed axis length for the major axis of the hill	-
AMAX2	real	Maximum allowed axis length for the minor axis of the hill	-

The variables in Input Group 6b are entered for each of the "NHILLS" subgrid scale hills treated in the model run. The data for each hill is treated as a separate input subgroup, and therefore must end with an input group terminator (i.e., !END!). The format of Input Group 6b is shown below.

CALPUFF Control File Inputs - Input Group 6

Subgrid Scale Complex Terrain (CTSG) Inputs

Subgroup (6b)

---

1 **

HILL INFORMATION

HILL NO.		XC (km)	YC (km)	THETAH (deg.)	ZGRID (m)	RELIEF (m)	EXPO 1 (m)	EXPO 2 (m)	SCALE 1 (m)	SCALE 2 (m)	AMAX1 (m)	AMAX2 (m)		
1	! HILL =	2.5	2.0	69.	1310.	300.	1.91	1.24	1523.	2896.	2000.	1500.	!	!END
2	! HILL =	5.0	0.0	46.	1310.	230.	1.50	1.50	3000.	1000.	4000.	2000.	!	!END

Note that the hill number is an optional user comment which is outside of the delimiter containing the required data. The data for each hill must follow the opening delimiter and "HILLDAT=". The data for each hill is followed by a closing delimiter and an input group terminator (i.e., !END!).

CALPUFF Control File Inputs - Input Group 6

Subgrid Scale Complex Terrain (CTSG) Inputs

Variable	Type	Description	Default Value
		(Input Group 6c - CTSG Receptor Data)	
XRCT	real	X coordinate (km) on the meteorological grid system of a CTSG receptor	-
YRCT	real	Y coordinate (km) on the meteorological grid system of a CTSG receptor	-
ZRCT	real	Height (m) of the ground above mean sea level at the CTSG receptor	-
IHH	integer	Hill number associated with this CTSG receptor	-

The variables in Input Group 6c are entered for each of the "NCTRECS" complex terrain receptors in the model run. The data for each receptor is treated as a separate input subgroup, and therefore must end with an input group terminator (i.e., !END!). The format of Input Group 6c is shown below.

```
--------------
Subgroup (6c)
--------------

                                                1 **
   COMPLEX TERRAIN RECEPTOR INFORMATION

            XRCT      YRCT       ZRCT          IHH
            (km)      (km)        (m)
           ------    -----      ------         ----
! CTREC =  2.5       1.0        1430.          1      !  !END!
! CTREC =  1.0       1.5        1430.          1      !  !END!
! CTREC =  2.5       2.0        1580.          1      !  !END!
! CTREC =  5.0       0.0        1525.          2      !  !END!
! CTREC =  4.5       0.0        1430.          2      !  !END!
```

The data for each CTSG receptor must follow an opening delimiter and "CTREC=". The data for each receptor is followed by a closing delimiter and an input group terminator (i.e., !END!).

CALPUFF Control File Inputs - Input Group 7

Dry Deposition Parameters - Gases

Input Group 7 consists of a table containing the following five parameters which are required by the resistance deposition model for computing deposition velocities for gases:

- Pollutant diffusivity (cm^2/s) (see Eqn. 2.7-10)
- Aqueous phase dissociation constant, α_* (see Eqn. 2.7-17)
- Pollutant reactivity (see Eqn. 2.7-15)
- Mesophyll resistance, r_m (s/cm) (see Section 2.4.1)
- Henry's Law coefficient, H (dimensionless) (see Eqn. 2.7-17)

These parameters must be specified for each pollutant with a dry deposition flag of "1" in the species list (Input Group 3) indicating the use of the resistance model for a gas.

The format of the input table is shown below:

new table coming

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

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

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

! SO2  =     0.1509   ,     1.00E3   ,     8.0    ,          0.0          ,          4.e-2          !
! NOX  =     0.1656   ,     1.00     ,     8.0    ,          5.0          ,          3.5            !
! HNO3 =     0.1628   ,     1.00     ,     18.0   ,          0.0          ,          8.e-8          !

!END!
```

CALPUFF Control File Inputs - Input Group 8

Dry Deposition Parameters - Particles

Input Group 8 consists of a table containing the geometric mass mean diameter (microns) and the geometric standard deviation (microns) required by the resistance deposition model for computing deposition velocities for particulate matter.

These parameters must be specified for each pollutant with a dry deposition flag of "2" in the species list (Input Group 3) indicating the use of the resistance model for a pollutant deposited as particulate matter.

The format of the input table is shown below:

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

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

SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
 NAME             DIAMETER                    DEVIATION
                  (microns)                   (microns)
-------      ------------------         ------------------
! SO4    =          0.48          ,           2.00     !
! NO3    =          0.48          ,           2.00     !


!END!
```

CALPUFF Control File Inputs - Input Group 9

Miscellaneous Dry Deposition Parameters

Variable	Type	Description	Default Value
RCUTR	real	Reference cuticle resistance (s/cm) (see Eqn. 2.7-15)	17.
RGR	real	Reference ground resistance (s/cm) (see Eqn. 2.7-16)	5.
REACTR	real	Reference pollutant reactivity (see Eqn. 2.7-15)	8.
IVEG	integer	Vegetation state in unirrigated areas 1 = vegetation is active and unstressed 2 = vegetation is active and stressed 3 = vegetation is inactive	-

CALPUFF Control File Inputs - Input Group 10
Wet Deposition Parameters

Input Group 10 consists of a table containing pollutant-dependent values of the scavenging coefficient, λ, defined by Equation (2.9-2), for both liquid and frozen precipitation types. The format of the input table is shown below.

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

INPUT GROUP: 10 -- Wet Deposition Parameters
--------------

                                                                        -1
                      Scavenging Coefficient -- Units: (sec)

     Pollutant        Liquid Precip.        Frozen Precip.
     ---------        --------------        --------------
   !   SO2     =        3.0e-5      ,          0.0          !
   !   SO4     =       10.0e-5      ,          3.0e-5       !
   !   NOX     =        0.0         ,          0.0          !
   !  HNO3     =        6.0e-5      ,          0.0          !
   !   NO3     =       10.0e-5      ,          3.0e-5       !

!END!
```

CALPUFF Control File Inputs - Input Group 11

Chemistry Parameters

Variable	Type	Description	Default Value
MOZ	integer	Control variable for the input of hourly ozone data used in the chemical transformation module (Used only if MCHEM=1) 0 = use a constant background ozone value in chemistry calculation 1 = use hourly ozone concentrations from the OZONE.DAT data file	1
BLKO3	real	Background ozone concentration in ppb 80. (Used only if MCHEM=1 and MOZ=0 or if (MOZ=1 and all hourly ozone data are missing))	
BLKNH3	real	Background ammonia concentration in ppb	10.
RNITE1	real	Nighttime SO_2 loss rate in percent/hour (k_1 in Eqn. 2.8-2)	0.2
RNITE2	real	Nighttime NO_x loss rate in percent/hour (k_2 in Eqn. 2.8-3)	2.0
RNITE3	real	Nighttime HNO_3 formation rate in percent/hour (k_3 in Eqn. 2.8-4)	2.0

CALPUFF Control File Inputs - Input Group 12

Dispersion Parameters

Variable	Type	Description	Default Value
TMDEP	real	Total puff travel distance (km) beyond which the time-dependent dispersion equation of Heffter (1965)	10.0
JSUP	integer	Stability class used to determine dispersion rates for puffs above the boundary layer (e.g., 6 = F stability)	6
CONK1	real	Vertical dispersion constant for stable conditions (k_1 in Eqn. 2.7-3)	0.01
CONK2	real	Vertical dispersion constant for neutral/unstable conditions (k_2 in Eqn. 2.7-4)	0.10
IURB1, IURB2	integers	Land use categories associated with urban areas. MP dispersion coefficients are used when puff is over land use type IURB1 through IURB2, and if MDISP = 3 or 4.	100, 199

CALPUFF Control File Inputs - Input Group 13

Point Source Parameters

Variable	Type	Description	Default Value
		(Input Group 13a - General Data)	
NPT1	integer	Number of point sources with constant emission parameters	-
NPT2	integer	Number of point sources with arbitrarily-varying emission parameters (If NPT2 > 0, the point source emissions file PTEMARB.DAT must be provided)	-
		(Input Group 13b - Point Source Data for Sources with Constant Stack and Emission Parameters)	
XUTM	real	X coordinate (km) of the stack on the meteorological grid	-
YUTM	real	Y coordinate (km) of the stack on the meteorological grid	-
HSTAK	real	Stack height (m)	-
SELEV	real	Stack base elevation (m) above mean sea level	-
DIAM	real	Stack diameter (m)	-
EXITW	real	Stack gas exit velocity (m/s)	-
EXITT	real	Stack gas exit temperature (deg. K)	-
IDOWN	integer	Building downwash flag 0 = building downwash not modeled, 1 = building downwash modeled	-
EMS	real array	Emission rate (g/s) of each modeled species Note: "NSPEC" values must be entered.	-

The variables in Input Group 13b are entered for each of the "NPT1" point sources with constant emission parameters. The data for each source is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). The format of Input Group 13b is shown below.

CALPUFF Control File Inputs - Input Group 13

Point Source Parameters

Subgroup (13b)

POINT SOURCE DATA FOR SOURCES WITH CONSTANT EMISSION PARAMETERS [a]

Source No.	X UTM Coordinate (km)	Y UTM Coordinate (km)	Stack Height (m)	Base Elevation (m)	Stack Diameter (m)	Exit Velocity (m/s)	Exit Temp. (deg. K)	Bldg. Downwash [b]	Emission Rates [c] (g/s)	
1	! X = 196.1,	3866.2,	5.5,	0.0,	2.0,	4.5,	273.,	0 ,	1.2 !	!END!
2	! X = 172.0,	3859.2,	20.5,	0.0,	2.2,	3.5,	283.,	1 ,	0.9 !	!END!
3	! X = 180.1,	3869.2,	85.0,	0.0,	4.5,	12.0,	450.,	1 ,	22.9 !	!END!

---

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

[b] NOTE: 0 = No building downwash modeled, 1 = downwash modeled

[c] "NSPEC" emission rates must be entered (one for every pollutant). Enter emission rate of zero for secondary pollutants.

Note that the source number is an optional user comment which is outside of the delimiter containing the required source data. The data for each source must follow an opening delimiter and "X=". The data for each source is followed by a closing delimiter and an input group terminator.

CALPUFF Control File Inputs - Input Group 13

Point Source Parameters

Variable	Type	Description	Default Value
		(Input Group 13c - Building Dimension Data)	
WIDTH	real array	Array of 36 direction-specific building dimensions for flow vectors from 10°-360° in 10° increments	-
HEIGHT	real array	Array of 36 direction-specific building dimensions for flow vectors from 10°-360° in 10° increments	-

The variables in Input Group 13c are entered for each point source for which IDOWN=1 in Input Group 13b. The data for each point source is treated as a separate input subgroup and therefore must end with an input group terminator (i.e., !END!). The format of Input Group 13c is shown below.

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

          BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
          -------------------------------------------------------
Source
 No.      Effective building width and height (in meters) every 10 degrees
------    ------------------------------------------------------------------

  2       ! WIDTH  = 36 * 12.0 !
  2       ! HEIGHT = 36 * 22.5 !
!END!
  3       ! WIDTH  = 20 * 0.0, 45.5, 48.5, 52.5, 13 * 0.0 !
  3       ! HEIGHT = 20 * 0.0, 78.0, 78.0, 78.0, 13 * 0.0 !
!END!
```

Note that the source number is an optional user comment which is outside of the delimiters. The data for each source must follow an opening delimiter and either "WIDTH=" or "HEIGHT=". The data for each source is followed by a closing delimiter and an input group terminator (i.e., !END!).

CALPUFF Control File Inputs - Input Group 14

Area Source Parameters

Variable	Type	Description	Default Value
		(Input Group 14a - General Area Source Data)	
NAR1	integer	Number of area sources with constant emission parameters	-
IGRDAR	integer	Gridded area source data used? (0 = no, 1 = yes)	-
AEFFHT	real	Effective height (m) of gridded area source emissions	-
ASIGYI	real	Initial horizontal dispersion coefficient (σ_y), in meters, of gridded area source emissions	-
ASIGZI	real	Initial vertical dispersion coefficient (σ_z), in meters, of gridded area source emissions	
		(Input Group 14b - Area Source Data for Sources with Constant Emissions)	
XUTM	real	X coordinate (km) of the center of the area source on the meteorological grid	-
YUTM	real	Y coordinate (km) of the center of the area source on the meteorological grid	-
HTEFF	real	Effective height (m) of the area source	-
AELEV	real	Base elevation (m) above mean sea level	-
SIGYI	real	Initial horizontal dispersion coefficient (σ_y), in meters, of the area source	-
SIGZI	real	Initial vertical dispersion coefficient (σ_z), in meters, of the area source	-
EMIS	real	Emission rate (g/s) of each modeled species Note: "NSPEC" values must be entered	-

The variables in Input Group 14b are entered for each of the "NAR1" area sources with constant emissions. The data for each source is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). The format of Input Group 14b is shown below.

CALPUFF Control File Inputs - Input Group 14

Area Source Parameters

```
--------------
Subgroup (14b)
--------------
                                                                    a
          AREA SOURCE DATA FOR SOURCES WITH CONSTANT EMISSION PARAMETERS
          ------------------------------------------------------------
                                                                          b
     X UTM       Y UTM      Effect.    Base      Initial    Initial    Emission
   Coordinate  Coordinate   Height   Elevation  Sigma y    Sigma z      Rates
     (km)        (km)        (m)       (m)        (m)        (m)       (g/s)
   ----------  ----------  ------   ------   --------   --------   --------

! X =  201.1,    3886.2,     12.0,     0.0,    120.0,     20.0,      1.2  !  !END!
! X =  182.0,    3889.2,     25.0,     0.0,    550.0,     50.0,      0.9  !  !END!

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

    b
     "NSPEC" emission rates must be entered (one for every pollutant).
      Enter emission rate of zero for secondary pollutants.
```

Note that the receptor number is an optional user comment which is outside of the delimiter. The data for each source must follow an opening delimiter and "X=". The data for each source is followed by a closing delimiter and an input group terminator.

CALPUFF Control File Inputs - Input Group 15

Non-Gridded (Discrete) Receptor Data

Variable	Type	Description	Default Value
		(Input Group 15a - General Discrete Receptor Data)	
NREC	integer	Number of non-gridded receptors	-
		(Input Group 15b - Discrete Receptor Data)	
XUTM	real	X coordinate (km) of the receptor on the meteorological grid	-
YUTM	real	Y coordinate (km) of the receptor on the meteorological grid	-
ELEV	real	Ground elevation (m) above mean sea level of the receptor	-

The variables in Input Group 15b are entered for each of the "NREC" discrete receptors. The data for each receptor is treated as a separate input subgroup, and therefore, must end with an input group terminator (i.e., !END!). The format of Input Group 15b is shown below.

```
--------------
Subgroup (15b)
--------------
                                                    a
          NON-GRIDDED (DISCRETE) RECEPTOR DATA
          ------------------------------------

                    X UTM       Y UTM       Ground
Receptor          Coordinate  Coordinate  Elevation
  No.               (km)        (km)        (m)
--------          ----------  ----------  ---------

   1      ! X =  180.1,     3859.2,       22.0    !  !END!
   2      ! X =  195.1,     3862.2,       65.0    !  !END!
   3      ! X =  212.5,     3877.2,      105.0    !  !END!

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

The data for each receptor must follow an opening delimiter and "X=". The data for each receptor is followed by a closing delimiter and an input group terminator (i.e., !END!).

4.2.2 Meteorological Data File (CALMET.DAT)

The CALMET.DAT file contains the meteorological data fields required to drive the CALPUFF model. It also contains certain geophysical fields, such as terrain elevations, surface roughness lengths, and land use types, used by both the CALMET meteorological model and CALPUFF. Although the input requirements of CALPUFF are designed to be directly compatible with CALMET, meteorological fields produced by other meteorological models can be substituted for the CALMET output as long as the required variables are produced and the output is reformatted to be consistent with the CALMET.DAT file specifications described in this section.

CALMET.DAT File - Header Records

The CALMET.DAT file consists of a set of up to fourteen header records, followed by a set of hourly data records. The header records contains a descriptive title of the meteorological run, information including the horizontal and vertical grid systems of the meteorological grid, the number, type, and coordinates of the meteorological stations included in the CALMET run, gridded fields of surface roughness lengths, land use, terrain elevations, leaf area indexes, and a pre-compute field of the closest surface meteorological station number to each grid point.

The actual number of header records may vary because, as explained below, records containing surface, upper air, and precititation station coordinates are not included if these stations were not included in the run.

The following variables stored in the CALMET.DAT header records are checked in the setup phase of the CALPUFF model run to ensure compatibility with variables specified in the CALPUFF control file: number of grid cells in the X and Y directions, grid size, reference UTM coordinates of the grid origin, and UTM zone of the grid origin.

Sample Fortran read statements for the CALMET.DAT header records are:

```
c --- Header record 1 -- Run title
      READ(iunit)TITLE

c --- Header record 2 -- General run and grid information
      READ(iunit)VERMET, LEVMET, IBYR, IBMO, IBDY, IBHR, IBTZ, IRLG, IRTYPE,
     1 NXM, NYM, NZM, XGRIDM, XORIGM, YORIGM, IUTMZNM, IWFCOD, NSSTA,
     2 NUSTA, NPSTA, NOWSTA, NLU, IWAT1, IWAT2, LCALGRD

c --- Header record 3 -- Vertical cell face heights (nz+1 values)
      READ(iunit)CLAB1,ZFACEM

c --- Header records 4 and 5 -- Surface station coordinates
      if(nssta.gt.0)then
         READ(iunit)CLAB2,XSSTA
         READ(iunit)CLAB3,YSSTA
      endif

c --- Header records 6 and 7 -- Upper air station coordinates
      if(nusta.gt.0)then
         READ(iunit)CLAB4,XUSTA
         READ(iunit)CLAB5,YUSTA
      endif

c --- Header records 8 and 9 -- Precipitation station coordinates
      if(npsta.gt.0)then
         READ(iunit)CLAB6,XPSTA
         READ(iunit)CLAB7,YPSTA
      endif

c --- Header record 10 -- Surface roughness lengths
      READ(iunit)CLAB8,Z0

c --- Header record 11 -- Land use categories
      READ(iunit)CLAB9,ILANDU
```

```
c --- Header record 12 -- Terrain elevations
      READ(iunit)CLAB10,ELEV

c --- Header record 13 - Leaf area indexes
      READ(iunit)CLAB11,XLAI

c --- Header record 14 - Nearest surface station to each grid point
      READ(iunit)CLAB12,NEARS
```

where the following declarations apply:

```
      real ZFACEM(nzm+1),XSSTA(nssta),YSSTA(nssta),XUSTA(nusta),YUSTA(nusta)
      real XPSTA(npsta),YPSTA(npsta)
      real Z0(nxm,nym),ELEV(nxm,nym),XLAI(nxm,nym)
      integer ILANDU(nxm,nym),NEARS(nxm,nym)
      character*80 TITLE(3)
      character*8 VERMET,LEVMET,CLAB1,CLAB2,CLAB3,CLAB4,CLAB5,CLAB6
      character*8 CLAB7,CLAB8,CLAB9,CLAB10,CLAB11,CLAB12
      logical LCALGRD
```

CALMET.DAT file - Header Records

Header Record No.	Variable No.	Variable Name	Type[a]	Description
1	1	TITLE	C*80 array	Array with three 80-character lines of the user's title of the CALMET run
2	1	VERMET	C*8	CALMET model version number
2	2	LEVMET	C*8	CALMET model level number
2	3	IBYR	integer	Starting year of CALMET run
2	4	IBMO	integer	Starting month
2	5	IBDY	integer	Starting day
2	6	IBHR	integer	Starting hour
2	7	IBTZ	integer	Base time zone (05=EST, 06=CST, 07=MST, 08=PST)
2	8	IRLG	integer	Run length (hours)
2	9	IRTYPE	integer	Run type (must be run type 1 to drive CALPUFF)
2	10	NXM	integer	Number of grid cells in the X direction
2	11	NYM	integer	Number of grid cells in the Y direction
2	12	NZM	integer	Number of vertical layers
2	13	XGRIDM	real	Grid spacing (m)
2	14	XORIGM	real	UTM X coordinate (m) of south-west corner of grid point (1,1)
2	15	YORIGM	real	UTM Y coordinate (m) of south-west corner of grid point (1,1)
2	16	IUTMZNM	integer	UTM zone of coordinates

[a] C*80 = Character*80
C*8 = Character*8

CALMET.DAT file - Header Records

Header Record No.	Variable No.	Variable Name	Type[a]	Description
2	17	IWFCOD	integer	Wind field module used (0=objective analysis, 1=diagnostic model)
2	18	NSSTA	integer	Number of surface meteorological stations
2	19	NUSTA	integer	Number of upper air stations
2	20	NPSTA	integer	Number of precipitation stations
2	21	NOWSTA	integer	Number of overwater stations
2	22	NLU	integer	Number of land use categories
2	23	IWAT1	integer	Range of land use categories
2	24	IWAT2	integer	corresponding to water surfaces (IWAT1 to IWAT2, inclusive)
2	25	LCALGRD	logical	Flag indicating if special meteorological parameters required by CALPUFF and the CTSG module of CALPUFF are contained in the file (i.e., LCALGRD must be TRUE to use the CTSG option of CALPUFF)
3	1	CLAB1	C*8	Variable label ('ZFACE')
3	2	ZFACEM	real array	Heights (m) of cell faces (NZM + 1 values)
4[b]	1	CLAB2	C*8	Variable label ('XSSTA')
4[b]	2	XSSTA	real	X UTM coordinates (m) of each array surface met. station

[a] C*8 = Character*8
[b] Included only if NSSTA > 0

CALMET.DAT file - Header Records

Header Record No.	Variable No.	Variable Name	Type[a]	Description
5[b]	1	CLAB3	C*8	Variable label ('YSSTA')
5[b]	2	YSSTA	real	Y UTM coordinates (m) of each array surface met. station
6[c]	1	CLAB4	C*8	Variable label ('XUSTA')
6[c]	2	XUSTA	real array	X UTM coordinates (m) of each upper air met. station
7[c]	1	CLAB5	C*8	Variable label ('YUSTA')
7[c]	2	YUSTA	real array	Y UTM coordinate (m) of each upper air met. station
8[d]	1	CLAB6	C*8	Variable label ('XPSTA')
8[d]	2	XPSTA	real array	X UTM coordinate (m) of each precipitation station
9[d]	1	CLAB7	C*8	Variable label ('YPSTA')
9[d]	2	YPSTA	real array	Y UTM coordinate (m) of each precipitation station
10	1	CLAB8	C*8	Variable label ('ZO')
10	2	ZO	real array	Gridded field of surface roughness lengths (m)
11	1	CLAB9	C*8	Variable label ('ILANDU')
11	2	ILANDU	integer array	Gridded field of land use category for each grid cell

[a] C*8 = Character*8

[b] Included only if NSSTA > 0

[c] Included only if NUSTA > 0

[d] Included only if NPSTA > 0

CALMET.DAT file - Header Records

Header Record No.	Variable No.	Variable Name	Type[a]	Description
12	1	CLAB10	C*8	Variable label ('ELEV')
12	2	ELEV	real array	Gridded field of terrain elevations for each grid cell
13	1	CLAB11	C*8	Variable label ('XLAI')
13	2	XLAI	real array	Gridded field of leaf area index for each grid cell
14	1	CLAB12	C*8	Variable label ('NEARS')
14	2	NEARS	integer array	Nearest surface met. station to each grid point

[a] C*8 = Character*8

CALMET.DAT File - Data Records

The CALMET.DAT data records include hourly fields of winds and meteorological variables. In additional to the regular CALMET output variables, the CALMET.DAT file may contain three-dimensional fields of the vertical velocity and air temperature. The presence of these fields in the CALMET output file is flagged by the header record logical variable, LCALGRD, having a value of TRUE.

The data records contain three-dimensional gridded fields of U, V, and W wind components and air temperature, two-dimensional fields of PGT stability class, surface friction velocity, mixing height, Monin-Obukhov length, convective velocity scale, and precipitation rate, and values of the temperature, air density, short-wave solar radiation, relative humidity, and precipitation type codes defined at the surface meteorological stations.

Sample Fortran read statements for the CALMET.DAT data records are:

```
c --- Read U, V, W wind components
      ┌────Loop over vertical layers, k
      │
      │     READ(iunit)CLABU,((UMET(i,j,k),i=1,nxm),j=1,nym)
      │     READ(iunit)CLABV,((VMET(i,j,k),i=1,nxm),j=1,nym)
      │     if(LCALGRD)READ(iunit)CLABW,((WMET(i,j,k),i=1,nxm),j=1,nym)
      │
      └────End loop over vertical layers

c --- Read 3-D temperature field
      if(LCALGRD)
          ┌────Loop over vertical layers, k
          │
          │    READ(iunit)CLABT,((TMET(i,j,k),i=1,nxm),j=1,nym)
          │
          └────End loop over vertical layers
      endif
```

```
c --- Read 2-D meteorological fields
      READ(iunit)CLABSC,IPGT
      READ(iunit)CLABUS,USTAR
      READ(iunit)CLABZI,HTMIX
      READ(iunit)CLABL,XMONIN
      READ(iunit)CLABWS,WSTAR
      READ(iunit)CLABRMM,RMM

c --- Read 1-D variables defined at surface met. stations
      READ(iunit)CLABTK,TEMPSS
      READ(iunit)CLABD,RHOSS
      READ(iunit)CLABQ,QSWSS
      READ(iunit)CLABRH,IRHSS
      READ(iunit)CLABPC,IPCODE
```

where the following declarations apply:

```
      real UMET(nxm,nym,nzm),VMET(nxm,nym,nzm),WMET(nxm,nym,nzm)
      real TMET(nxm,nym,nzm)
      real USTAR(nxm,nym),HTMIX(nxm,nym),XMONIN(nxm,nym)
      real WSTAR(nxm,nym),RMM(nxm,nym)
      real TEMPSS(nssta),RHOSS(nssta),QSWSS(nssta)
      integer IPGT(nxm,nym)
      integer IRHSS(nssta),IPCODE(nssta)
      character*8 CLABU, CLABV, CLABW, CLABT, CLABSC, CLABUS, CLABZI
      character*8 CLABL, CLABWS, CLABRMM, CLABTK, CLABD, CLABQ, CLABRH
      character*8 CLABPC
```

CALMET.DAT file - Data Records

Record Type	Variable No.	Variable Name	Type[a]	Description
1	1	CLABU	C*8	Variable label ('U-LEVxxx', where xxx indicates the layer number)
1	2	UMET	real array	U-component (m/s) of the winds at array each grid point
2	1	CLABV	C*8	Variable label ('V-LEVxxx', where xxx indicates the layer number)
2	2	VMET	real array	V-component (m/s) of the winds at each grid point
3[b]	1	CLABW	C*8	Variable label ('W-LEVxxx', where xxx indicates the layer number)
3[b]	2	WMET	real array	W-component (m/s) of the winds at each grid point
(Record types 1,2,3 repeated NZM times (once per layer) as a set)				
4[b]	1	CLABT	C*8	Variable label ('T-LEVxxx', where xxx indicates the layer number)
4[b]	2	TMET	real array	Air temperature (deg. K) at each grid point
(Record type 4 repeated NZM times (once per layer))				
5	1	CLABSC	C*8	Variable label ('IPGT')
5	2	IPGT	integer array	PGT stability class

[a] C* 8 = Character*8
[b] Record types 3 and 4 are included only if LCALGRD is TRUE

CALMET.DAT file - Data Records

Record Type	Variable No.	Variable Name	Type[a]	Description
6	1	CLABUS	C*8	Variable label ('USTAR')
6	2	USTAR	real array	Surface friction velocity (m/s)
7	1	CLABZI	C*8	Variable label ('ZI')
7	2	HTMIX	real array	Mixing height (m)
8	1	CLABL	C*8	Variable label ('EL')
8	2	XMONIN	real array	Monin-Obukhov length (m)
9	1	CLABWS	C*8	Variable label ('WS')
9	2	WSTAR	real array	Convective velocity scale (m/s)
10	1	CLABRMM	C*8	Variable label ('RMM')
10	2	RMM	real array	Precipitation rate (mm/hr). Required only if wet deposition is modeled.
11	1	CLABTK	C*8	Variable label ('TEMPK')
11	2	TEMPSS	real array	Temperature (deg. K) at each surface met. station
12	1	CLABD	C*8	Variable label ('RHO')
12	2	RHOSS	real array	Air density (kg/m^3) at each surface met. station

[a] C*8 = Character*8

CALMET.DAT file - Data Records

Record Type	Variable No.	Variable Name	Type[a]	Description
13	1	CLABQ	C*8	Variable label ('QSW')
13	2	QSWSS	real array	Short-wave solar radiation (W/m^2) at each surface met. station
14	1	CLABRH	C*8	Variable label ('IRH')
14	2	IRHSS	integer array	Relative humidity (percent) at each surface met. station
15	1	CLABPC	C*8	Variable label ('IPGT')
15	2	IPCODE	real array	Precipitation type code

[a] C*8 = Character*8

CALMET.DAT file - Data Records

Record Type	Variable No.	Variable Name	Type[a]	Description
6	1	CLABUS	C*8	Variable label ('USTAR')
6	2	USTAR	real array	Surface friction velocity (m/s)
7	1	CLABZI	C*8	Variable label ('ZI')
7	2	HTMIX	real array	Mixing height (m)
8	1	CLABL	C*8	Variable label ('EL')
8	2	XMONIN	real array	Monin-Obukhov length (m)
9	1	CLABWS	C*8	Variable label ('WS')
9	2	WSTAR	real array	Convective velocity scale (m/s)
10	1	CLABRMM	C*8	Variable label ('RMM')
10	2	RMM	real array	Precipitation rate (mm/hr). Required only if wet deposition is modeled.
11	1	CLABTK	C*8	Variable label ('TEMPK')
11	2	TEMPSS	real array	Temperature (deg. K) at each surface met. station
12	1	CLABD	C*8	Variable label ('RHO')
12	2	RHOSS	real array	Air density (kg/m^3) at each surface met. station

[a] C*8 = Character*8

CALMET.DAT file - Data Records

Record Type	Variable No.	Variable Name	Type[a]	Description
13	1	CLABQ	C*8	Variable label ('QSW')
13	2	QSWSS	real array	Short-wave solar radiation (W/m^2) at each surface met. station
14	1	CLABRH	C*8	Variable label ('IRH')
14	2	IRHSS	integer array	Relative humidity (percent) at each surface met. station
15	1	CLABPC	C*8	Variable label ('IPGT')
15	2	IPCODE	real array	Precipitation type code

[a] C*8 = Character*8

4.2.3 Point Source Emissions File With Arbitrarily Varying Emissions (PTEMARB.DAT)

The PTEMARB.DAT file contains point source emissions data for sources with detailed, arbitrarily varying emissions parameters. In the PTEMARB.DAT file, values for the stack parameters and emission rates can be specified for each time step in the run. Plume rise is computed within the CALPUFF model for each source.

PTEMARB.DAT is a sequential, unformatted data file consisting of three header records, followed by a set of data records containing time-invariant source information. The time-invariant records contain the stack height, diameter, coordinates, and optional descriptive codes for each source. The time varying emissions and stack parameter data follow in subsequent records. One data record per source is required for each time period (e.g.,usually at hourly intervals).

The data in the PTEMARB.DAT file is independent of the horizontal and vertical grid systems being used in the model. The horizontal coordinates are specified in terms of UTM coordinates. The vertical layers receiving the emissions of the source are based on the plume rise of the source computed internally by the model. However, the PTEMARB.DAT file does contain time-dependent data specifying the emission parameters for a particular time period.

PTEMARB.DAT File - Header Records

The header records of the PTEMARB.DAT file contain the number of sources, starting and ending time periods of data in the file, and a list of the emitted species. Sample Fortran read statements are:

```
READ(iunit)FNAME2,NSRC2,NSE2,IUTMZ2,IBDAT2,IBTIM2,IEDAT2,
1 IETIM2,VRS2,LABEL2

READ(iunit)CSLST2
READ(iunit)XMWEM2
```

where the following declarations apply:

```
CHARACTER*12 FNAME2,VRS2,LABEL2,CSLST2(nse2)
REAL XMWEM2(nse2)
```

PTEMARB.DAT - Header Record 1 - General Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAME2	C*12	Data set name	PTEMARB
2	NSRC2	integer	Number of sources in the file	10
3	NSE2	integer	Number of species emitted	3
4	IUTMZ2	integer	UTM zone in which source coordinates are specified	11
5	IBDAT2	integer	Date of beginning of data in the file (YYJJJ, where YY=year, JJJ=Julian day)	84220
6	IBTIM2	integer	Hour of beginning of data in the file (00-23, LST)	00
7	IEDAT2	integer	Date of ending of data in the file (YYJJJ, where YY=year, JJJ=Julian day)	84224
8	IETIM2	integer	Hour of ending of data in the file (00-23, LST)	23
9	VRS2	C*12	Data set version	Base Case
10	LABEL2	C*12	Data set label	Major pts.

[a] C*12 = Character*12

PTEMARB.DAT - Header Record 2 - Species List

No.*	Type[a]	Description	Sample Values
1	C*12	Species identifier for species 1	SO2
2	C*12	Species identifier for species 2	SO4
.	.	.	.
.	.	.	.
.	.	.	.
3	C*12	Species identifier for species "NSE2"	NOX

---

* "NSE2" elements of CSLST2 array

[a] C*12 = Character*12

PTEMARB.DAT - Header Record 3 - Molecular Weights

No.*	Type	Description	Sample Values
1	real	Molecular weight for species 1	64. (SO2)
2	real	Molecular weight for species 2	96. (SO4)
.	.	.	.
.	.	.	.
.	.	.	.
NSE2	Real	Molecular weight for species "NSE"	30. (NOX as NO)

* "NSE2" elements of XMWEM2 array

PTEMARB.DAT File - Data Records

The PTEMARB.DAT file contains two types of data records. A set of time-invariant records are read after the header records. These records specify the time-invariant source parameters, including the source coordinates, stack height, and diameter. A set of time-varying data follows. The time-varying records contain the stack temperature, exit velocity, flow rate, and emission rate for each species.

Sample Fortran read statements for time-invariant data records are:

```
┌──Loop over sources
│
│  READ(iunit)CID,TIDATA
│
└──End loop over sources
```

where the following declarations apply:

```
CHARACTER*16 CID
REAL TIDATA(7)
```

Sample Fortran read statements for time-varying data records are:

```
┌──Loop over time periods
│
│  READ(iunit)IBDAT,IBTIM,IEDAT,IETIM
│
│  ┌──Loop over sources
│  │
│  │  READ(iunit)CID,TEMPK,VEXIT,VOLFLOW,QEMIT
│  │
│  └──End loop over sources
│
└──End loop over time periods
```

where the following declarations apply:

```
CHARACTER*16 CID
REAL QEMIT(nse2)
```

PTEMARB.DAT - Time-Invariant Data Record Contents

(Repeated for each source)

No.	Variable	Type[a]	Description
1	CID	C*16	Source identifier (16 characters=4 words)
2	TIDATA(1)	real	Easting UTM coordinate (km) of the source
3	TIDATA(2)	real	Northing UTM coordinate (km) of the source
4	TIDATA(3)	real	Stack height (m)
5	TIDATA(4)	real	Stack diameter (m)
6	TIDATA(5)	real	Stack base elevation (m)
7	TIDATA(6)	real	User defined flag (e.g., industry code)
8	TIDATA(7)	real	User defined flag (e.g., fuel code)

[a] C*16 = Character*16

PTEMARB.DAT - Time-Varying Data Record Contents

(First record of "NSRC2"+1 records required for each time period)

No.	Variable	Type	Description
1	IBDAT	integer	Beginning date for which data in this set is valid (YYJJJ, where YY=year, JJJ=Julian day)
2	IBTIM	integer	Beginning hour for which data in this set is valid (00-23, LST)
3	IEDAT	integer	Ending date for which data in this set is valid (YYJJJ, where YY=year, JJJ=Julian day)
4	IETIM	integer	Ending hour for which data in this set is valid (00-23, LST)

Example:

Data Valid for 1 hour:

IBDAT=89183, IBTIM=00, IEDAT=89183, IETIM=00

IBDAT=89183, IBTIM=01, IEDAT=89183, IETIM=01

IBDAT=89183, IBTIM=02, IEDAT=89183, IETIM=02

Data Valid for 3 hours:

IBDAT=89183, IBTIM=00, IEDAT=89183, IETIM=02

IBDAT=89183, IBTIM=03, IEDAT=89183, IETIM=05

IBDAT=89183, IBTIM=06, IEDAT=89183, IETIM=08

PTEMARB.DAT - Time-Varying Data Record Contents

(Next "NSRC2" records)

No.	Variable	Type[a]	Description
1	CID	C*16	Source identifier (must match values in time-invariant records)
2	TEMPK	real	Exit temperature (deg. K)
3	VEXIT	real	Exit velocity (m/s)
4	VOLFLOW	real	Volumetric flow rate (m^3/s)
Next NSE2	QEMIT	real array	Emission rates (g/s) for each species in the order specified in Header Record 2

[a] C*16 = Character*16

4.2.4 Area Source Emissions File (AREM.DAT) with Arbitrarily Varying Emissions

Time independent area source data are contained in the CALPUFF control file (CALPUFF.INP). The AREM.DAT emissions file contains time-dependent gridded area source emissions data. AREM.DAT is a sequential, unformatted data file containing one two-dimensional grid for each emitted species modeled by CALPUFF for each time step. There are three header records with information describing the grid system, dates and time of data in the file, species names, and molecular weights.

The total emission rate for each pollutant is specified for the grid column. Individual source information is not stored in the file, so plume rise is not computed by CALPUFF for the AREM.DAT emissions. The effective height and initial vertical and horizontal plume dimensions (σ_y, σ_z) are specified by the user in the control file (CALPUFF.INP) for the gridded area source inventory.

AREM File - Header Records

The header records contain information regarding the horizontal grid system, species emitted, molecular weights, and dates of the data contained in the file. These data are checked by CALPUFF in the setup phase of the model run to ensure the parameters are compatible with those specified in the CALPUFF control file. Any mismatch in the specifications results in an error message and termination of the run.

Sample Fortran read statements for the header records are:

```
READ(iunit)FNAME4,IGTYP4,NX4,NY4,DELX4,DELY4,XORIG4,YORIG4,IUTMZ4,
1 NSE4,IBDAT4,IBTIM4,IEDAT4,IETIM4,VRS4,LABEL4

READ(iunit)CSLST4
READ(iunit)XMWEM4
```

where the following declarations apply:

```
CHARACTER*12 FNAME4,VRS4,LABEL4,CSLST4(nse4)
REAL XMWEM4(nse4)
```

AREM - Header Record 1 - General Grid, Species, and Date Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAME4	C*12	Data set name	AREM
2	IGTYP4	integer	Horizontal grid type (always = 1 for CALPUFF runs)	1
3	NX4	integer	Number of grid cells in the X direction	30
4	NY4	integer	Number of grid cells in the Y direction	30
5	DELX4	real	Grid spacing (km) in the X direction	5.
6	DELY4	real	Grid spacing (km) in the Y direction	5.
7	XORIG4	real	Reference X UTM coordinate (km) of the southwest corner of grid cell (1,1)	168.000
8	YORIG4	real	Reference Y UTM coordinate (km) of the southwest corner of grid cell (1,1)	3839.000
9	IUTMZ4	integer	UTM zone of horizontal coordinates	11
10	NSE4	integer	Number of species emitted	3
11	IBDAT4	integer	Date of beginning of data in file (YYJJJ, where YY=year, JJJ=Julian day)	84220
12	IBTIM4	integer	Hour of beginning of data in file (00-23, LST)	00
13	IEDAT4	integer	Date of ending of data in file (YYJJJ, where YY=year, JJJ=Julian day)	84224
14	IETIM4	integer	Hour of ending of data in file (00-23, LST)	23
15	VRS4	C*12	Data set version	Base Case
16	LABEL4	C*12	Data set label	'84 - KERN

[a] C*12 = Character*12

AREM - Header Record 2 - Species List

No.	Type[a]	Description	Sample Values
1	C*12	Species identifier for species 1	SO2
2	C*12	Species identifier for species 2	SO4
.	.	.	.
.	.	.	.
.	.	.	.
NSE4	C*12	Species identifier for species "NSE4"	NOX

---

* "NSE4" elements of CSLST4 array

[a] C*12 = Character*12

AREM - Header Record 3 - Molecular Weights

No.	Type[a]	Description	Sample Values
1	real	Molecular weight for species 1	64. (SO2)
2	real	Molecular weight for species 2	96. (SO4)
•	•	•	•
•	•	•	•
•	•	•	•
NSE4	real	Molecular weight for species "NSE4"	30. (NOX)

---

* "NSE4" elements of XMWEM1 array

AREM.DAT File - Data Records

The AREM.DAT file contains a set of "NSE4"+1 records for each time period (e.g., hour). The first data record of each set defines the time period over which the emissions data in the following records are valid. The next "NSE4" records each contain a species identifier and a two-dimensional gridded field of emissions.

Sample Fortran read statements for a set of data records are:

```
Loop over time periods (e.g., Hours)

  READ(iunit)IBDAT, IBTIM, IEDAT, IETIM

    Loop over species

      READ(iunit)CSPEC, QEMIT

    End loop over species

End loop over time periods
```

where the following declarations apply:

```
CHARACTER*12 CSPEC
REAL QEMIT(nx4, ny4)
```

AREM - Data Record Contents

(Record 1 of each set)

No.	Variable	Type	Description
1	IBDAT	integer	Beginning date for which data in this set is valid (YYJJJ, where YY=year, JJJ=Julian day)
2	IBTIM	integer	Beginning time for which data in this set is valid (00-23, LST)
3	IEDAT	integer	Ending date for which data in this set is valid (YYJJJ, where YY=year, JJJ=Julian day)
4	IETIM	integer	Ending time for which data in this set is valid (00-23, LST)

Example:

Data Valid for 1 hour:

IBDAT=89183, IBTIM=00, IEDAT=89183, IETIM=00

IBDAT=89183, IBTIM=01, IEDAT=89183, IETIM=01

IBDAT=89183, IBTIM=02, IEDAT=89183, IETIM=02

Data Valid for 3 hours:

IBDAT=89183, IBTIM=00, IEDAT=89183, IETIM=02

IBDAT=89183, IBTIM=03, IEDAT=89183, IETIM=05

IBDAT=89183, IBTIM=06, IEDAT=89183, IETIM=08

AREM - Data Record Contents

(Records 2, 3, ... "NSE4"+1 of each set)

No.	Variable	Type[a]	Description
1	CSPEC	C*12	Species identifier (up to 12 characters)
Next NX4*NY4	QEMIT array	real	Area source emission rate (g/s) of species "CSPEC" for each grid column (QEMIT(nx4,ny4))

[a] C*12 = Character*12

4.2.5 User-Specified Deposition Velocity Data File (VD.DAT)

The CALPUFF model requires that the user specify the a method for determining dry deposition velocities for each species. In Input Group 3 of the control file, one of the following flags must be specified for each pollutant.

0 = no dry deposition (deposition velocities set to zero)
1 = resistance model used - pollutant deposited as a gas
2 = resistance model used - pollutant deposited as a particle
3 = user-specified deposition velocities used

Note that different methods can be used for different pollutants in the same CALPUFF run.

If any species are flagged as using "user-specified" deposition velocities, CALPUFF reads a formatted user-prepared data file with a 24-hour diurnal cycle of deposition velocities for each species flagged. The 24 values correspond to hours 01-24 (LST) of the simulated day. Twenty-four values must be entered for each flagged pollutant, even if the model run is for less than a full diurnal cycle. The units of the deposition velocities are m/s.

An example of a user-specified VD.DAT file is shown in Table 4.2.5-1. The VD.DAT file uses a control file format (see Section 4.2.1). All text outside the delimiters (!) is considered as user comment information and is echoed back but otherwise ignored by the input module. Each data line consists of a delimiter followed by the species name, 24 deposition velocities, and a terminating delimiter. The data may extend over more than one line. The line being continued must end with a comma. The control file format allows the use of repetition factors (e.g., 3 * 1.0 instead of 1.0, 1.0, 1.0). The order in which the species are entered in the file is not important. However, the file must end with an input group terminator (i.e., !END!).

The model checks that values have been entered for each species flagged as using user-specified deposition velocities. An error message is printed and execution of the run is terminated if any values are missing. The run will also terminate with an error message from the input routine if too many values are entered (i.e., more than 24 values for a particular pollutant). The species names must match those used in the chemical mechanism of the model.

Table 4.2.5-1. Sample user-specified deposition velocity file for two species.

```
                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
(CALPUFF.INP).

   NOTE: Units are in m/s.
   -----------------------

SPECIES
 NAME          Deposition Velocities (m/s)
-------        ---------------------------

! HNO3     =   5*1.5e-2, 4*1.7e-2, 3*1.8e-2, 3*1.9e-2, 3*1.7e-2, 6*1.5e-2 !
! SO2      =   5*0.8e-2,13*1.0e-2, 6*0.8e-2                               !

!END!
```

4.2.6 Hourly Ozone Data File (OZONE.DAT)

If the MESOPUFF II chemical mechanism is used to simulate the chemical transformation of $SO_2 \rightarrow SO_4^{=}$ and $NO_x \rightarrow HNO_3 \longleftrightarrow NO_3^{-}$, estimates of background ambient ozone concentration levels are required to compute the hourly conversion rates. CALPUFF provides two options for the user to provide these data: (1) a single, typical background value appropriate for the modeling region, or (2) hourly ozone data from one or more ozone monitoring stations. The selection of Option 2 requires that a file called OZONE.DAT be created with the necessary data.

OZONE.DAT is a sequential, formatted data file containing three types of records: single header record, time-invariant data records, and hourly ozone data records. The header record contains information on the number of stations in the data set, the time period of the data, and descriptive information regarding the file. The time-invariant records contain the coordinates of each of the ozone stations. The time-varying data consists of hourly ozone concentrations at each of the ozone stations.

OZONE.DAT File - Header Record

The header records of the OZONE.DAT file contain the name, version, and label of the data set, the number of ozone stations, and starting and ending time periods of data in the file. A sample Fortran read statement for the header record is:

```
READ(iunit,*)FNAMEO,NOZSTA,IUTMZO,IBDATO,IBTIMO,IEDATO,
1 IETIMO,VRSO,LABELO
```

where the following declaration applies:

```
CHARACTER*12 FNAMEO,VRSO,LABELO.
```

OZONE.DAT - Header Record - General Data

No.	Variable	Type[a]	Description	Sample Values
1	FNAMEO	C*12	Data set name	OZONE
2	NOZSTA	integer	Number of ozone stations in the file	3
3	IUTMZO	integer	UTM zone in which ozone station coordinates are specified	11
4	IBDATO	integer	Date of beginning of data in the file (YYJJJ, where YY=year, JJJ=Julian day)	84220
5	IBTIMO	integer	Hour of beginning of data in the file (00-23, LST)	00
6	IEDATO	integer	Date of ending of data in the file (YYJJJ, where YY=year, JJJ=Julian day)	84224
7	IETIMO	integer	Hour of ending of data in the file (00-23, LST)	23
8	VRSO	C*12	Data set version	Base Case
9	LABELO	C*12	Data set label	Major pts.

[a] C*12 = Character*12

OZONE.DAT File - Data Records

The OZONE.DAT file contains two types of data records. A set of time-invariant records are read after the header records. These records specify the coordinates of each ozone station. A set of time-varying data follows, which contain the hourly ozone concentration (in ppm) for each station.

Sample Fortran read statements for time-invariant data records are:

```
┌──Loop over stations
│
│  READ(iunit,*)CID,XOZ,YOZ
│
└──End loop over stations
```

where the following declaration applies:

```
CHARACTER*16 CID
```

Sample Fortran read statements for time-varying data records are:

```
┌──Loop over hours
│
│      READ(iunit,*)IYR,IJUL,IHR,OZCONC
│
└──End loop over hours
```

where the following declaration applies:

```
REAL OZCONC(nozsta)
```

OZONE.DAT - Time-Invariant Data Record Contents
(Repeated for each station)

No.	Variable	Type[a]	Description
1	CID	C*16	Station identifier (16 characters=4 words)
2	XOZ	real	Easting UTM coordinate (km) of the ozone station
3	YOZ	real	Northing UTM coordinate (km) of the ozone station

[a] C*16 = Character*16

OZONE.DAT - Time-Varying Data Record Contents

(One record per hour)

No.	Variable	Type	Description
1	IYR	integer	Year of data (two digits)
2	IJUL	integer	Julian day
3	IHR	integer	Hour of data
Next	OZCONC	real	Ozone concentration (ppm) at each ozone "NOZSTA"arraystation (in the same order as the station coordinates in the time-invariant records)

4.2.7 User-specified Chemical Transformation Rate Data File (CHEM.DAT)

If chemical conversion is to be considered by CALPUFF, the user must specify a variable in the control file, MCHEM, which determines how chemical transformation rates are computed. The options for MCHEM are:

0 = chemical transformation is not modeled

1 = the MESOPUFF II chemical scheme is used to compute transformation rates

2 = user-specified 24-hour cycles of transformation rates are used

If MCHEM is set equal to 2, CALPUFF reads a formatted user-prepared data file with 24-hour diurnal cycles of transformation rates k_1, k_2, k_3 (described in Section 2.8). The nature of the equilibrium relationship assumed between pollutants 4 and 5 (e.g., HNO_3 and NO_3^-) precludes the use of a user-specified conversion rate between these pollutants. If NO_3 is being modeled, the NH_4NO_3 dissociation constant is determined as a function of temperature and relative humidity as described in Section 2.8.1.

A sample user-specified CHEM.DAT file is shown in Table 4.2.7-1. The CHEM.DAT file uses a control file format (see Section 4.2.1). All text outside the delimiters (!) is considered as user comment information and is echoed back but otherwise ignored by the input module. Each data line consists of a delimiter followed by the species name, 24 conversion rates, and a terminating delimiter. The data may extend over more than one line. The line being continued must end with a comma. The control file format allows the user of repetition factors (e.g., 3 * 1.0 instead of 1.0, 1.0, 1.0). The order in which the species are entered in the file is not important. However, the file must end with an input group terminator (i.e., !END).

The model checks that the proper number of values have been entered for each conversion rate. An error message is printed and execution of the run is terminated if any values are missing. The run will also terminate with an error message from the input routine if too many values are entered (i.e., more than 24 values).

Table 4.2.7-1. Sample user-specified chemical transformation rate data file (CHEM.DAT).

```
                CHEMICAL TRANSFORMATION RATE FILE (CHEM.DAT)
                --------------------------------------------

    CHEM.DAT contains a 24-hour diurnal cycle of chemical transformation
rates for the chemical transformation of SO2 to SO4, and NOx to HNO3/PAN.

        k1 = SO2 to SO4 transformation rate(percent/hour)

        k2 = NOx to HNO3 + PAN transformation rate (percent/hour)

        k3 = NOx to HNO3 (only) transformation rate (percent/hour)


                TRANSFORMATION RATE (percent/hour)
                ----------------------------------

! K1        =   7*0.2, 0.4, 0.8, 1.2, 1.6, 3*2.0, 1.6, 1.2, 0.8, 0.4, 6*0.2 !
! K2        =   7*2.0, 4.0, 8.0,12.0,15.0,3*20.0,15.0,12.0, 8.0, 4.0, 6*2.0 !
! K3        =   7*2.0, 3.0, 6.0, 8.0,11.0,3*15.0,11.0, 8.0, 6.0, 3.0, 6*2.0 !

!END!
```

4.2.8 Site-Specific Turbulence Data (SIGMA.DAT)

CALPUFF provides several options for computing the dispersion coefficients, σ_y and σ_z. In Input Group 2 of the control file, the user specifies a value for the dispersion method flag, MDISP:

1 = dispersion coefficients computed from values of σ_v and σ_w read from a data file (SIGMA.DAT),

2 = dispersion coefficients determined from internally computed values of σ_v and σ_w based on similarity scaling relationships,

3 = PGT coefficients (computed using the ISCST multi-segment approximation) used for rural areas and MP coefficients used in urban areas,

4 = same as 3 except that the PGT coefficients are computed using the MESOPUFF II equations.

Section 2.2.1 contains more information on these options. If Option 1 is selected, the user must prepare a data file with hourly values of σ_v and σ_w. This option is intended primarily for application to a single source or facility with onsite measurements of σ_v and σ_w. Therefore, only one set of observations are allowed in the data base and they are assumed to apply over the entire computational region.

SIGMA.DAT is a sequential, formatted data file containing a single time-invariant header record followed by a set of hourly data records. The header record contains some general descriptive information on the file and specifies the time period of the data in the file. The time-varying data records consist of a date and hour followed by values of σ_v and σ_w.

SIGMA.DAT File - Header Record

The header record of the SIGMA.DAT file contains the name, version, and label of the data set, and the starting and ending time periods of the data in the file. A sample Fortran read statement for the header record is:

```
READ(iunit)FNAMES, IBDATS, IBTIMS, IEDATS, IETIMS, VRSS, LABELS
```

where the following declaration applies:

```
CHARACTER*12 FNAMES, VRSS, LABELS
```

SIGMA.DAT - Header Record - General Data

NO.	VARIABLE	TYPE[a]	DESCRIPTION	SAMPLE VALUES
1	FNAMES	C*12	Data set name	SIGMA
2	IBDATS	integer	Date of beginning of data in the file (YYJJJ, where YY=year and JJJ=Julian day)	84220
3	IBTIMS	integer	Hour of beginning of data in the file (00-23, LST)	00
4	IEDATS	integer	Date of ending of data in the file (YYJJJ, where YY=year and JJJ=Julian day)	84224
5	IBTIMS	integer	Hour of ending of data in the file (00-23, LST)	23
6	VRSS	C*12	Data set version	Base Case
7	LABELS	C*12	Data set label	Onsite10m

[a] C*12 = Character*12

SIGMA.DAT File - Data Records

The SIGMA.DAT file contains one data record per hour. Each record contains values for σ_v and σ_w, in m/s, at a 10 meter measurement height. A sample read statement for the hourly data records is:

```
Loop over hours

    READ(iunit,*)IYR, IJUL, IHR, SIGU, SIGW

End loop over hours
```

SIGMA.DAT - Time-Varying Data Record Contents

(One record per hour)

NO.	VARIABLE	TYPE[a]	DESCRIPTION
1	IYR	integer	Year of data (two digits)
2	IJUL	integer	Julian day
3	IHR	integer	Hour of data
4	SIGV	real	Standard deviation (m/s) of the horizontal crosswind component of the wind (σ_v)
5	SIGW	real	Standard deviation (m/s) of the vertical component of the wind (σ_w)

4.3 CALPUFF Output Files

4.3.1 Concentration File (CONC.DAT)

The CONC.DAT file is an unformatted data file containing gridded fields of time averaged concentrations predicted by CALPUFF. The creation and contents of the CONC.DAT file are controlled by user-specified inputs in Input Group 7 of the control file (see Section 4.2.1). The control file variable ICON must be set equal to one in order to create the CONC.DAT file.

CONC.DAT File - Header Records

The CONC.DAT file consists of five header records followed by a set of data records. The header records contain information describing the version of the model used in the run creating the file, horizontal and vertical grid data, a user-input title, a list of the species combinations stored in the output file, and receptor information.

Sample FORTRAN read statements for the header records are:

```
READ(iunit)CMODEL,VER,LEVEL,IBYR,IBJUL,IBHR,
1 IRLG,IAVG,NXM,NYM,DXKM,DYKM,IONE,IBCOMP,IECOMP,JBCOMP,JECOMP,
2 IBSAMP,JBSAMP,IESAMP,JESAMP,MESHDN,NPTS,NAREAS,NDREC,NCTREC,LSGRID,
3 NSPOUT
READ(iunit)TITLE
READ(iunit)CSOUT
READ(iunit)XREC,YREC,ZREC
READ(iunit)XRCT,YRCT,ZRCT,IHILL
```

where the following declarations apply:

```
Character*80 TITLE(3)
Character*15 CSOUT(NSPOUT)
Character*12 CMODEL,VER,LEVEL
```

```
Real XREC(NDREC),YREC(NDREC),ZREC(NDREC)
Real XRCT(NCTREC),YRCT(NCTREC),ZRCT(NCTREC)

Integer IHILL(NCTREC)
```

Unformatted CONC.DAT file - Header Record 1 - General Data

No.	Variable	Type[a]	Description	Sample Value
1	CMODEL	C*12	Model name	CALPUFF
2	VER	C*12	Model version number	1.0
3	LEVEL	C*12	Model level number	900330
4	IBYR	integer	Starting year of the run	80
5	IBJUL	integer	Starting Julian day	183
6	IBHR	integer	Starting hour (00-23)	8
7	IRLG	integer	Length of run (hours)	5
8	IAVG	integer	Averaging time (hours) of output concentrations	1
9	NXM	integer	Number of grid points in meteorological grid (X direction)	20
10	NYM	integer	Number of grid points in meteorological grid (Y direction)	20
11	DXKM	real	Grid spacing (km) in the X direction	5.
12	DYKM	real	Grid spacing (km) in the Y direction	5.
13	IONE	integer	Number of receptor layers (must be equal to one for CALPUFF runs)	1
14	IBCOMP	integer	Start of computational grid in X direction	1
15	IECOMP	integer	End of computational grid in X direction	20
16	JBCOMP	integer	Start of computational grid in Y direction	1
17	JECOMP	integer	End of computational grid in Y direction	20
18	IBSAMP	integer	Start of sampling grid in X direction	1
19	JBSAMP	integer	End of sampling grid in X direction	20

[a] C*12 = Character*12

Unformatted CONC.DAT file - Header Record 1 - General Data (Concluded)

No.	Variable	Type	Description	Sample Value
20	IESAMP	integer	Start of sampling grid in Y direction	1
21	JESAMP	integer	End of sampling grid in Y direction	20
22	MESHDN	integer	Sampling grid spacing factor	1
23	NPTS	integer	Number of point sources	2
24	NAREAS	integer	Number of area sources	0
25	NDREC	integer	Number of discrete receptors	0
26	NCTREC	integer	Number of complex terrain receptors	0
27	LSGRID	logical	Sampling grid flag (T = gridded receptors, F = no gridded receptors)	T
28	NSPOUT	integer	Number of output species	5

Unformatted CONC.DAT file - Header Record 2 - Run Title

No.	Variable	Type[a]	Description
1	title array	C*80	User-specified run title (three lines of up to 70 characters/line)

Header Record 3 - List of Species in Output File

No.	Variable	Type[a]	Description
1-NSPEC	CSOUT array	C*15	Species name (first 11 characters) and layer (last 3 characters) of concentrations stored in the output filed. CALPUFF concentrations are always computed at ground-level and therefore are labeled as layer 1.

[a] C*80 = Character*80
C*15 = Character*15

Header Record 4 - Discrete Receptors

(Included only if NDREC > 0)

No.	Variable	Type	Description
1	XREC	real array	X-coordinate (km) of each discrete receptor
2	YREC	real array	Y-coordinate (km) of each discrete receptor
3	ZREC	real array	Ground level elevation (m) of each discrete receptor

Header Record 5 - Complex Terrain Receptors

(Included only if NCTREC > 0)

No.	Variable	Type	Description
1	XRCT	real array	X-coordinate (km) of each complex terrain receptor
2	YRCT	real array	Y-coordinate (km) of each complex terrain receptor
3	ZRCT	real array	Ground level elevation (m) of each complex terrain receptor
4	IHILL	integer array	Hill number associated with this receptor

CONC.DAT File - Data Records

The CONC.DAT data records consist of a set of "NSPOUT+1" records for each hour of the CALPUFF run (NSPOUT is the number of output species in the CALPUFF run). The first record of each set contains the date and hour of the data in the records which follow it. The next "NSPOUT" records contain the predicted concentrations in g/m^3, for each species, flagged for output in the control file.

Sample FORTRAN read statements for the data records are:

```
LOOP OVER OUTPUT SPECIES

GRIDDED RECEPTOR CONCENTRATIONS
IF(LSGRID)READ(iunit)CSPECG,CONCG

DISCRETE RECEPTOR CONCENTRATIONS
IF(NDREC.GT.0)READ(iunit)CSPECD,CONCD

COMPLEX TERRAIN RECEPTOR CONCENTRATIONS
IF(NCTREC.GT.0)READ(iunit)CSPECCT,CONCCT

END LOOP OVER OUTPUT SPECIES
```

where the following declarations apply:

```
Character*15 CSPECG,CPSECD,CSPECCT
Real CONCG(nxg,nyg) 1 CONCD(NDREC),CONCCT(NCTREC)
```

and

```
nxg = IESAMP - IBSAMP+1
nyg = JESAMP - JBSAMP+1
```

Unformatted CONC.DAT File - Data Records

(Record 1 of each set)

No.	Variable	Type[a]	Description
1	NYR	integer	Year of concentration data (two digits)
2	NJUL	integer	Julian day of data
3	NHR	integer	Hour (00-23) of data

(Next Data Record)

(Included only if LSGRID=TRUE)

No.	Variable	Type[a]	Description
1	CSPECG	C*15	Species name (first 12 characters) and layer (last 3 characters) of the concentrations in this record. (Note: Layer is always "001" in CALPUFF output).
Next	CONCG	real	"IAVG" - hour averaged concentrations (g/m^3)
NXG*NYG		array	for each sampling grid point.

[a] C*15 = Character*15

4.3.2 Dry Flux File (DFLX.DAT)

The DFLX.DAT file is an unformatted data file containing gridded fields of time averaged dry deposition fluxes predicted by CALPUFF. The creation and contents of the DFLX.DAT file are controlled by user-specified inputs in Input Group 7 of the control file (see Section 4.2.1).

The control file variable IDRY must be set equal to one in order to create the DFLX.DAT file. The species saved in the output file are also controlled by the user by setting flags in the output species table in Input Group 7 of the control file. The model checks that only deposited species are flagged for output into the DFLX.DAT file. The effects of dry deposition on ambient concentrations can be evaluated without saving the dry fluxes in the output file if the actual values of the deposition fluxes are not of interest.

DFLX.DAT File - Header Records

The DFLX.DAT file consists of five header records followed by a set of data records. The header records contain information describing the version of the model used in the run creating the file, horizontal and vertical grid data, a user-input run title, and a list of the deposited species stored in the output file, and receptor information.

Sample FORTRAN read statements for the header records are:

```
READ(iunit)CMODEL,VER,LEVEL,IBYR,IBJUL,IBHR,IRLG,
1 IAVG,NXM,NYM,DXKM,DYKM,IONE,IBCOMP,IECOMP,JBCOMP,JECOMP
2 IBSAMP,JBSAMP,IESAMP,JESAMP,MESHDN,NPTS,NAREAS,NDREC,NCTREC,LSGRID,
3 NDFOUT
READ(iunit)TITLE
READ(iunit)CDFOUT
READ(iunit)XREC,YREC,ZREC
READ(iunit)XRCT,YRCT,ZRCT,IHILL
```

where the following declarations apply:

```
Character*80 TITLE(3)
Character*15 CDFOUT(NDFOUT)
Character*12 CMODEL,VER,LEVEL

Real XREC(NDREC),YREC(NDREC),ZREC(NDREC)
Real XRCT(NCTREC),YRCT(NCTREC),ZRCT(NCTREC)

Integer IHILL(NCTREC)
```

Unformatted DFLX.DAT file - Header Record 1 - General Data

No.	Variable	Type[a]	Description	Sample Value
1	CMODEL	C*12	Model name	CALPUFF
2	VER	C*12	Model version number	1.0
3	LEVEL	C*12	Model level number	900330
4	IBYR	integer	Starting year of the run	80
5	IBJUL	integer	Starting Julian day	183
6	IBHR	integer	Starting hour (00-23)	8
7	IRLG	integer	Length of run (hours)	5
8	IAVG	integer	Averaging time (hours) of output concentrations	1
9	NXM	integer	Number of grid points in meteorological grid (X direction)	20
10	NYM	integer	Number of grid points in meteorological grid (Y direction)	20
11	DXKM	real	Grid spacing (km) in the X direction	5.
12	DYKM	real	Grid spacing (km) in the Y direction	5.
13	IONE	integer	Number of grid points in meteorological grid (X direction)	1
14	IBCOMP	integer	Start of computational grid in X direction	1
15	IECOMP	integer	End of computational grid in X direction	20
16	JBCOMP	integer	Start of computational grid in Y direction	1
17	JECOMP	integer	End of computational grid in Y direction	20
18	IBSAMP	integer	Start of sampling grid in X direction	1
19	JBSAMP	integer	End of sampling grid in X direction	20

[a] C*12 = Character*12

Unformatted DFLX.DAT file - Header Record 1 - General Data (Concluded)

No.	Variable	Type	Description	Sample Value
20	IESAMP	integer	Start of sampling grid in Y direction	1
21	JESAMP	integer	End of sampling grid in Y direction	20
22	MESHON	integer	Sampling grid spacing factor	1
23	NPTS	integer	Number of point sources	2
24	NAREAS	integer	Number of area sources	0
25	NDREC	integer	Number of discrete receptors	0
26	NCTREC	integer	Number of complex terrain receptors	0
27	LSGRID	logical	Sampling grid flag (T = gridded receptors, F = no gridded receptors)	T
28	NDFOUT	integer	Number of dry deposited species stored in the output file	5

Unformatted DFLX.DAT file - Header Record 2 - Run Title

No.	Variable	Type[a]	Description
1	title array	C*80	User-specified run title (three lines of up to 70 characters/line)

Header Record 3 - List of Species-Layers in Output File

No.	Variable	Type[a]	Description
1–NDFOUT	CDFOUT array	C*15	Species name (first 11 characters) and dry flux flag (last 3 characters) of data stored in the output file. The dry flux flag is ' DF'.

[a] C*80 = Character*80
C*15 = Character*15

Header Record 4 - Discrete Receptors

(Included only if NDREC > 0)

No.	Variable	Type	Description
1	XREC	real array	X-coordinate (km) of each discrete receptor
2	YREC	real array	Y-coordinate (km) of each discrete receptor
3	ZREC	real array	Ground level elevation (m) of each discrete receptor

Header Record 5 - Complex Terrain Receptors

(Included only if NCTREC > 0)

No.	Variable	Type	Description
1	XRCT	real array	X-coordinate (km) of each complex terrain receptor
2	YRCT	real array	Y-coordinate (km) of each complex terrain receptor
3	ZRCT	real array	Ground level elevation (m) of each complex terrain receptor
4	IHILL	integer array	Hill number associated with this receptor

DFLX.DAT File - Data Records

The DFLX.DAT data records consist of a set of "NDFOUT+1" records for each hour of the CALPUFF runs (NDFOUT is the number of species flagged as being stored in the output file). The first record of each set contains the data and hour of the data in the records which follow it. The next "NDFOUT" records contain predicted one-hour averaged dry deposition fluxes in $g/m^2/s$ for each relevant species.

Sample FORTRAN read statements for the data records are:

```
LOOP OVER DRY DEPOSITED SPECIES STORED ON DISK

GRIDDED RECEPTOR DRY FLUXES
   IF(LSGRID)READ(iunit)CDFG,DFLXG

DISCRETE RECEPTOR DRY FLUXES
   IF(NDREC.GT.0)READ(iunit)CDFD,DFLXD

COMPLEX TERRAIN RECEPTOR DRY FLUXES
   IF (NCTREC.GT.0)READ(iunit)CDFCT,DFLXCT

END LOOP OVER DRY DEPOSITED SPECIES STORED ON DISK
```

where the following declarations apply:

```
Character*15 CDFG,CDFD,CDFCT
Real DFLXG(nxg,nyg),DFLXD(NDREC),DFLXCT(NCTREC)
```

and

```
nxg = IESAMP - IBSAMP+1
nyg = JESAMP - JBSAMP+1
```

Unformatted DFLX.DAT File - Data Records

(Record 1 of each set)

No.	Variable	Type	Description
1	NYR	integer	Year of dry flux data (two digits)
2	NJUL	integer	Julian day of data
3	NHR	integer	Hour (00-23) of data

(Next Data Record)

(Included only if LSGRID = TRUE)

No.	Variable	Type[a]	Description
1	CDFG	C*15	Species name (first 12 characters) and dry flux flag (last 3 characters = ' DF') of the data in this record
Next NXG*NYG	DFLXG	real array	"IAVG" - hour averaged dry deposition fluxes ($g/m^2/s$) for each gridded receptor

[a] C*15 = Character*15

Unformatted DFLX.DAT File - Data Records

(Next Data Record)

(Included only if NDREC > 0)

No.	Variable	Type[a]	Description
1	CDFD	C*15	Species name (first 12 characters) and dry flux flag (last 3 characters = ' DF') of the data in this record
Next NDREC	DFLXD	real array	"IAVG" - hour averaged dry deposition fluxes ($g/m^2/s$) for each discrete receptor

(Next Data Record)

(Included only if NCTREC > 0)

No.	Variable	Type[a]	Description
1	CDFCT	C*15	Species name (first 12 characters) and dry flux flag (last 3 characters = ' DF') of the data in this record
Next NCTREC	DFLXCT	real array	"IAVG" - hour averaged dry deposition fluxes ($g/m^2/s$) at each complex terrain (CTSG) receptor

[a] C*15 = Character*15

4.3.3 Wet Flux File (WFLX.DAT)

The WFLX.DAT file is an unformatted data file containing gridded fields of time averaged wet deposition fluxes predicted by CALPUFF. The creation and contents of the WFLX.DAT file are controlled by user-specified inputs in Input Group 7 of the control file (see Section 4.2.1).

The control file variable IWET must be set equal to one in order to create the WFLX.DAT file. The species saved in the output file are also controlled by the user by setting flags in the output species table in Input Group 7 of the control file. The model checks that only deposited species are flagged for output into the WFLX.DAT file. The effects of wet deposition on ambient concentrations can be evaluated without saving the wet fluxes in the output file if the actual values of the deposition fluxes are not of interest.

WFLX.DAT File - Header Records

The WFLX.DAT file consists of five header records followed by a set of data records. The header records contain information describing the version of the model used in the run creating the file, horizontal and vertical grid data, a user-input run title, and a list of the deposited species stored in the output file, and receptor information.

Sample FORTRAN read statements for the header records are:

```
READ(iunit)CMODEL,VER,LEVEL,IBYR,IBJUL,IBHR,IRLG,
1 IAVG,NXM,NYM,DXKM,DYKM,IONE,IBCOMP,IECOMP,JBCOMP,JECOMP
2 IBSAMP,JBSAMP,IESAMP,JESAMP,MESHDN,NPTS,NAREAS,NDREC,NCTREC,LSGRID,
3 NWFOUT
READ(iunit)TITLE
READ(iunit)CWFOUT
READ(iunit)XREC,YREC,ZREC
READ(iunit)XRCT,YRCT,ZRCT,IHILL
```

where the following declarations apply:

```
Character*80 TITLE(3)
Character*15 CWFOUT(NWFOUT)
Character*12 CMODEL,VER,LEVEL

Real XREC(NDREC),YREC(NDREC),ZREC(NDREC)
Real XRCT(NCTREC),YRCT(NCTREC),ZRCT(NCTREC)

Integer IHILL(NCTREC)
```

Unformatted WFLX.DAT file - Header Record 1 - General Data

No.	Variable	Type[a]	Description	Sample Value
1	CMODEL	C*12	Model name	CALPUFF
2	VER	C*12	Model version number	1.0
3	LEVEL	C*12	Model level number	900330
4	IBYR	integer	Starting year of the run	80
5	IBJUL	integer	Starting Julian day	183
6	IBHR	integer	Starting hour (00-23)	8
7	IRLG	integer	Length of run (hours)	5
8	IAVG	integer	Averaging time (hours) of output concentrations	1
9	NXM	integer	Number of grid points in meteorological grid (X direction)	20
10	NYM	integer	Number of grid points in meteorological grid (Y direction)	20
11	DXKM	real	Grid spacing (km) in the X direction	5.
12	DYKM	real	Grid spacing (km) in the Y direction	5.
13	IONE	integer	Number of grid points in meteorological grid (X direction)	1
14	IBCOMP	integer	Start of computational grid in X direction	1
15	IECOMP	integer	End of computational grid in X direction	20
16	JBCOMP	integer	Start of computational grid in Y direction	1
17	JECOMP	integer	End of computational grid in Y direction	20
18	IBSAMP	integer	Start of sampling grid in X direction	1

[a] C*12 = Character*12

Unformatted WFLX.DAT file - Header Record 1 - General Data (Concluded)

No.	Variable	Type	Description	Sample Value
19	JBSAMP	integer	End of sampling grid in X direction	20
20	IESAMP	integer	Start of sampling grid in Y direction	1
21	JESAMP	integer	End of sampling grid in Y direction	20
22	MESHON	integer	Sampling grid spacing factor	1
23	NPTS	integer	Number of point sources	2
24	NAREAS	integer	Number of area sources	0
25	NDREC	integer	Number of discrete receptors	0
26	NCTREC	integer	Number of complex terrain receptors	0
27	LSGRID	logical	Sampling grid flag (T = gridded receptors, F = no gridded receptors)	T
28	NWFOUT	integer	Number of wet deposited species stored in the output file	5

Unformatted WFLX.DAT file - Header Record 2 - Run Title

No.	Variable	Type[a]	Description
1	title array	C*80	User-specified run title (three lines of up to 70 characters/line)

Header Record 3 - List of Species-Layers in Output File

No.	Variable	Type[a]	Description
1–NWFOUT	CWFOUT array	C*15	Species name (first 11 characters) and wet flux flag (last 3 characters) of data stored in the output file. The wet flux flag is ' WF'.

[a] C*80 = Character*80
C*15 = Character*15

Header Record 4 - Discrete Receptors

(Included only if NDREC > 0)

No.	Variable	Type	Description
1	XREC	real array	X-coordinate (km) of each discrete receptor
2	YREC	real array	Y-coordinate (km) of each discrete receptor
3	ZREC	real array	Ground level elevation (m) of each discrete receptor

Header Record 5 - Complex Terrain Receptors

(Included only if NCTREC > 0)

No.	Variable	Type	Description
1	XRCT	real array	X-coordinate (km) of each complex terrain receptor
2	YRCT	real array	Y-coordinate (km) of each complex terrain receptor
3	ZRCT	real array	Ground level elevation (m) of each complex terrain receptor
4	IHILL	integer array	Hill number associated with this receptor

WFLX.DAT File - Data Records

The WFLX.DAT data records consist of a set of "NWFOUT+1" records for each hour of the CALPUFF runs (NWFOUT is the number of species flagged as being stored in the output file). The first record of each set contains the data and hour of the data in the records which follow it. The next "NWFOUT" records contain predicted one-hour averaged wet deposition fluxes in $g/m^2/s$ for each relevant species.

Sample FORTRAN read statements for the data records are:

```
LOOP OVER WET DEPOSITED SPECIES STORED ON DISK

GRIDDED RECEPTOR WET FLUXES
   IF(LSGRID)READ(iunit)CWFG,WFLXG

DISCRETE RECEPTOR WET FLUXES
   IF(NDREC.GT.0)READ(iunit)CWFD,WFLXD

COMPLEX TERRAIN RECEPTOR WET FLUXES
   IF (NCTREC.GT.0)READ(iunit)CWFCT,WFLXCT

END LOOP OVER WET DEPOSITED SPECIES STORED ON DISK
```

where the following declarations apply:

```
Character*15 CWFG,CWFD,CWFCT
Real WFLXG(nxg,nyg),WFLXD(NDREC),WFLXCT(NCTREC)
```

and

```
nxg = IESAMP - IBSAMP+1
nyg = JESAMP - JBSAMP+1
```

Unformatted WFLX.DAT File - Data Records

(Record 1 of each set)

No.	Variable	Type	Description
1	NYR	integer	Year of wet flux data (two digits)
2	NJUL	integer	Julian day of data
3	NHR	integer	Hour (00-23) of data

(Next Data Record)

(Included only if LSGRID = TRUE)

No.	Variable	Type[a]	Description
1	CWFG	C*15	Species name (first 12 characters) and wet flux flag (last 3 characters = ' WF') of the data in this record
Next NXG*NYG	WFLXG	real array	"IAVG" - hour averaged wet deposition fluxes ($g/m^2/s$) for each gridded receptor

[a] C*15 = Character*15

Unformatted WFLX.DAT File - Data Records

(Next Data Record)
(Included only if NDREC > 0)

No.	Variable	Type[a]	Description
1	CWFD	C*15	Species name (first 12 characters) and wet flux flag (last 3 characters = ' WF') of the data in this record
Next NDREC	WFLXD	real array	"IAVG" - hour averaged wet deposition fluxes ($g/m^2/s$) for each discrete receptor

(Next Data Record)
(Included only if NCTREC > 0)

No.	Variable	Type[a]	Description
1	CWFCT	C*15	Species name (first 12 characters) and wet flux flag (last 3 characters = ' WF') of the data in this record
Next NCTREC	WFLXD	real array	"IAVG" - hour averaged wet deposition fluxes ($g/m^3/s$) at each complex terrain (CTSG) receptor

[a] C*15 = Character*15

4.4 POSTPRO Postprocessing Program

The POSTPRO program is a postprocessor designed to produce ranked tabulations of averages of selected concentration (or wet/dry deposition flux) data obtained from either the CALGRID or the CALPUFF model. Its capabilities and options include:

- User-selected processing periods.
- User-selected chemical species.
- User-selected layer from which concentration data are obtained.
- Option to include gridded receptors, discrete receptors, and complex terrain receptors in any combination.
- Option to scale all concentration/deposition data by means of a linear function of the form: a*C + b (where C is concentration/deposition).
- User-specified averaging time.
- Option to produce tables of the "top-50" average concentration/deposition data (includes time and receptor information) for specified averaging times.
- Option to produce tables of the "top-N" (user specifies the number N) average concentration/deposition data at each receptor for specified averaging times.
- Option to produce a table of the annual (or length-of-run) average concentration/deposition at each receptor.
- Option to print concentration/deposition averages for selected days.

Two input files are read by POSTPRO: a user-input control file and the unformatted concentration/deposition data file generated by either CALPUFF or CALGRID. The output file, POSTPRO.LST contains the printed data selected by the user. Table 4-4.1 contains a summary of the input files and output file for POSTPRO.

The POSTPRO control file contains the user's inputs entered in Fortran free format. A description of each input variable is shown in Table 4-4.2. A sample input file is presented in Table 4-4.3. A sample output file is shown in Table 4-4.4.

Table 4.4-1

POSTPRO Input and Output Files

Unit	File Name	Type	Format	Description
5	POSTPRO.INP	input	formatted	Control file containing user inputs
7	POSTPRO.LST	output	formatted	List file (line printer output file)
4	CALOUT.DAT	input	unformatted	CALPUFF or CALGRID output file containing modeled concentration/deposition data.

Table 4.4-2

POSTPRO Control File Inputs (POSTPRO.INP)

Record 1. Beginning date and time.

Columns	Variable	Type	Description
*	ISYR	integer	Starting year of data to print (two digit)
*	JSDAY	integer	Starting Julian day (1-366)
*	ISHR	integer	Starting hour (00-23)

* Entered in Fortran free format

Table 4.4-2 (Continued)

POSTPRO Control File Inputs (POSTPRO.INP)

Records 2-7. Run length, species, layer, and receptor-types.

Record[1]	Columns	Variable	Type	Description
2	*	NHRS	integer	Number of hours to include.
3	*	ASPEC	character	Chemical species to include (there are 36 in CALGRID, and 5 in CALPUFF output from which one is selected).
4	*	ILAYER	integer	Layer from which data are obtained (set to -1 for dry deposition flux, or -2 for wet deposition flux)
5	*	LG	logical	Control variable for selecting gridded receptor data. (T=include, F=do not include)
6	*	LD	logical	Control variable for selecting discrete receptor data. (T=include, F=do not include)
7	*	LCT	logical	Control variable for selecting complex terrain receptor data. (T=include, F=do not include)

---

* Entered in Fortran free format

[1] Note: One variable entered per input record.

Table 4.4-2 (Continued)

POSTPRO Control File Inputs (POSTPRO.INP)

Record 8. Constants for scaling concentration/deposition data.

Columns	Variable	Type	Description
*	A	real	Multiplicative constant
*	B	real	Additive constant (Use zero for both if no scaling is wanted)

* Entered in Fortran free format

Table 4-4.2 (Continued)

POSTPRO Control File Inputs (POSTPRO.INP)

Records 9-14 Averaging[2] and "top-50" tabulation control variables[3].

Record[1]	Columns	Variable	Type	Description
9	*	NAVG	integer	User-specified averaging time. (hours).
10	*	L1T50	logical	Control variable for top-50 table of 1-hr averages (T= include, F=do not include).
11	*	L3T50	logical	Control variable for top-50 table of 3-hr averages (T= include, F=do not include).
12	*	L24T50	logical	Control variable for top-50 table of 24-hr averages (T= include, F=do not include).
13	*	LNT50	logical	Control variable for top-50 table of navg-hr averages (T= include, F=do not include).
14	*	LRT50	logical	Control variable for top-50 table of length-of-run averages (T= include, F=do not include).

---

* Entered in Fortran free format

[1] Note: One variable entered per input record.

[2] Note: The averaging is actually performed in units determined by the CALGRID or CALPUFF run. If this unit is 1 hour, then the 1-hr, 3-hr (etc.) naming convention holds. If the basic unit is 2 hours, then 2-hr, 6-hr (etc.) averages are printed. The variable reported as "mavg" in the POSTPRO output file gives the basic unit of time, and the POSTPRO output tables explicitly account for "mavg" in reporting (for example) "3 * 2 hr" averages.

[3] Note: Top-50 tables include only those receptor types (gridded, discrete, or complex terrain) that are selected by setting the corresponding control variables (LG,LD,LCT) equal to "T".

Table 4.4-2 (Continued)

POSTPRO Control File Inputs (POSTPRO.INP)

Records 15-20 "N-TOP" tabulation control variables[2].

Record[1]	Columns	Variable	Type	Description
15	*	NTOP	integer	User-specified number of "top" concentration/deposition values to tabulate at each receptor (the maximum number is 4).
16	*	L1TOPN	logical	Control variable for top-NTOP table of 1-hr averages (T= include, F=do not include).
17	*	L3TOPN	logical	Control variable for top-NTOP table of 3-hr averages (T= include, F=do not include).
18	*	L24TOPN	logical	Control variable for top-NTOP table of 24-hr averages (T= include, F=do not include).
19	*	LNTOPN	logical	Control variable for top-NTOP table of navg-hr averages (T= include, F=do not include).
20	*	LRAVG	logical	Control variable for table of length-of-run average (T= include, F=do not include).

---

* Entered in Fortran free format

1 Note: One variable entered per input record.

2 Note: NTOP tables are produced for all receptors (gridded, discrete, and complex terrain) that are included in the data-file.

Table 4.4-2 (Continued)

POSTPRO Control File Inputs (POSTPRO.INP)

Records 21-24 Daily output control variables.

Record[1]	Columns	Variable	Type	Description
21	*	LECH1	logical	Control variable for printing all 1-hr averages for days in IECHO array.
22	*	LECH3	logical	Control variable for printing all 3-hr averages for days in IECHO array.
23	*	LECH24	logical	Control variable for printing all 24-hr averages for days in IECHO array.
24	*	LECHN	logical	Control variable for printing all navg-hr averages for days in IECHO array.

---

* Entered in Fortran free format

[1] Note: One variable entered per input record.

Table 4.4-2 (Concluded)

POSTPRO Control File Inputs (POSTPRO.INP)

Record 25. IECHO array for selecting days for detailed printout.

Columns	Variable	Type	Description
*	IECHO(366)	integer	Sequence of 366 control variables that identify those days for which averages of concentration/deposition will be printed - see records 21-24. Each variable represents one Julian day, so all 366 values must be filled in. (0=do not print, 1=print).

* Entered in Fortran free format

Table 4.4-3
Sample POSTPRO Control File (POSTPRO.INP)

```
****************************************************************************
*              POSTPRO -- OPTIONS AND INPUT VARIABLES                      *
****************************************************************************
   VALUES       -    NAMES       /            COMMENTS
----------------------------------------------------------------------------
80, 001, 01     -isyr,jsday,ishr/Processing start year, Julian day, and hour
3               -nhrs            /Number of hours to process
"O3"            -aspec *         /Species
-1              -ilayer **       /Layer from which concentrations are processed
T               -LG              /Include gridded receptors
F               -LD              /Include discrete receptors
F               -LCT             /Include discrete complex terrain receptors
----------------------------------------------------------------------------
0., 0.          -a,b             /Scaling (new=old*a+b): Not applied if 0.,0.
----------------------------------------------------------------------------
8               -navg            /User-specified averaging time (hours)
T               -L1T50 ***       /Top 50 table for 1-hr avg. (all T types)
T               -L3T50           /Top 50 table for 3-hr avg. (all T types)
F               -L24T50          /Top 50 table for 24-hr avg. (all T types)
F               -LNT50           /Top 50 table for navg-hr avg. (all T types)
F               -LRT50           /Top 50 table for length of run (all T types)
----------------------------------------------------------------------------
3               -ntop ****       /Number of "top" concentrations at each rec.
T               -L1TOPN          /Top ntop table for 1-hr avg. (each rec.)
F               -L3TOPN          /Top ntop table for 3-hr avg. (each rec.)
F               -L24TOPN         /Top ntop table for 24-hr avg. (each rec.)
F               -LNTOPN          /Top ntop table for navg-hr avg. (each rec.)
F               -LRAVG           /Table for length-of-run avg. (each rec.)
----------------------------------------------------------------------------
T               -LECH1           /Output 1-hr avgs. for days in IECHO array
T               -LECH3           /Output 3-hr avgs. for days in IECHO array
F               -LECH24          /Output 24-hr avgs. for days in IECHO array
F               -LECHN           /Output navg-hr avgs. for days in IECHO array
----------------------------------------------------------------------------
1,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,  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,  0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0,  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,  0,0,0,0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0
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
0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,  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,  0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0
0,0,0,0,0,0,0,0,0,0,  0,0,0,0,0,0,0,0,0,0,  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,  0,0,0,0,0,0,0,0,0,0
0,0,0,0,0,0     -iecho(366)      /Specify days to echo by replacing 0 with 1
----------------------------------------------------------------------------
NOTES:
        *       There are up to 36 chemical species in CALGRID output, and 5
                species in CALPUFF output (SO2, SO4, NOx, HNO3, NO3)

        **      Set to -1 for dry deposition flux; -2 for wet deposition flux

        ***     Top 50 tables include only those receptor types (LG, LD, LCT)
                indicated as T (.true.)

        ****    Maximum number is 4
```

Table 4.4-4
Sample POSTPRO Output File (POSTPRO.LST)

```
*******************************************************************************************************************************
                                        POSTPRO  Version  0.0  Level  890515
*******************************************************************************************************************************


CONTENTS OF CONTROL FILE ----------------------
 isyr,jsday,ishr =          80          1          1
 nhrs =          3
 aspec,ilayer = O3                  -1
 asplv = O3          DF
 LG,LD,LCT = T F F
 a,b,LSCALE =   0.000000       0.000000      F
 navg,ntop =          8          3
 L[1,3,24,N,R]T50 = T T F F F
 L[1,3,24,N]TOPN = T F F F
 LRAVG = F
 LECH[1,3,24,N] = T T F F
 iecho(366) =
 1 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 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 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 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 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 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 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 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 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 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 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0

CONTENTS OF HEADER OF MODEL OUTPUT FILE ----------
 model :   CALGRID     1.0          890531
 msyr,mjsday,mshr =          80          1          1
 mnhrs,nszout,mavg =          3          1          1
 ielmet,jelmet =          10          10
 delx,dely,nz =    4.00000        4.00000              3
 iastar,iastop,jastar,jastop =          1          10          1          10
 isastr,isastp,jsastr,jsastp =          1          10          1          10
 (computed) ngx,ngy =          10          10
 meshdn,npts,nareas =          1          0          0
 ndrec,nctrec,LSGRID =          0          0 T

TEST RUN --  3 hours starting at 00:00 PST, 1/01/80
3 Fixed Layers
Horizontal grid -- 10 x 10

Chemical species names for nszout =          1
O3          DF
```

Table 4.4-4 (Continued)
Sample POSTPRO Output File (POSTPRO.LST)

```
**********************************************************************************************************************

                                        POSTPRO  Version  0.0  Level  890515

**********************************************************************************************************************


ECHO OPTION -
 DRY DEPOSITION AT EACH RECEPTOR IS PRINTED FOR THE FOLLOWING DAYS (0=NOT printed; 1=PRINTED):
1000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000
0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000
0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   0000000000
0000000000   0000000000   0000000000   0000000000   0000000000   0000000000   000000
 AND FOR THE FOLLOWING AVERAGING PERIODS:    (NOTE THAT THE AVERAGING PERIOD IN MODEL IS MAVG =  1 HR.)
         1*MAVG-HOUR AVERAGES
         3*MAVG-HOUR AVERAGES


     1 *  1-HOUR AVERAGE DRY DEPOSITION AT EACH RECEPTOR FOR THE PERIOD ENDING                YEAR: 80 DAY:   1 HOUR:  1

    GRIDDED RECEPTORS:

 O3           DF

 Multiply all values by 10 ** -21

10 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
 9 I  0  36  27  18  16  31  36  39  42   0
   I  +   +   +   +   +   +   +   +   +   +
 8 I  0  38  36  32  26  31  24  20  11   0
   I  +   +   +   +   +   +   +   +   +   +
 7 I  0  49  56  65  19  22  25  58  55   0
   I  +   +   +   +   +   +   +   +   +   +
 6 I  0  11  22  33  38  31  40  39  43   0
   I  +   +   +   +   +   +   +   +   +   +
 5 I  0  38  33  35  29  31  12  13  15   0
   I  +   +   +   +   +   +   +   +   +   +
 4 I  0  51  28  41  21  29  35  35  39   0
   I  +   +   +   +   +   +   +   +   +   +
 3 I  0  34  34  28  29  30  30  20  16   0
   I  +   +   +   +   +   +   +   +   +   +
 2 I  0  32  29  29  14  16  17  43  39   0
   I  +   +   +   +   +   +   +   +   +   +
 1 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
    ---------------------------------------
      1   2   3   4   5   6   7   8   9  10


     1 *  1-HOUR AVERAGE DRY DEPOSITION AT EACH RECEPTOR FOR THE PERIOD ENDING                YEAR: 80 DAY:   1 HOUR:  2

    GRIDDED RECEPTORS:

 O3           DF

 Multiply all values by 10 ** -21

10 I  0   0   0   0   0   0   0   0   0   0
```

```
   I  +   +   +   +   +   +   +   +   +   +
 9 I  0  53  27  17  29  57  63  64  57   0
   I  +   +   +   +   +   +   +   +   +   +
 8 I  0  38  35  38  41  48  51  59  11   0
   I  +   +   +   +   +   +   +   +   +   +
 7 I  0  44  49  68  22  25  28  65  62   0
   I  +   +   +   +   +   +   +   +   +   +
 6 I  0   8  36  52  54  46  54  50  62   0
   I  +   +   +   +   +   +   +   +   +   +
 5 I  0  37  40  48  57  63  14  14  17   0
   I  +   +   +   +   +   +   +   +   +   +
 4 I  0  50  27  38  26  41  49  40  36   0
   I  +   +   +   +   +   +   +   +   +   +
 3 I  0  42  44  40  38  35  36  37  12   0
   I  +   +   +   +   +   +   +   +   +   +
 2 I  0  49  53  52  13  14  16  38  36   0
   I  +   +   +   +   +   +   +   +   +   +
 1 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
    ------------------------------------------
      1   2   3   4   5   6   7   8   9  10
```

1 * 1-HOUR AVERAGE DRY DEPOSITION AT EACH RECEPTOR FOR THE PERIOD ENDING YEAR: 80 DAY: 1 HOUR: 3

GRIDDED RECEPTORS:

O3 DF

Multiply all values by 10 ** -21

```
10 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
 9 I  0  64  28  17  40  72  83  85  72   0
   I  +   +   +   +   +   +   +   +   +   +
 8 I  0  40  35  45  61  69  73  83  11   0
   I  +   +   +   +   +   +   +   +   +   +
 7 I  0  42  47  78  28  26  28  70  70   0
   I  +   +   +   +   +   +   +   +   +   +
 6 I  0   6  45  70  71  54  63  61  79   0
   I  +   +   +   +   +   +   +   +   +   +
 5 I  0  39  52  62  76  90  17  16  19   0
   I  +   +   +   +   +   +   +   +   +   +
 4 I  0  50  26  37  36  56  62  39  33   0
   I  +   +   +   +   +   +   +   +   +   +
 3 I  0  49  52  45  42  39  36  33   9   0
   I  +   +   +   +   +   +   +   +   +   +
 2 I  0  58  63  59  13  13  15  34  35   0
   I  +   +   +   +   +   +   +   +   +   +
 1 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
    ------------------------------------------
      1   2   3   4   5   6   7   8   9  10
```

3 * 1-HOUR AVERAGE DRY DEPOSITION AT EACH RECEPTOR FOR THE PERIOD ENDING YEAR: 80 DAY: 1 HOUR: 3

GRIDDED RECEPTORS:

Table 4.4-4 (Continued)
Sample POSTPRO Output File (POSTPRO.LST)

```
O3              DF

Multiply all values by 10 ** -21

10 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
 9 I  0  51  27  17  28  53  61  63  57   0
   I  +   +   +   +   +   +   +   +   +   +
 8 I  0  39  35  39  43  49  49  54  11   0
   I  +   +   +   +   +   +   +   +   +   +
 7 I  0  45  51  70  23  24  27  64  62   0
   I  +   +   +   +   +   +   +   +   +   +
 6 I  0   9  34  52  54  44  53  50  61   0
   I  +   +   +   +   +   +   +   +   +   +
 5 I  0  38  42  48  54  62  15  15  17   0
   I  +   +   +   +   +   +   +   +   +   +
 4 I  0  50  27  39  28  42  48  38  36   0
   I  +   +   +   +   +   +   +   +   +   +
 3 I  0  42  43  37  36  35  34  30  12   0
   I  +   +   +   +   +   +   +   +   +   +
 2 I  0  47  48  47  13  14  16  38  37   0
   I  +   +   +   +   +   +   +   +   +   +
 1 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
     ---------------------------------------
      1   2   3   4   5   6   7   8   9  10
```

Table 4.4-4 (Continued)
Sample POSTPRO Output File (POSTPRO.LST)

```
**********************************************************************************************************************

                                        POSTPRO  Version  0.0  Level  890515

**********************************************************************************************************************

                    O3          DF

 TOP-50   1 *  1-HOUR AVERAGE DRY DEPOSITION VALUES

  YEAR  DAY  HOUR    RECEPTOR   TYPE   DRY DEPOSITION

    80    1     3     ( 6, 5)     G     9.0070E-20
    80    1     3     ( 8, 9)     G     8.5233E-20
    80    1     3     ( 7, 9)     G     8.3397E-20
    80    1     3     ( 8, 8)     G     8.3044E-20
    80    1     3     ( 9, 6)     G     7.9424E-20
    80    1     3     ( 4, 7)     G     7.8376E-20
    80    1     3     ( 5, 5)     G     7.6365E-20
    80    1     3     ( 7, 8)     G     7.3132E-20
    80    1     3     ( 9, 9)     G     7.1782E-20
    80    1     3     ( 6, 9)     G     7.1737E-20
    80    1     3     ( 5, 6)     G     7.1163E-20
    80    1     3     ( 4, 6)     G     7.0285E-20
    80    1     3     ( 8, 7)     G     6.9562E-20
    80    1     3     ( 9, 7)     G     6.9556E-20
    80    1     3     ( 6, 8)     G     6.8801E-20
    80    1     2     ( 4, 7)     G     6.7830E-20
    80    1     2     ( 8, 7)     G     6.4592E-20
    80    1     1     ( 4, 7)     G     6.4591E-20
    80    1     3     ( 2, 9)     G     6.4044E-20
    80    1     2     ( 8, 9)     G     6.3663E-20
    80    1     3     ( 3, 2)     G     6.3423E-20
    80    1     3     ( 7, 6)     G     6.3421E-20
    80    1     2     ( 7, 9)     G     6.3225E-20
    80    1     2     ( 6, 5)     G     6.3023E-20
    80    1     2     ( 9, 7)     G     6.2481E-20
    80    1     2     ( 9, 6)     G     6.1996E-20
    80    1     3     ( 4, 5)     G     6.1879E-20
    80    1     3     ( 7, 4)     G     6.1558E-20
    80    1     3     ( 8, 6)     G     6.1409E-20
    80    1     3     ( 5, 8)     G     6.1152E-20
    80    1     2     ( 8, 8)     G     5.8750E-20
    80    1     3     ( 4, 2)     G     5.8690E-20
    80    1     3     ( 2, 2)     G     5.8492E-20
    80    1     1     ( 8, 7)     G     5.8306E-20
    80    1     2     ( 9, 9)     G     5.7497E-20
    80    1     2     ( 6, 9)     G     5.7180E-20
    80    1     2     ( 5, 5)     G     5.6923E-20
    80    1     3     ( 6, 4)     G     5.6198E-20
    80    1     1     ( 3, 7)     G     5.6175E-20
    80    1     1     ( 9, 7)     G     5.4977E-20
    80    1     2     ( 5, 6)     G     5.4476E-20
    80    1     2     ( 7, 6)     G     5.4444E-20
    80    1     3     ( 6, 6)     G     5.4259E-20
    80    1     2     ( 3, 2)     G     5.2987E-20
    80    1     2     ( 2, 9)     G     5.2854E-20
    80    1     3     ( 3, 5)     G     5.2306E-20
    80    1     3     ( 3, 3)     G     5.2065E-20
    80    1     2     ( 4, 2)     G     5.1880E-20
    80    1     2     ( 4, 6)     G     5.1509E-20
    80    1     1     ( 2, 4)     G     5.1430E-20
```

Table 4.4-4 (Continued)
Sample POSTPRO Output File (POSTPRO.LST)

POSTPRO Version 0.0 Level 890515

O3 DF

TOP-SO 3 * 1-HOUR AVERAGE DRY DEPOSITION VALUES

YEAR	DAY	HOUR	RECEPTOR	TYPE	DRY DEPOSITION
80	1	3	(4, 7)	G	7.0266E-20
80	1	3	(8, 7)	G	6.4153E-20
80	1	3	(8, 9)	G	6.2737E-20
80	1	3	(9, 7)	G	6.2338E-20
80	1	3	(6, 5)	G	6.1507E-20
80	1	3	(9, 6)	G	6.1483E-20
80	1	3	(7, 9)	G	6.0856E-20
80	1	3	(9, 9)	G	5.7219E-20
80	1	3	(5, 6)	G	5.4451E-20
80	1	3	(5, 5)	G	5.4209E-20
80	1	3	(8, 8)	G	5.3810E-20
80	1	3	(6, 9)	G	5.3414E-20
80	1	3	(7, 6)	G	5.2694E-20
80	1	3	(4, 6)	G	5.1741E-20
80	1	3	(2, 9)	G	5.1130E-20
80	1	3	(3, 7)	G	5.0853E-20
80	1	3	(2, 4)	G	5.0226E-20
80	1	3	(8, 6)	G	5.0155E-20
80	1	3	(7, 8)	G	4.9346E-20
80	1	3	(6, 8)	G	4.9067E-20
80	1	3	(3, 2)	G	4.8390E-20
80	1	3	(7, 4)	G	4.8346E-20
80	1	3	(4, 5)	G	4.8271E-20
80	1	3	(2, 2)	G	4.6643E-20
80	1	3	(4, 2)	G	4.6631E-20
80	1	3	(2, 7)	G	4.4882E-20
80	1	3	(6, 6)	G	4.3808E-20
80	1	3	(3, 3)	G	4.3370E-20
80	1	3	(5, 8)	G	4.2832E-20
80	1	3	(3, 5)	G	4.1982E-20
80	1	3	(6, 4)	G	4.1896E-20
80	1	3	(2, 3)	G	4.1542E-20
80	1	3	(2, 8)	G	3.8848E-20
80	1	3	(4, 4)	G	3.8634E-20
80	1	3	(4, 8)	G	3.8575E-20
80	1	3	(2, 5)	G	3.8339E-20
80	1	3	(8, 2)	G	3.8090E-20
80	1	3	(8, 4)	G	3.8012E-20
80	1	3	(4, 3)	G	3.7429E-20
80	1	3	(9, 2)	G	3.6750E-20
80	1	3	(5, 3)	G	3.6217E-20
80	1	3	(9, 4)	G	3.6154E-20
80	1	3	(3, 8)	G	3.5413E-20
80	1	3	(6, 3)	G	3.4969E-20
80	1	3	(3, 6)	G	3.4474E-20
80	1	3	(7, 3)	G	3.3812E-20
80	1	3	(8, 3)	G	3.0179E-20
80	1	3	(5, 9)	G	2.8136E-20
80	1	3	(5, 4)	G	2.7636E-20
80	1	3	(3, 9)	G	2.7293E-20

Table 4.4-4 (Continued)
Sample POSTPRO Output File (POSTPRO.LST)

POSTPRO Version 0.0 Level 890515

3 HIGHEST 1 * 1-HOUR AVERAGE DRY DEPOSITION VALUES AT EACH GRIDDED RECEPTOR (YEAR,DAY,ENDING HOUR)

O3 DF

RECEPTOR	HIGHEST		2ND HIGHEST		3RD HIGHEST	
1, 1	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1, 2	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1, 3	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1, 4	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1, 5	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1, 6	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1, 7	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1, 8	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1, 9	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
1,10	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
2, 1	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
2, 2	5.8492E-20	(80, 1, 3)	4.9139E-20	(80, 1, 2)	3.2297E-20	(80, 1, 1)
2, 3	4.8882E-20	(80, 1, 3)	4.1904E-20	(80, 1, 2)	3.3840E-20	(80, 1, 1)
2, 4	5.1430E-20	(80, 1, 1)	4.9665E-20	(80, 1, 3)	4.9584E-20	(80, 1, 2)
2, 5	3.9453E-20	(80, 1, 3)	3.8425E-20	(80, 1, 1)	3.7138E-20	(80, 1, 2)
2, 6	1.1179E-20	(80, 1, 1)	8.2087E-21	(80, 1, 2)	6.4056E-21	(80, 1, 3)
2, 7	4.9122E-20	(80, 1, 1)	4.3904E-20	(80, 1, 2)	4.1621E-20	(80, 1, 3)
2, 8	3.9661E-20	(80, 1, 3)	3.8499E-20	(80, 1, 2)	3.8386E-20	(80, 1, 1)
2, 9	6.4044E-20	(80, 1, 3)	5.2854E-20	(80, 1, 2)	3.6491E-20	(80, 1, 1)
2,10	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
3, 1	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
3, 2	6.3423E-20	(80, 1, 3)	5.2987E-20	(80, 1, 2)	2.8759E-20	(80, 1, 1)
3, 3	5.2065E-20	(80, 1, 3)	4.3933E-20	(80, 1, 2)	3.4110E-20	(80, 1, 1)
3, 4	2.8382E-20	(80, 1, 1)	2.6578E-20	(80, 1, 2)	2.6449E-20	(80, 1, 3)
3, 5	5.2306E-20	(80, 1, 3)	4.0439E-20	(80, 1, 2)	3.3203E-20	(80, 1, 1)
3, 6	4.5342E-20	(80, 1, 3)	3.6281E-20	(80, 1, 2)	2.1798E-20	(80, 1, 1)
3, 7	5.6175E-20	(80, 1, 1)	4.9278E-20	(80, 1, 2)	4.7106E-20	(80, 1, 3)
3, 8	3.5774E-20	(80, 1, 1)	3.5380E-20	(80, 1, 3)	3.5086E-20	(80, 1, 2)
3, 9	2.8159E-20	(80, 1, 3)	2.6987E-20	(80, 1, 2)	2.6734E-20	(80, 1, 1)
3,10	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
4, 1	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
4, 2	5.8690E-20	(80, 1, 3)	5.1880E-20	(80, 1, 2)	2.9323E-20	(80, 1, 1)
4, 3	4.4563E-20	(80, 1, 3)	3.9563E-20	(80, 1, 2)	2.8160E-20	(80, 1, 1)
4, 4	4.0678E-20	(80, 1, 1)	3.7998E-20	(80, 1, 2)	3.7227E-20	(80, 1, 3)
4, 5	6.1879E-20	(80, 1, 3)	4.7778E-20	(80, 1, 2)	3.5155E-20	(80, 1, 1)
4, 6	7.0285E-20	(80, 1, 3)	5.1509E-20	(80, 1, 2)	3.3430E-20	(80, 1, 1)
4, 7	7.8376E-20	(80, 1, 3)	6.7830E-20	(80, 1, 2)	6.4591E-20	(80, 1, 1)
4, 8	4.5368E-20	(80, 1, 3)	3.8446E-20	(80, 1, 2)	3.1910E-20	(80, 1, 1)
4, 9	1.7558E-20	(80, 1, 1)	1.7417E-20	(80, 1, 2)	1.6928E-20	(80, 1, 3)
4,10	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
5, 1	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)	0.0000E+00	(0, 0, 0)
5, 2	1.3691E-20	(80, 1, 1)	1.3012E-20	(80, 1, 2)	1.2632E-20	(80, 1, 3)
5, 3	4.1648E-20	(80, 1, 3)	3.7915E-20	(80, 1, 2)	2.9087E-20	(80, 1, 1)
5, 4	3.5701E-20	(80, 1, 3)	2.6345E-20	(80, 1, 2)	2.0861E-20	(80, 1, 1)
5, 5	7.6365E-20	(80, 1, 3)	5.6923E-20	(80, 1, 2)	2.9340E-20	(80, 1, 1)
5, 6	7.1163E-20	(80, 1, 3)	5.4476E-20	(80, 1, 2)	3.7714E-20	(80, 1, 1)
5, 7	2.8084E-20	(80, 1, 3)	2.2427E-20	(80, 1, 2)	1.8669E-20	(80, 1, 1)
5, 8	6.1152E-20	(80, 1, 3)	4.1115E-20	(80, 1, 2)	2.6231E-20	(80, 1, 1)

Table 4.4-4 (Continued)
Sample POSTPRO Output File (POSTPRO.LST)

5, 9	3.9903E-20	(80,	1,	3)	2.8520E-20	(80,	1,	2)	1.5985E-20	(80,	1, 1)
5,10	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
6, 1	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
6, 2	1.5563E-20	(80,	1,	1)	1.4193E-20	(80,	1,	2)	1.3476E-20	(80,	1, 3)
6, 3	3.9316E-20	(80,	1,	3)	3.5460E-20	(80,	1,	2)	3.0132E-20	(80,	1, 1)
6, 4	5.6198E-20	(80,	1,	3)	4.0516E-20	(80,	1,	2)	2.8974E-20	(80,	1, 1)
6, 5	9.0070E-20	(80,	1,	3)	6.3023E-20	(80,	1,	2)	3.1429E-20	(80,	1, 1)
6, 6	5.4259E-20	(80,	1,	3)	4.6420E-20	(80,	1,	2)	3.0746E-20	(80,	1, 1)
6, 7	2.5723E-20	(80,	1,	3)	2.4545E-20	(80,	1,	2)	2.2134E-20	(80,	1, 1)
6, 8	6.8801E-20	(80,	1,	3)	4.7700E-20	(80,	1,	2)	3.0699E-20	(80,	1, 1)
6, 9	7.1737E-20	(80,	1,	3)	5.7180E-20	(80,	1,	2)	3.1326E-20	(80,	1, 1)
6,10	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
7, 1	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
7, 2	1.7407E-20	(80,	1,	1)	1.5965E-20	(80,	1,	2)	1.5003E-20	(80,	1, 3)
7, 3	3.5891E-20	(80,	1,	2)	3.5773E-20	(80,	1,	3)	2.9771E-20	(80,	1, 1)
7, 4	6.1558E-20	(80,	1,	3)	4.8769E-20	(80,	1,	2)	3.4710E-20	(80,	1, 1)
7, 5	1.7070E-20	(80,	1,	3)	1.4145E-20	(80,	1,	2)	1.2494E-20	(80,	1, 1)
7, 6	6.3421E-20	(80,	1,	3)	5.4444E-20	(80,	1,	2)	4.0217E-20	(80,	1, 1)
7, 7	2.8296E-20	(80,	1,	3)	2.7935E-20	(80,	1,	2)	2.5206E-20	(80,	1, 1)
7, 8	7.3132E-20	(80,	1,	3)	5.1338E-20	(80,	1,	2)	2.3568E-20	(80,	1, 1)
7, 9	8.3397E-20	(80,	1,	3)	6.3225E-20	(80,	1,	2)	3.5945E-20	(80,	1, 1)
7,10	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
8, 1	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
8, 2	4.2844E-20	(80,	1,	1)	3.7655E-20	(80,	1,	2)	3.3772E-20	(80,	1, 3)
8, 3	3.7123E-20	(80,	1,	2)	3.2929E-20	(80,	1,	3)	2.0486E-20	(80,	1, 1)
8, 4	4.0091E-20	(80,	1,	2)	3.9310E-20	(80,	1,	3)	3.4635E-20	(80,	1, 1)
8, 5	1.5898E-20	(80,	1,	3)	1.4325E-20	(80,	1,	2)	1.3363E-20	(80,	1, 1)
8, 6	6.1409E-20	(80,	1,	3)	4.9658E-20	(80,	1,	2)	3.9397E-20	(80,	1, 1)
8, 7	6.9562E-20	(80,	1,	3)	6.4592E-20	(80,	1,	2)	5.8306E-20	(80,	1, 1)
8, 8	8.3044E-20	(80,	1,	3)	5.8750E-20	(80,	1,	2)	1.9636E-20	(80,	1, 1)
8, 9	8.5233E-20	(80,	1,	3)	6.3663E-20	(80,	1,	2)	3.9316E-20	(80,	1, 1)
8,10	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
9, 1	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
9, 2	3.9007E-20	(80,	1,	1)	3.6109E-20	(80,	1,	2)	3.5134E-20	(80,	1, 3)
9, 3	1.5835E-20	(80,	1,	1)	1.1764E-20	(80,	1,	2)	8.9821E-21	(80,	1, 3)
9, 4	3.9166E-20	(80,	1,	1)	3.6343E-20	(80,	1,	2)	3.2954E-20	(80,	1, 3)
9, 5	1.8973E-20	(80,	1,	3)	1.6525E-20	(80,	1,	2)	1.4854E-20	(80,	1, 1)
9, 6	7.9424E-20	(80,	1,	3)	6.1996E-20	(80,	1,	2)	4.3029E-20	(80,	1, 1)
9, 7	6.9556E-20	(80,	1,	3)	6.2481E-20	(80,	1,	2)	5.4977E-20	(80,	1, 1)
9, 8	1.1317E-20	(80,	1,	3)	1.1176E-20	(80,	1,	2)	1.0661E-20	(80,	1, 1)
9, 9	7.1782E-20	(80,	1,	3)	5.7497E-20	(80,	1,	2)	4.2377E-20	(80,	1, 1)
9,10	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 1	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 2	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 3	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 4	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 5	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 6	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 7	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 8	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10, 9	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)
10,10	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0,	0)	0.0000E+00	(0,	0, 0)

HIGHEST VALUES FOR PERIOD

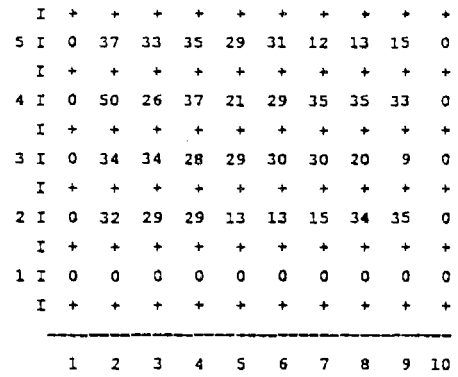
Multiply all values by 10 ** -21

10 I	0	0	0	0	0	0	0	0	0	0
I	+	+	+	+	+	+	+	+	+	+
9 I	0	64	28	18	40	72	83	85	72	0

Table 4.4-4 (Continued)
Sample POSTPRO Output File (POSTPRO.LST)

```
   I  +   +   +   +   +   +   +   +   +   +
 8 I  0  40  36  45  61  69  73  83  11   0
   I  +   +   +   +   +   +   +   +   +   +
 7 I  0  49  56  78  28  26  28  70  70   0
   I  +   +   +   +   +   +   +   +   +   +
 6 I  0  11  45  70  71  54  63  61  79   0
   I  +   +   +   +   +   +   +   +   +   +
 5 I  0  39  52  62  76  90  17  16  19   0
   I  +   +   +   +   +   +   +   +   +   +
 4 I  0  51  28  41  36  56  62  40  39   0
   I  +   +   +   +   +   +   +   +   +   +
 3 I  0  49  52  45  42  39  36  37  16   0
   I  +   +   +   +   +   +   +   +   +   +
 2 I  0  58  63  59  14  16  17  43  39   0
   I  +   +   +   +   +   +   +   +   +   +
 1 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
    ---------------------------------------
      1   2   3   4   5   6   7   8   9  10

2ND HIGHEST VALUES FOR PERIOD

Multiply all values by 10 ** -21

10 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
 9 I  0  53  27  17  29  57  63  64  57   0
   I  +   +   +   +   +   +   +   +   +   +
 8 I  0  38  35  38  41  48  51  59  11   0
   I  +   +   +   +   +   +   +   +   +   +
 7 I  0  44  49  68  22  25  28  65  62   0
   I  +   +   +   +   +   +   +   +   +   +
 6 I  0   8  36  52  54  46  54  50  62   0
   I  +   +   +   +   +   +   +   +   +   +
 5 I  0  38  40  48  57  63  14  14  17   0
   I  +   +   +   +   +   +   +   +   +   +
 4 I  0  50  27  38  26  41  49  39  36   0
   I  +   +   +   +   +   +   +   +   +   +
 3 I  0  42  44  40  38  35  36  33  12   0
   I  +   +   +   +   +   +   +   +   +   +
 2 I  0  49  53  52  13  14  16  38  36   0
   I  +   +   +   +   +   +   +   +   +   +
 1 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
    ---------------------------------------
      1   2   3   4   5   6   7   8   9  10

3RD HIGHEST VALUES FOR PERIOD

Multiply all values by 10 ** -21

10 I  0   0   0   0   0   0   0   0   0   0
   I  +   +   +   +   +   +   +   +   +   +
 9 I  0  36  27  17  16  31  36  39  42   0
   I  +   +   +   +   +   +   +   +   +   +
 8 I  0  38  35  32  26  31  24  20  11   0
   I  +   +   +   +   +   +   +   +   +   +
 7 I  0  42  47  65  19  22  25  58  55   0
   I  +   +   +   +   +   +   +   +   +   +
 6 I  0   6  22  33  38  31  40  39  43   0
```

Table 4.4-4 (Concluded)
Sample POSTPRO Output File (POSTPRO.LST)



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