United States
Environmental
Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park, NC 27711

EPA-450/4-89-009b
JULY 1989

AIR

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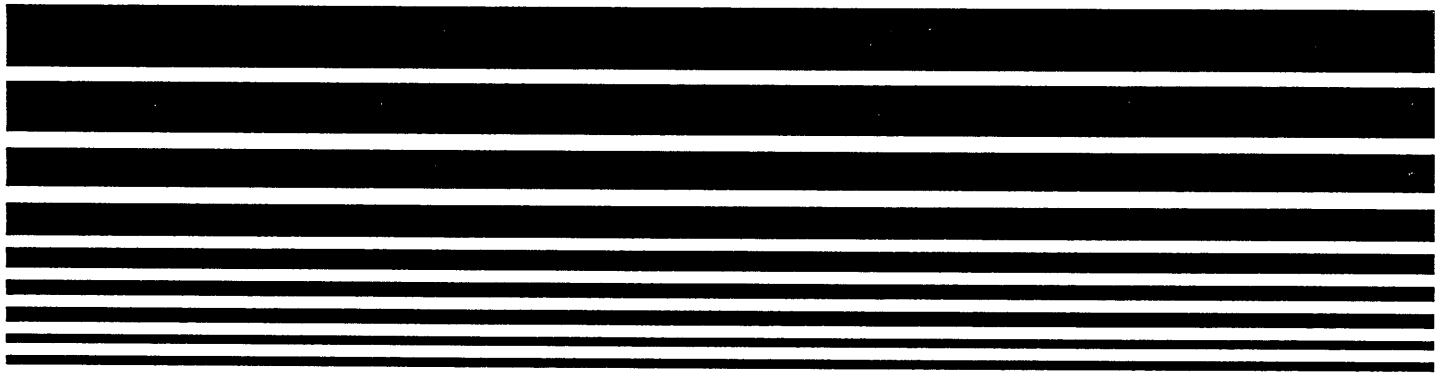
USER'S MANUAL FOR OZIPM-4 (OZONE ISOPLETH PLOTTING WITH OPTIONAL MECHANISMS)

VOLUME 2: COMPUTER CODE



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USER'S MANUAL FOR OZIPM-4 (OZONE ISOPLETH PLOTTING WITH OPTIONAL MECHANISMS) VOLUME 2: COMPUTER CODE

OFFICE OF AIR QUALITY PLANNING AND STANDARDS
U. S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

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EPA-450/4-89-009b

PREFACE

This document is one of five related to application of EKMA and the use of OZIPM-4 (Ozone Isopleth Plotting with Optional Mechanisms), the computer program used by EKMA. Listed below are the titles of the five documents and a brief description of each.

"Procedures for Applying City-specific EKMA", EPA-450/4-89-012, July 1989

- Describes the procedures for using the Empirical Kinetic Modeling Approach (EKMA). The major focus is on how to develop needed inputs for OZIPM-4. In addition this document describes how to determine a control target once OZIPM-4 has been run.

"A PC Based System for Generating EKMA Input Files", EPA-450/4-88-016, November 1988

- Describes a program that creates EKMA input files using a menu driven program. This sofware is only available for an IBM-PC or compatible machine. Files built using this system can be uploaded to a mainframe computer.

"User's Manual for OZIPM-4 (Ozone Isopleth Plotting with Optional Mechanisms)-Volume 1", EPA-450/4-89-009a, July 1989

- Describes the conceptual basis behind OZIPM-4. It describes the chemical mechanism, Carbon Bond 4, and each of the options available in OZIPM-4. Formats for each of the options are outlined so that a user can create input files using any text editor.

"User's Manual for OZIPM-4 (Ozone Isopleth Plotting with Optional Mechanisms)-Volume 2: Computer Code", EPA-450/4-89-009b, July 1989

- Describes modifications to the computer code that are necessary in order to use OZIPM-4 on various machines. A complete listing of OZIPM-4 is also found in this publication.

"Consideration of Transported Ozone and Precursors and Their Use in EKMA", EPA-450/4-89-010, July 1989

- Recommends procedures for considering transported ozone and precursors in the design of State Implementation Plans to meet national ambient air quality standards for ozone. A computerized (PC) system for determining whether an ozone exceedance is due to overwhelming transport is described. This document is necessary, only if an area is suspected of experiencing overwhelming transport of ozone or ozone precursors.

EKMA may be used in several ways: (1) as a means for helping to focus more resource-intensive photochemical grid modeling analyses on strategies most likely to be successful in demonstrating attainment; (2) as a procedure to assist in making comparisons between VOC and NOx controls; (3) in non-SIP applications, such as in helping to make national policy evaluations assessing cost/benefits associated with various alternatives and (4) for preparation of control estimates consistent with limitations/provisions identified in Clean Air Act Amendments.

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INTRODUCTION

The OZIPP program has been revised on several occasions. The most recent version is OZIPM-4. Volume 1 of this document describes OZIPM-4 and how to run the computer program. Volume 2 lists the computer code and describes modifications needed to make the software run on various machines.

OZIPM-4 contains 56 FORTRAN routines. Each subroutine has an identifying letter as part of the line number (in the right-hand columns). The alphabetical identifier corresponds to the page number (section) in this document.

CHAPTER 1

COMPUTER CONSIDERATIONS

This chapter describes modifications that need to be made to the OZIPM-4 code in order to make it work on different computers.

Several statements in the subroutine OPENA may have to be commented out depending on which computer system you are using. There is some inherent incompatibility between IBM JCL and ANSI Fortran OPEN statements for which we found the easiest solution was to comment out the OPEN statements and several other support lines. Also, this software was originally written so that plotting could be accomplished using proprietary software on the IBM main-frame. Not all computer system users have access to compatible software. Five dummy subroutines have been written to field any calls to a plotter. Also an OPEN statement in subroutine OPENA, which contains the coding FORM='BINARY', has been commented out but will serve as a reminder that some plotting packages require a non ANSI standard binary file be written for later plotting. Some compilers do not have a binary option.

The source code for this version of EKMA has been compiled and tested on an IBM 3090, IBM-PC/AT compatible (Microsoft compiler only), Sun 386i(UNIX system), and a VAX 8650 computer system. The results were replicated on all four systems using six different sets of input data. Slight differences were noted among the output due to differences in computer processors. In one case, the variable, NTRYS, which controls the number of cycles in which to try for a solution to an iterative process and with a sequence identifier of U 72, was

increased from 8 to 12 in order to obtain a replicated ozone concentration instead of an approximate value.

The following are instructions for executing any one of the five data sets on any one of the four computer systems mentioned above. The input files are labelled with a .INP extention. The output files are labelled with a .OUT extention while any computer processing control files (e.g. IBM JCL) are labelled with an extention for that computer system (i.e. .IBM - for the IBM mainframe). The data and associated function filenames are identified as EXAM1, EXAM3, EXAM4, EXAM5 and EXAM12. These filenames are associated with prior test cases that went under the names: Testcase, EKMA, BASEISOP, FUTISOP, and PEAK, respectively. All these files are part of the OZPC.ARC file which was downloaded from SCRAM. (Support Center for Regulatory Air Models - Bulletin Board System).

Since the output file is set up to write to disk instead of directly to a printer, the carriage control symbols are also printed and are not an error. The example output files contain these symbols. You will note that column one in these output files contain many 0s and 1s because of this procedure. If you want the output to go directly to a printer, all unit references in the processing control files (ie JCL) need to be changed from 10 to 6 and in OZPC.FOR, the 10 on line BC 76 needs to be changed to 6 (see MCB#2, step 12 for a sample of the coding).

These instructions assume you have uploaded the files in OZPC.ARC to your computer system.

IBM 3090(mainframe) OS/MVS system

The following instructions will allow you to process any one of the data sets above or use the information in them to execute other data sets.

1. Determine if you have a software plotting package capable of fielding the calls to the subroutines NEWPEN, NUMBER, PLOT, PLOTS and SYMBOL. (These calls were originally written for a Calcomp plotting package.)

   a. If you do, then you will have to delete the five subroutines in step 1. These subroutines are located after sequence identifier BC 39 in OZPC.FOR. Go to step 2.

   b. If you do not, then you go to step 2.

2. The following lines with sequence identifiers, BC 11, BC 23, BC 24, BC 26, BC 32, and BC 35 need to be commented out. These lines are associated with OPEN and READ statements that are used by other computer systems.

3. The file, OZPC.ICL, is an example of compile and link JCL for you to follow. Note the four lines beginning with the line that starts with //LKED.SYSLIB...have been altered so a CALCOMP 5845 can be used.

```
//uid JOB (acct,bin),uid,PRTY=2,TIME=(min,sec),NOTIFY=uid
/*ROUTE PRINT HOLD
//*
//CL            EXEC FORTVCL,PARM=(NOMAP,NOXREF)
//*
//FORT.SYSIN    DD DSN=source.code.file.name,DISP=SHR
//*
//LKED.SYSLIB   DD DSN=SYS1.VSF2FORT,DISP=SHR
//*             DD DSN=SYS2.IMSL.R9M2.SP,DISP=SHR
//              DD DSN=SYS2.IMSL.V1ROM0.LOAD,DISP=SHR
//              DD DSN=SYS2.CALCOMP.PLOT1051,DISP=SHR
```

```
//PLOTSTEP EXEC PLINIT,ACCOUNT=acct,NAME=plotname,DEST=dest
//PLOTINST DD *
DELIVER TO:    user name
bin
//*
//OZPC   EXEC PGM=OZPC,PARM='NOXUFLOW'
//STEPLIB  DD DSN=loadlib,DISP=SHR
//*
//*  PARAMETER INPUT
//FT07F001  DD DSN=input.filename,DISP=SHR
//*  OUTPUT DIRECTLY TO PRINTER
//*FT10F001  DD SYSOUT=*
//*  OUTPUT DIRECTLY TO FILE
//FT10F001  DD DSN=output.filename,
//          UNIT=SYSDA,SPACE=(TRK,(45,5),RLSE),
//          DCB=(RECFM=FBA,LRECL=133,BLKSIZE=2660),
//          DISP=(MOD,CATLG,KEEP)
//*  ALREADY FILE (READ)
//FT08F001  DD DUMMY
//*  ALREADY FILE (WRITE)
//FT09F001  DD DUMMY
//*  EKMA FILE
//FT11F001  DD DUMMY
//*  PLOT FILE FOR CALCOMP 5845 PLOTTER
```

```
//              DD DSN=SYS2.CALCOMP.MODULES,DISP=SHR
//              DD DSN=SYS1.VSF2LINK,DISP=SHR
//*
//LKED.SYSLMOD DD DSN=loadlib,DISP=NEW
//
```

NOTE: Right-hand names are user-specified as follows:

uid	=	user ID
acct	=	account number or information
bin	=	bin number
dest	=	destination of printout or plot (RMT0)
plotname	=	OZIPM-4 plotter output name
plotter.file	=	output plotter tape file name of the form: dest.uidacct.plotname (required only when PLOT option is selected)
loadlib	=	file name of load module library
DUMMY	=	when data is present for this unit, a file name and other file specifications are needed. (ie DSN=file.name,DISP=SHR)
OZPC	=	member name of a partitioned data set. EKMA can be used in its place.

4. The following JCL is a generic example that, when edited, will allow the user to process data.

```
//uid JOB (acct,bin),name,PRTY=2,TIME=(min,sec),NOTIFY=uid
/*ROUTE PRINT HOLD
//*
```

```
//GO.FT 14F001  DD DSN= plot.input.data.file.name,
//          DISP=(NEW,CATLG),UNIT=DISK,SPACE=(TRK,(10,10)),
//          DCB=(LRECL=80,BLKSIZE=3200,RECFM=FB,DSORG=PS)
//EXEC      C58ROUTE,
//          PFILE='plot.input.data.file.name;
//          DEST=dest
//HEADER.DELIVER DD*
USER NAME,FILE.NAME
ADDRESS
//
```

IBM-PC and compatibles DOS system

OZPC.FOR is over 600 kbytes long. Most PCs, using the Microsoft Fortran Version 5.0, can not compile the whole program at once. The program needs to be divided into individual subroutines that are compiled one by one. The object files for these subroutines are then linked into an executable file. The following steps assume that you have divided OZPC.FOR into individual subroutines.

1. If you have a plotting package that can function using the calls to NEWPEN, NUMBER, PLOT, PLOTS, and SYMBOL, you will need to delete these subroutines.
2. Compile and link the individual subroutines. OZPC.PCL was included for your convenience. This file will automatically compile each subroutine and then link the subroutines into a executable program not requiring a link to a software plotting package. This file may have to be edited

depending upon your compile and link situation. The file is executed at the by typing: OZPC.PCL

3. Rename the executable file in step 2 to OZPC.EXE.
   (ie Rename AXES.EXE OZPC.EXE)
4. A control file is necessary in order to execute OZPC.EXE. A generic file is provided that you can edit to run the examples provided. The file is named OZPC.PC.
5. A program can be executed by typing:
   OZPC filename.ext
6. Examine your example output files and compare them with the output examples provided from SCRAM.

VAX VMS system

The following instructions will allow you to process anyone of the data sets above or use the information in them to execute other data sets.

1. If you have a plotting package that can function using the calls to NEWPEN, NUMBER, PLOT, PLOTS, and SYMBOL, you will need to delete these subroutines.
2. OZPC.FOR can be compiled and linked using the following two statements or by executing the COM file, OZPC.VCL:

```
$FORTRAN/CROSS-REFERENCE/LIST/NOOPTIMIZE/DEBUG/SHOW/WARNINGS=NONE -

  OZPC
$LINK/DEBUG OZPC
```

3. OZPC.VAX is an example of a control file for running your program.
   Type: @OZPC.VAX to run an example

4. Examine your example output files and compare them with the examples provided.

Sun 386i Unix System

This set of instructions assumes you have the files in a directory readily accessible by the Unix system and that your Fortran listing has been converted to a Unix readible format.

1. If you have a plotting package that can function using the calls to NEWPEN, NUMBER, PLOT, PLOTS, and SYMBOL, you will need to delete these subroutines.

2. Compile and link OZPC.FOR using the following statements:

   f77 -ANSI ozpc.for

   cp a.out to ozpc.exe

3. Copy your input files to Fort.(unit#). Unit 14 is NOT used.

   cp exam1.inp fort.7

4. To execute, type: ozpc.exe

5. Rename output files from fort.(unit#) to more identifable name(s).

   cp fort.10 output.filename

6. Examine your output and compare it with the examples provided.

```
      PROGRAM EKMA                                                          A     1
C                                                                           A     2
C*************************************************************************A     3
C                                                                           A     4
C                                                                           A     5
C                          OZIPM-4 (EKMA)                                   A     6
C                                                                           A     7
C       THE OZONE ISOPLETH PLOTTING PACKAGE WITH OPTIONAL CHEMICAL          A     8
C   MECHANISM (VERSION 4.00) IS USED IN THE EMPIRICAL KINETICS              A     9
C   MODELING APPROACH (EKMA) TO ESTIMATE VOC CONTROL REQUIREMENTS           A    10
C                                                                           A    11
C       THIS VERSION WAS WRITTEN TO ANSI FORTRAN 77 STANDARDS AND           A    12
C   CONTAINS THE CARBON-BOND CHEMICAL MECHANISM (CBM-4) DESCRIBED           A    13
C   BY GERY ET AL. (1988) (EPA-600/3-88-012).                               A    14
C                                                                           A    15
C                                                                           A    16
C      OZIPM-4 IS AN CONDENSED VERSION OF OZIPM-3.  SUPERFICIALLY,          A    17
C   THERE ARE NO CHANGES.  THE DEFAULT MECHANISM IS THE CARBON-BOND          A    18
C   (VERSION 4) INSTEAD OF THE CBM-X IN OZIPM-3.  THE USER IS REFERRED      A    19
C   TO HOGO AND GERY (1988) FOR A DESCRIPTION OF MODEL USAGE.               A    20
C                                                                           A    21
C      OZIPM-4 IS BASED ON THE ORIGINAL OZIPP PROGRAM BY WHITTEN            A    22
C   AND HOGO (1978) AND THE OZIPM-2 PROGRAM (GIPSON, 1984).                 A    23
C   THIS VERSION USES THE GEAR INTEGRATION ROUTINES WRITTEN BY              A    24
C   SPELLMANN AND HINDMARSH (1975).                                         A    25
C                                                                           A    26
C      PARTS OF THIS PROGRAM ARE CONTRIBUTIONS FROM JEFFRIES (1982) AND     A    27
C   GIPSON (1984).  THEORETICAL PHOTOLYSIS ROUTINE ARE FROM SCHERE AND      A    28
C   DEMERJIAN (1977).  THE SPLINE ROUTINES ARE FROM CLINE (1974).           A    29
C                                                                           A    30
C                                                                           A    31
C                                                                           A    32
C            CODE WRITTEN BY:                                               A    33
C                                                                           A    34
C                     H. HOGO                                               A    35
C                     M. W. GERY                                            A    36
C                     R. G. JOHNSON                                         A    37
C                     G. W. LUNDBERG                                        A    38
C                                                                           A    39
C                     SYSTEMS APPLICATIONS, INC                             A    40
C                     101 LUCAS VALLEY RD                                   A    41
C                     SAN RAFAEL, CA 94903                                  A    42
C                     (415) 472-4011                                        A    43
C                                                                           A    44
C                                                                           A    45
C   ***************  CODE REVISION DATE:  MAY, 1989                         A    46
C                                                                           A    47
C                                    BY:  H. HOGO/SAI                       A    48
C                                                                           A    49
C   ******** DEFAULT CHEMICAL MECHANISM:  CARBON-BOND VERSION 4             A    50
C                                        (AUGUST, 1987)                     A    51
C                                                                           A    52
C                                    BY:  M. GERY/SAI                       A    53
C                                                                           A    54
C*************************************************************************A    55
C                                                                           A    56
      SAVE                                                                  A    57
      COMMON /ALOFT/  IALFT,CALFT(10),LOCALF(10)                            A    58
      COMMON /BIOG/   NBEM,IBSP,          WTMOL(5),ACB4(5),SURFBI(5),       A    59
     1                ALOFBI(5),REDBI(5),FSRFBI(5),FALFBI(5),BEMO(26,5),A   60
     2                BECO(126,5),CBTOT(5),IBLS(5),BESTOP,BFRAC(20,5)       A    61
      COMMON /BK1/    FBK(20),FBKAL(5),HCBK,XNBK,OZBK,H2OBK                 A    62
      COMMON /CALC/ NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),IA(60)A   63
```

```
     1             ,JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENI A     64
      COMMON /CNTRL/  SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN, A     65
     1                FLST,TLST                                          A     66
      COMMON /CRED/   ICR,ISPCR,SPCR69(3),SURFCR(3),ALOFCR(3),          A     67
     1                REDCR(3),FSRFCR(3),FALFCR(3),COSFBK,COAFBK         A     68
      COMMON /EMIS/   NEM,ISP,ESTRT(5),ESTOP,ESLP,IEMLS(5),EOSLP(5),    A     69
     1                EMO(26,5),ECI(5),EM(26),EC(125),ECO(125,5)         A     70
      COMMON /FRPLOT/ SAVCON(80,5),SAVTIM(80),NTSV,INOW                  A     71
      COMMON /HEAT/   SC(200,12),ISC(200,3)                              A     72
      COMMON /HOUR/   OZM(5),NGO,TTM,TM(5)                               A     73
      COMMON /INOUT/  IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                  A     74
      COMMON /MIX/    NMIX,AMIX(26),STRM,STOPM,DC(104)                   A     75
      COMMON /MIXING/ DSTRT,DEND,AMC(5),BMC(5),CMC(5),FD(6),FG(6),       A     76
     1                AMXX(26),DL,TTMAX,SSRISE,SRMIN,DELH,TDIL,NMXX,     A     77
     2                HEIGHT,SSET,SRISE                                  A     78
      COMMON /NEED/   HC,XN,NL,OZP(20),OZN(11,11,5),MR,LS,HCS,XNS        A     79
      COMMON /NEED1/  IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,      A     80
     1                IIH2O,JPLUS                                        A     81
      COMMON /OPTS/   ISPD,ICAL,IACR,IDIL,IPLC,IEMS,IRDY,IBLK,IBCK,IPLT,A     82
     1                ITRN,ITIT,IRCT,IRAT,ITIM,IMCH,INIT,ISTR,IMIX,ISPC,A     83
     2                ITMP,IALF,IDEP,IZNI,IMAS,IMOL,ICRE,IBIO,IWAT       A     84
      COMMON /PHOTON/ CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20),  A     85
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),      A     86
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)         A     87
      COMMON /PLTVEC/ HCT(20),OT(20),NT,OHC,HCG,PLTGRD,OXN,XNG,HC1,XN1,  A     88
     1                TICZ,DIGZ,CHRZ,IPLDEV                              A     89
      COMMON /SCRAT3/ WY(20)                                             A     89A
      COMMON /SCRATC/ ISPN                                               A     90
      COMMON /SPEC/   NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),        A     91
     1                FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,  A     92
     2                XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                   A     93
      COMMON /STORE/  AST(60)                                            A     94
      COMMON /SUNLIT/ Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,      A     95
     1                ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),       A     96
     2                XZ(24),KKK(24),JSTRT,JSTOP,PSPEC,MNLM,MXLM,MAXL,   A     97
     3                MAXJ                                               A     97A
      COMMON /TEMPER/ TEMEND,NTEMP,QM(30)                                A     97B
      COMMON /TITL/   ITTL(36)                                           A     97C
      COMMON /VVLB1/  FCTR,DIST,CHRSIZ,NNCHR,OZBL                        A     97D
      COMMON /WATER/  WATEND,NWATER,PAMB,QW(30),QR(30),PMILLI,ILH2O      A     97D
      COMMON /ZENITH/ IPZ,ZDEF(10,20),IPHZ(20),IZENP                     A     97E
C                                                                        A     97F
      COMMON /ALFCHR/ ISPAL(10)                                          A     97G
      COMMON /BIOCHR/ IISOP, IBEMSP(5)                                   A     97H
      COMMON /CALCHR/ SPECIS(61)                                         A     97I
      COMMON /CRECHR/ ISPNCR(3)                                          A     97J
      COMMON /EMSCHR/ EMSP(5)                                            A     97K
      COMMON /NEED1C/ IBZA                                               A     97L
      COMMON /PHTCHR/ ISPDP(10)                                          A     97M
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                     A     97N
C                                                                        A     97O
      CHARACTER*1 AST                                                    A     97P
      CHARACTER*2 ITTL, JTTL, ITEST                                      A     97Q
      CHARACTER*4 ISPAL, ISPDP, ISPNCR, IBEMSP                           A     97R
      CHARACTER*4 IPLACE, IOPT                                           A     97S
      CHARACTER*4 SPECIS, HCSPEC, PLSP, IISOP, ISPN, EMSP, REACT         A     97T
      CHARACTER*4  ISPD,ICAL,IACR,IDIL,IPLC,IEMS,IRDY,IBLK,IBCK,         A     97U
     1   IPLT,ITRN,ITIT,IRCT,IRAT,ITIM,IMCH,INIT,ISTR,IMIX,ISPC,ITMP,    A     97X
     2   IALF,IDEP,IZNI,IMAS,IMOL,ICRE,IBIO,IWAT,                        A     97Y
     3   IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,                   A     97Z
     4   IIH2O,IBZA,JPLUS                                                A     98A
C                                                                        A     98B
                                                                         A     98C
```

```
      DIMENSION X(7), IPLACE(6), JTTL(36)                                A    98D
C     DIMENSION ITT1(20)                                                 A    98E
      DIMENSION NRTC(200), XRTC(200),OZAR(4)                             A    99
C                                                                        A    99A
      INTEGER   PSPEC                                                    A   100
C                                                                        A   101
C  INITIALIZE SOME LOCAL VARIABLES                                       A   102
C                                                                        A   103
      DATA HCCON/595./,XNXCON/1890./ITEST/'ZO'/                          A   104
      DATA IPLACE/' LOS',' ANG','ELES',', CA','LIF.','    '/             A   105
      DATA IEM,KALCMP,JS,KS1/4*0/,NC/11/                                 A   106
      DATA JTTL /'  ',' I','SO','PL','ET','H ',30*'  '/                  A   107
C                                                                        A   108
C     CALL DATA INITIALIZATION ROUTINES                                  A   109
C                                                                        A   110
      CALL OPENA                                                         A   110A
      WRITE (IOUT,830)                                                   A   111
      WRITE (IOUT,831)                                                   A   111A
      WRITE (IOUT,832)                                                   A   111B
      CALL MECH                                                          A   112
      CALL PHOT                                                          A   113
      CALL MIXST                                                         A   114
      CALL SUNTIM                                                        A   115
C                                                                        A   116
C  READ INPUT FILE AND PRINT IT                                          A   117
C                                                                        A   118
C **** NOTE THE FOLLOWING CODE IS NOT NEEDED IN ORDER TO USE             A   119
C      OZIPM-4.XX.  IF THE USER FINDS THAT THE INPUT FILE (DEFAULT       A   120
C      UNIT 7) CANNOT BE REWOUND USING  REWIND  STATEMENT THEN           A   121
C      EITHER THE INPUT UNIT NUMBER NEEDS TO BE CHANGED OR               A   122
C      THE FOLLOWING SECTION OF CODE CAN BE COMMENTED OUT.               A   123
C                                                                        A   124
C     WRITE (IOUT,980)                                                   A   125
C     DO 30 I=1,1000                                                     A   126
C     READ (IN,850) ITT1                                                 A   127
C     DO 10 IJ=1,20                                                      A   128
C     IF (ITT1(IJ).NE.IBLK) GO TO 20                                     A   129
C  10 CONTINUE                                                           A   130
C     GO TO 40                                                           A   131
C  20 IF(MOD(I,50).EQ.0) WRITE (IOUT,980)                                A   132
C     WRITE (IOUT,860) ITT1                                              A   133
C  30 CONTINUE                                                           A   134
C  40 CONTINUE                                                           A   135
C     REWIND IN                                                          A   136
C                                                                        A   137
C OPTIONS LOOP                                                           A   138
C                                                                        A   139
      DO 820 IOPTLP=1,1000                                               A   140
      READ(IN,840) IOPT,(X(I),I=1,6)                                     A   141
C                                                                        A   142
C  DO ISOPLETH                                                           A   143
C                                                                        A   144
      IF (IOPT.NE.ISPD) GO TO 60                                         A   145
      IF (ABS(X(1)).NE.0.) HC=X(1)                                       A   146
      IF (ABS(X(2)).NE.0.) XN=X(2)                                       A   147
      IF (ABS(X(4)).NE.0.) INFO=-1                                       A   148
      IF (ABS(X(3)).NE.0.) NL=IFIX(X(3)+0.1)                             A   149
      IF (ABS(X(3)).NE.0.) READ(IN,880) (OZP(I),I=1,NL)                  A   150
      IF (ABS(X(5)).NE.0.) NUMPSP=IFIX(X(5)+0.1)                         A   151
      IF (ABS(X(6)).NE.0.) NUMPSP=IFIX(X(6)+0.1)                         A   152
      CALL HDWRIT(IPLACE,IEM)                                            A   153
C                                                                        A   154
C  PERFORM DIAGRAM CALCULATIONS                                          A   155
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C                                                                       A   156
      CALL RLINE (KS1,JS)                                               A   157
      DO 50 K=1,NOZ                                                     A   158
   49 IF (NUMPSP.GT.1.AND.K.GT.1) READ (IN,880) (OZP(I),I=1,NL)         A   159
      ISPN=PLSP(K)                                                      A   160
      CALL LINER (KALCMP,OZN(1,1,K))                                    A   161
   50 CONTINUE                                                          A   162
      INFO=0                                                            A   163
      JS=0                                                              A   164
      GO TO 820                                                         A   165
C                                                                       A   166
C  DO INDIVIDUAL CALCULATIONS                                           A   167
C                                                                       A   168
   60 IF (IOPT.NE.ICAL) GO TO 80                                        A   169
      NPTO=1                                                            A   170
      IF (ABS(X(3)).NE.0.) INFO=1                                       A   171
      TPRNT=60.                                                         A   172
      TSTEP=60.                                                         A   173
      IF (ABS(X(4)).NE.0.) TPRNT=X(4)                                   A   174
      IF (ABS(X(5)).NE.0.) TSTEP=X(5)                                   A   175
      NTSV=0                                                            A   176
      CALL HDWRIT(IPLACE,IEM)                                           A   177
      CALL SIM (X(1),X(2),ZN,1)                                         A   178
      IF (INFO.EQ.1) WRITE (IOUT,870)                                   A   179
      DO 70 I=1,NOZ                                                     A   180
      IF (TM(I).GT.0.) TMX=CLOCK(FLOAT(JSTRT),IFIX(TM(I)))              A   181
      IF (TM(I).GT.0.) WRITE (IOUT,900) PLSP(I),OZM(I),TMX              A   182
      IF (TM(I).LE.0.) WRITE (IOUT,940) PLSP(I),OZM(I)                  A   183
   70 CONTINUE                                                          A   184
      CALL SPLOT                                                        A   185
      NPTO=0                                                            A   186
      INFO=0                                                            A   187
      GO TO 820                                                         A   188
C                                                                       A   189
C  IMPLEMENT ACCURACY OPTION                                            A   190
C                                                                       A   191
   80 IF (IOPT.NE.IACR) GO TO 90                                        A   192
      IF (ABS(X(1)).NE.0.) NC=IFIX(X(1)+0.1)                            A   193
      IF ((NC/2).EQ.((NC+1)/2)) NC=NC+1                                 A   194
      IF (ABS(X(2)).NE.0.) MR=IFIX(X(2)+0.1)                            A   195
      IF (ABS(X(3)).NE.0.) ERR=X(3)                                     A   196
      IF (ABS(X(4)).NE.0.) SIG=X(4)                                     A   197
      IF (ABS(X(5)).NE.0.) SIGMA=X(5)                                   A   198
      IF (ABS(X(6)).NE.0.) NGO=0                                        A   199
      GO TO 820                                                         A   200
C                                                                       A   201
C  READ PLACE OPTION                                                    A   202
C                                                                       A   203
   90 IF (IOPT.NE.IPLC) GO TO 100                                       A   204
      IF (ABS(X(1)).NE.0.) SLA=X(1)                                     A   205
      IF (ABS(X(2)).NE.0.) SLO=X(2)                                     A   206
      IF (ABS(X(3)).NE.0.) TZ=X(3)                                      A   207
      IF (ABS(X(4)).NE.0.) IY=IFIX(X(4)+0.01)                           A   208
      IF (ABS(X(5)).NE.0.) IM=IFIX(X(5)+0.01)                           A   209
      IF (ABS(X(6)).NE.0.) ID=IFIX(X(6)+0.01)                           A   210
      IF(ABS(X(1)).NE.0..OR.ABS(X(2)).NE.0.)READ(IN,930)(IPLACE(I),I=1,6A   211
     1)                                                                 A   212
      CALL PHOT                                                         A   213
      CALL MIXST                                                        A   214
      CALL SUNTIM                                                       A   215
      GO TO 820                                                         A   216
C                                                                       A   217
C  READ MORNING AND AFTERNOON MIXING HEIGHTS                            A   218
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C                                                                       A   219
  100 IF (IOPT.NE.IDIL) GO TO 110                                       A   220
      IF (ABS(X(1)).NE.0.) Z1=X(1)                                      A   221
      IF (ABS(X(2)).NE.0.) Z2=X(2)                                      A   222
      IF (ABS(X(3)).NE.0.) DSTRT=X(3)                                   A   223
      IF (ABS(X(4)).NE.0.) DEND=X(4)                                    A   224
      AMIX(1)=-3.                                                       A   225
      CALL MIXST                                                        A   226
      CALL SUNTIM                                                       A   227
      JMIN=IFIX(DSTRT)-((IFIX(DSTRT)/100)*100)                          A   228
      TMIN1=FLOAT((IFIX(DSTRT)/100)*60+JMIN)                            A   229
      JMIN=IFIX(DEND)-((IFIX(DEND)/100)*100)                            A   230
      TMIN2=FLOAT((IFIX(DEND)/100)*60+JMIN)                             A   231
      JMIN=JSTRT-((JSTRT/100)*100)                                      A   232
      TMIN3=FLOAT((JSTRT/100)*60+JMIN)                                  A   233
      TMIN4=AMAX1(TMIN1,TMIN3,SSRISE)                                   A   234
      TSRT=TMIN4-TMIN3                                                  A   235
      IF (TSRT.GT.0.) DTIM=TMIN2-TMIN4                                  A   236
      IF (TSRT.LE.0.) DTIM=TMIN2-TMIN3                                  A   237
      IF (DTIM.LT.0.) DTIM=0.                                           A   238
      DCON=ABS(X(5))                                                    A   239
      GO TO 820                                                         A   240
C                                                                       A   241
C  READ HOURLY MIXING HEIGHTS                                           A   242
C                                                                       A   243
  110 IF (IOPT.NE.IMIX) GO TO 150                                       A   244
      NMIX=IFIX(X(1)+0.1)+1                                             A   245
      DO 120 I=1,5                                                      A   246
  120 AMIX(I)=X(I+1)                                                    A   247
      IF (NMIX-5.GT.0) READ(IN,880) (AMIX(I),I=6,NMIX)                  A   248
C                                                                       A   249
      STRM=0.                                                           A   250
      STOPM=FLOAT(NMIX-1)*60.                                           A   251
      NMX4=(NMIX-1)*3                                                   A   252
      DO 130 I=1,NMX4                                                   A   253
  130 DC(I)=0.                                                          A   254
      NMIX1=NMIX-1                                                      A   255
      DO 140 I=1,NMIX1                                                  A   256
      K=3*I-2                                                           A   257
      DC(K)=(AMIX(I+1)-AMIX(I))/60.                                     A   258
  140 CONTINUE                                                          A   259
      DTIM=STOPM                                                        A   260
      TSRT=0.                                                           A   261
      GO TO 820                                                         A   262
C                                                                       A   263
C  READ HOURLY TEMPERATURE DATA                                         A   264
C                                                                       A   265
  150 IF (IOPT.NE.ITMP) GO TO 161                                       A   266
      NTEMP=IFIX(X(1)+0.1)+1                                            A   267
      DO 160 I=1,5                                                      A   268
  160 QM(I)=X(I+1)                                                      A   269
      IF (NTEMP-5.GT.0) READ(IN,880) (QM(I),I=6,NTEMP)                  A   270
      QM(NTEMP+1)=2.*QM(NTEMP)-QM(NTEMP-1)                              A   271
      QM(NTEMP+2)=3.*QM(NTEMP)-2.*QM(NTEMP-1)                           A   272
      TEMEND=FLOAT(NTEMP-1)*60.                                         A   273
      TEMP=QM(1)                                                        A   274
      GO TO 820                                                         A   275
C                                                                       A   275A
C  READ HOURLY RELATIVE HUMIDITIES AND CALCULATE WATER CONCENTRATIONS   A
275B
C
  161 IF (IOPT.NE.IWAT) GO TO 170                                       A   275C
      NWATER=IFIX(X(1)+0.1)+1                                           A   275D
                                                                        A   275E
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      PAMB=1.0                                                                  A   275F
      IF (ABS(X(2)).NE.0.) PMILLI=X(2)                                          A   275G
      IF (ABS(X(2)).NE.0.) PAMB=PMILLI/29.9213                                  A   275H
      READ (IN,880) (QR(I),I=1,NWATER)                                          A   275I
      WATEND=FLOAT(NWATER-1)*60.                                                A   275J
      TFACT=1./273.                                                             A   275K
      TNOW=TEMP                                                                 A   275L
      DO 165 I=1,NWATER                                                         A   276M
      RH1=QR(I)                                                                 A   275N
      IF (NTEMP.GT.0.AND.I.LE.NTEMP) TNOW=QM(I)                                 A   275O
      IF (NTEMP.GT.0.AND.I.GT.NTEMP) TNOW=QM(NTEMP)                             A   275P
      IF (TNOW.GE.273.) RCONST=18.02*(597.3-.566*(TNOW-273.))/1.9869            A   275Q
      IF (TNOW.LT.273.) RCONST=6133.17                                          A   275R
      IF (QR(I).GT.100.) RH1=100.                                               A   275S
      IF (QR(I).LT.0.) RH1=0.                                                   A   275T
      QW(I)=(6030.*.01*RH1/PAMB)*EXP(RCONST*(TFACT-1./TNOW))                    A   275U
  165 CONTINUE                                                                  A   275V
      QW(NWATER+1)=2.*QW(NWATER)-QW(NWATER-1)                                   A   275W
      QW(NWATER+2)=3.*QW(NWATER)-2.*QW(NWATER-1)                                A   275X
      GO TO 820                                                                 A   275Y
C                                                                               A   276
C  READ EMISSIONS                                                               A   277
C                                                                               A   278
  170 IF (IOPT.NE.IEMS) GO TO 220                                               A   279
      NEM=IFIX(X(1)+0.1)                                                        A   280
      IEM=IFIX(ABS(X(1))+0.1)                                                   A   281
      ESTOP=FLOAT(IEM)*60.                                                      A   282
      IF (X(1).LT.(-0.99999999)) GO TO 190                                      A   283
      DO 180 I=1,5                                                              A   284
  180 EM(I)=ABS(X(I+1))                                                         A   285
      IF (NEM-5.GT.0) READ(IN,880) (EM(I),I=6,NEM)                              A   286
      CALL EMISS (NEM,EM,EC)                                                    A   287
      ISP=2                                                                     A   288
      EMSP(1)=IIHC                                                              A   289
      EMSP(2)=IINX                                                              A   290
      GO TO 820                                                                 A   291
  190 DO 200 I=1,5                                                              A   292
  200 EMO(I,1)=X(I+1)                                                           A   293
      IF (EMO(1,1).LT.(-0.0001)) GO TO 210                                      A   294
      ISP=1                                                                     A   295
      EMSP(1)=IIHC                                                              A   296
      IF (IEM-5.GT.0) READ(IN,880) (EMO(I,1),I=6,IEM)                           A   297
      CALL EMISS (IEM,EMO(1,1),ECO(1,1))                                        A   298
  210 READ(IN,880) (EMO(I,2),I=1,7)                                             A   299
      IF (EMO(1,2).LT.(-0.0001)) GO TO 820                                      A   300
      ISP=2                                                                     A   301
      EMSP(2)=IINX                                                              A   302
      IF (IEM-7.GT.0) READ(IN,880) (EMO(I,2),I=8,IEM)                           A   303
      CALL EMISS (IEM,EMO(1,2),ECO(1,2))                                        A   304
      GO TO 820                                                                 A   305
C                                                                               A   306
C  READ EMISSIONS (MOLAR UNITS)                                                 A   307
C                                                                               A   308
  220 IF (IOPT.NE.IMOL) GO TO 300                                               A   309
      NEM=IFIX(X(1)+0.1)                                                        A   310
      IEM=IFIX(ABS(X(1))+0.1)                                                   A   311
      ESTOP=FLOAT(IEM)*60.                                                      A   312
      IF (X(1).LT.(-0.99999999)) GO TO 240                                      A   313
      DO 230 I=1,5                                                              A   314
  230 EM(I)=ABS(X(I+1))                                                         A   315
      IF (NEM-5.GT.0) READ(IN,880) (EM(I),I=6,NEM)                              A   316
      CALL EMISS (NEM,EM,EC)                                                    A   317
      GO TO 820                                                                 A   318
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  240 ISP=IFIX(ABS(X(2))+0.1)                                          A   319
      FHT=X(3)                                                         A   320
      DAREA=X(4)                                                       A   321
      HCEM=X(5)                                                        A   322
      XNEM=X(6)                                                        A   323
      EFACT=1.                                                         A   324
      IF (FHT.GT.0.) EFACT=24450./FHT                                  A   325
      IF (FHT.GT.0..AND.DAREA.GT.0.) EFACT=24450./(FHT*DAREA)          A   326
      IF (ISP.GT.2) READ (IN,880) (SPRSE(I),I=3,ISP)                   A   327
      SPRSE(1)=HCEM                                                    A   328
      SPRSE(2)=XNEM                                                    A   329
      DO 290 I=1,ISP                                                   A   330
      READ (IN,840) EMSP(I),(EMO(J,I),J=1,6)                           A   331
      IF (IEM-6.GT.0) READ (IN,880) (EMO(J,I),J=7,IEM)                 A   332
C                                                                      A   333
      IF (EMSP(I).NE.IIHC.AND.EMSP(I).NE.IINX) GO TO 260               A   334
      CONCEN=HCEM                                                      A   335
      IF (EMSP(I).EQ.IINX) CONCEN=XNEM                                 A   336
      Q0=EFACT/CONCEN                                                  A   337
      DO 250 J=1,IEM                                                   A   338
      EMO(J,I)=EMO(J,I)*Q0                                             A   339
  250 CONTINUE                                                         A   340
      GO TO 280                                                        A   341
C                                                                      A   342
C  CONVERT OTHER SPECIES                                               A   343
C                                                                      A   344
  260 CONTINUE                                                         A   345
      Q0=EFACT/SPRSE(I)                                                A   346
      DO 270 J=1,IEM                                                   A   347
      EMO(J,I)=EMO(J,I)*Q0                                             A   348
  270 CONTINUE                                                         A   349
  280 CALL EMISS (IEM,EMO(1,I),ECO(1,I))                               A   350
  290 CONTINUE                                                         A   351
      GO TO 820                                                        A   352
C                                                                      A   353
C  READ EMISSIONS (MASS UNITS)                                         A   354
C  THIS OPTION WAS IMPLEMENTED IN OZIPM-2                              A   355
C                                                                      A   356
  300 IF (IOPT.NE.IMAS) GO TO 330                                      A   357
      NEM=IFIX(X(1)+0.1)                                               A   358
      IEM=IFIX(ABS(X(1))+0.1)                                          A   359
      ESTOP=FLOAT(IEM)*60.                                             A   360
      ISP=2                                                            A   361
      EMSP(1)=IIHC                                                     A   362
      EMSP(2)=IINX                                                     A   363
      READ (IN,880) (EMO(I,1),I=1,IEM)                                 A   364
      READ (IN,880) (EMO(I,2),I=1,IEM)                                 A   365
      HCEM=X(2)                                                        A   366
      XNEM=X(3)                                                        A   367
      FHT=X(4)*.001                                                    A   368
      DO 320 I=1,ISP                                                   A   369
      CONCEN=HCEM                                                      A   370
      IF (EMSP(I).EQ.IINX) CONCEN=XNEM                                 A   371
      CONV=HCCON                                                       A   372
      IF (EMSP(I).EQ.IINX) CONV=XNXCON                                 A   373
      Q0=1./(CONV*CONCEN*FHT)                                          A   374
      DO 310 J=1,IEM                                                   A   375
      EMO(J,I)=EMO(J,I)*Q0                                             A   376
  310 CONTINUE                                                         A   377
      CALL EMISS (IEM,EMO(1,I),ECO(1,I))                               A   378
  320 CONTINUE                                                         A   379
      ISP=2                                                            A   380
      GO TO 820                                                        A   381
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C                                                                       A   382
C  READ CALCOMP PLOTTING OPTION                                        A   383
C                                                                       A   384
  330 IF (IOPT.NE.IPLT) GO TO 340                                       A   385
      KALCMP=1                                                          A   386
      FCTR=0.6                                                          A   387
      HC1=8.5                                                           A   388
      XN1=5.95                                                          A   389
      CHRZ=0.10                                                         A   390
      IF (ABS(X(1)).NE.0.) FCTR=X(1)                                    A   391
      PLTGRD=X(2)                                                       A   392
      IF (ABS(X(3)).NE.0.) HC1=X(3)                                     A   393
      IF (ABS(X(4)).NE.0.) XN1=X(4)                                     A   394
      IF (ABS(X(5)).NE.0.) CHRZ=X(5)                                    A   395
      IF (ABS(X(6)).NE.0.) CHRSIZ=X(6)                                  A   396
      DIGZ=CHRZ                                                         A   397
      TICZ=CHRSIZ                                                       A   398
      GO TO 820                                                         A   399
C                                                                       A   400
C  PERFORM VOC CONTROL REQUIREMENT ESTIMATIONS BASED ON                 A   401
C    CITY-SPECIFIC EKMA GUIDELINES                                      A   402
C                                                                       A   403
  340 IF (IOPT.NE.ISTR) GO TO 350                                       A   404
C                                                                       A   405
C  ALL EKMA CALCULATIONS ARE DONE IN SUBROUTINE EKCALC                  A   406
C                                                                       A   407
      CALL HDWRIT(IPLACE,IEM)                                           A   408
C                                                                       A   409
C  CALL EKMA SUBROUTINE TO CALCULATE VOC CONTROL REQUIREMENTS           A   410
C                                                                       A   411
      CALL EKCALC (X)                                                   A   412
      GO TO 820                                                         A   413
C                                                                       A   414
C  READ REACTIVITIES                                                    A   415
C                                                                       A   416
  350 IF (IOPT.NE.IRCT) GO TO 360                                       A   417
      KHC=IFIX(X(1)+0.1)                                                A   418
      IF (ABS(X(2)).NE.0.) XNF(1)=X(2)                                  A   419
      IF (ABS(X(2)).NE.0.) XNF(2)=1.-X(2)                               A   420
      IF (KHC.GT.0) READ(IN,880) (RCTY(I),I=1,KHC)                      A   421
      GO TO 820                                                         A   422
C                                                                       A   423
C  READ SPECIES OF INTEREST                                             A   424
C                                                                       A   425
  360 IF (IOPT.NE.ISPC) GO TO 410                                       A   426
      IF (ABS(X(1)).GT.0.) NOZ=IFIX(X(1)+0.1)                           A   427
      READ(IN,950) (PLSP(I),I=1,NOZ)                                    A   428
      DO 380 J=1,NOZ                                                    A   429
      DO 370 I=1,NS                                                     A   430
      IF (SPECIS(I).NE.PLSP(J)) GO TO 370                               A   431
      KOZ(J)=I                                                          A   432
      GO TO 380                                                         A   433
  370 CONTINUE                                                          A   434
      WRITE (IOUT,970) PLSP(J)                                          A   435
      STOP                                                              A   436
  380 CONTINUE                                                          A   437
  390 IF (PLSP(1).EQ.IIO3 ) GO TO 820                                   A   438
      IF (ITTL(6).NE.ITEST ) GO TO 820                                  A   439
      DO 400 I=1,36                                                     A   440
  400 ITTL(I)=JTTL(I)                                                   A   441
      GO TO 820                                                         A   442
C                                                                       A   443
C  READ TITLE                                                           A   444
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C                                                                       A   445
  410 IF (IOPT.NE.ITIT) GO TO 420                                       A   446
      READ(IN,850) (ITTL(I),I=1,36)                                     A   447
      GO TO 820                                                         A   448
C                                                                       A   449
C  READ TRANSPORT OPTIONS                                               A   450
C                                                                       A   451
  420 IF (IOPT.NE.ITRN) GO TO 440                                       A   452
      OZIN=X(1)                                                         A   453
      OZAL=X(2)                                                         A   454
      HCIN=X(3)                                                         A   455
      HCAL=X(4)                                                         A   456
      XNIN=X(5)                                                         A   457
      XNAL=X(6)                                                         A   458
      IF (HCIN.GT.(-0.0000001)) GO TO 430                               A   459
      JIN=IFIX(ABS(HCIN)+0.1)                                           A   460
      READ(IN,880) HCIN,(FINHC(I),I=1,JIN)                              A   461
  430 IF (HCAL.GT.(-0.0000001)) GO TO 820                               A   462
      JAL=IFIX(ABS(HCAL)+0.1)                                           A   463
      READ(IN,880) HCAL,(FALHC(I),I=1,JAL)                              A   464
      GO TO 820                                                         A   465
C                                                                       A   466
C  READ BACKGROUND CONDITIONS                                           A   467
C                                                                       A   468
  440 IF (IOPT.NE.IBCK) GO TO 450                                       A   469
      OZBK=X(1)                                                         A   470
      HCBK=X(2)                                                         A   471
      XNBK=X(3)                                                         A   472
      IF (HCBK.GE.(-0.00001)) GO TO 820                                 A   473
      JBK=IFIX(ABS(X(2))+0.01)                                          A   474
      READ (IN,880) HCBK,(FBK(I),I=1,JBK)                               A   475
      GO TO 820                                                         A   476
C                                                                       A   477
C  READ ALOFT CONCENTRATIONS OF SPECIES OTHER THAN O3,NMOC,NOX          A   478
C                                                                       A   479
  450 IF (IOPT.NE.IALF) GO TO 480                                       A   480
      IALFT=IFIX(ABS(X(1))+0.01)                                        A   481
      READ (IN,950) (ISPAL(I),I=1,IALFT)                                A   482
      DO 470 I=1,IALFT                                                  A   483
      DO 460 J=1,NS                                                     A   484
      IF (ISPAL(I).NE.SPECIS(J)) GO TO 460                              A   485
      LOCALF(I)=J                                                       A   486
      GO TO 470                                                         A   487
  460 CONTINUE                                                          A   488
  470 CONTINUE                                                          A   489
      READ (IN,880) (CALFT(I),I=1,IALFT)                                A   490
      GO TO 820                                                         A   491
C                                                                       A   492
C  READ INITIAL CONDITIONS FOR ALL SPECIES OTHER THAN O3,NMOC,NOX       A   493
C                                                                       A   494
  480 IF (IOPT.NE.INIT) GO TO 490                                       A   495
      NI=IFIX(ABS(X(1))+0.1)                                            A   496
      READ(IN,950) (REACT(I),I=1,NI)                                    A   497
      READ(IN,880) (C(I),I=1,NI)                                        A   498
      GO TO 820                                                         A   499
C                                                                       A   500
C  READ SURFACE DEPOSITION RATE (CM/SEC)                                A   501
C                                                                       A   502
  490 IF (IOPT.NE.IDEP) GO TO 530                                       A   503
      IDPTIM=IFIX(ABS(X(1))+0.01)                                       A   504
      IDEPO=IFIX(ABS(X(2))+0.01)                                        A   505
      DPEND=FLOAT(IDPTIM)*60.                                           A   506
      DO 520 I=1,IDEPO                                                  A   507
```

```
      READ (IN,840) ISPDP(I),(RDEP1(J,I),J=1,6)                          A   508
      IF (IDPTIM-6.GT.0) READ (IN,880) (RDEP1(J,I),J=7,IDPTIM)           A   509
      DO 500 J=1,IDPTIM                                                  A   510
      RDEPO(J,I)=RDEP1(J,I)*36.                                          A   511
  500 CONTINUE                                                           A   512
      CALL EMISS(IDPTIM,RDEPO(1,I),RDCOEF(1,I))                          A   513
      IF (ISPDP(I).EQ.IIHC) GO TO 520                                    A   514
      DO 510 J=1,NS                                                      A   515
      IF (ISPDP(I).NE.SPECIS(J)) GO TO 510                               A   516
      LOCDEP(I)=J                                                        A   517
      GO TO 520                                                          A   518
  510 CONTINUE                                                           A   519
  520 CONTINUE                                                           A   520
      GO TO 820                                                          A   521
C                                                                        A   522
C  READ ALREADY COMPLETED SIMULATIONS                                    A   523
C                                                                        A   524
  530 IF (IOPT.NE.IRDY) GO TO 560                                        A   525
      KS1=IFIX(ABS(X(1))+0.1)                                            A   526
      JS=2                                                               A   527
      IF (NOZ.EQ.1) WRITE (IOUT,910) PLSP(1)                             A   528
      IF (NOZ.GT.1) WRITE (IOUT,910) (PLSP(I),I=1,NOZ)                   A   529
      DO 550 I=1,KS1                                                     A   530
      IF (X(1).GT.0.) READ(IN,880) HCC,XNN,ZN,OZAR                       A   531
      IF (X(1).LT.(-0.98)) READ (IALL,990) HCC,XNN,ZN,OZAR               A   532
      WRITE (IALN,990) HCC,XNN,ZN,OZAR                                   A   533
      IF (XNN.GT.0.) RTO1=HCC/XNN                                        A   534
      IF (XNN.LE.0.) RTO1=HCC*1.0E7                                      A   535
      NOZM1=NOZ-1                                                        A   536
      IF (NOZ.EQ.1) WRITE (IOUT,920) HCC,XNN,RTO1,ZN                     A   537
      IF (NOZ.GT.1) WRITE (IOUT,920) HCC,XNN,RTO1,ZN,(OZAR(JJ),JJ=1,NO   A   538
     1ZM1)                                                               A   539
      JJ=MOD(I,11)                                                       A   540
      IF (JJ.EQ.0) JJ=11                                                 A   541
      II=(I-JJ)/11 + 1                                                   A   542
      OZN(JJ,II,1)=ZN                                                    A   543
      IF (NOZ.LE.1) GO TO 550                                            A   544
      DO 540 JK=2,NOZ                                                    A   545
      OZN(JJ,II,JK)=OZAR(JK-1)                                           A   546
  540 CONTINUE                                                           A   547
  550 CONTINUE                                                           A   548
      GO TO 820                                                          A   549
C                                                                        A   550
C  READ CHEMICAL MECHANISM                                               A   551
C                                                                        A   552
  560 IF (IOPT.NE.IMCH) GO TO 650                                        A   553
      IZENP=1                                                            A   554
      IF (X(1).LE.0.) CALL MCHWRT                                        A   555
      IF (ABS(X(5)).NE.0.) TEMP=X(5)                                     A   556
      IF (QM(1).GT.0.) TEMP=QM(1)                                        A   557
      IF (X(1).LT.0.) GO TO 820                                          A   558
      NX=IFIX(ABS(X(1))+0.1)                                             A   559
      IP=IFIX(ABS(X(2))+0.1)                                             A   560
      NHC=IFIX(ABS(X(3))+0.1)                                            A   561
      NEPA=IFIX(ABS(X(4))+0.1)                                           A   562
      IF (IP.NE.0) READ(IN,880) (XRTC(I),I=1,IP)                         A   563
      IF (IP.EQ.0) GO TO 600                                             A   564
      DO 570 I=1,IP                                                      A   565
  570 IPH(I)=IFIX(XRTC(I)+0.1)                                           A   566
C                                                                        A   567
C  PLACE ZENITH ANGLE.DEPENDENCE INTO APPROPRIATE SLOT FOR EACH REACTIONA   568
C                                                                        A   569
      DO 590 K=1,IP                                                      A   570
```

```
      DO 580 I=1,10                                                     A   571
      PP(I,K)=1.                                                        A   572
  580 CONTINUE                                                          A   573
  590 CONTINUE                                                          A   574
  600 IF (NHC.NE.0) READ(IN,950) (HCSPEC(I),I=1,NHC)                    A   575
      IF (NHC.NE.0) READ(IN,880) (CARB(I),I=1,NHC)                      A   576
      CALL MCHSET (NX,NEPA)                                             A   577
      ILH2O=-1                                                          A   577A
      DO 640 J=1,NS                                                     A   578
      DO 610 I=1,NHC                                                    A   579
      IF (SPECIS(J).NE.HCSPEC(I)) GO TO 610                             A   580
      IH(I)=J                                                           A   581
      GO TO 640                                                         A   582
  610 CONTINUE                                                          A   583
  620 IF (SPECIS(J).EQ.IINO2 ) INOX(1)=J                                A   584
      IF (SPECIS(J).EQ.IINO  ) INOX(2)=J                                A   585
      DO 630 K=1,NOZ                                                    A   586
  630 IF (SPECIS(J).EQ.PLSP(K)) KOZ(K)=J                                A   587
      IF (SPECIS(J).EQ.IIH2O ) ILH2O=J                                  A   587A
  640 CONTINUE                                                          A   588
      INHH=1                                                            A   589
      CALL PHOT                                                         A   589A
      CALL MIXST                                                        A   589B
      CALL SUNTIM                                                       A   589C
      GO TO 820                                                         A   590
C                                                                       A   591
C  MODIFY RATE CONSTANTS USING THE RATE OPTION                          A   592
C                                                                       A   593
  650 IF (IOPT.NE.IRAT) GO TO 720                                       A   594
      NRR=IFIX(X(1)+.1)                                                 A   595
      IF (ABS(X(2)).NE.0.) GO TO 700                                    A   596
      READ(IN,880) (XRTC(I),I=1,NRR)                                    A   597
      DO 660 I=1,NRR                                                    A   598
  660 NRTC(I)=IFIX(XRTC(I)+.1)                                          A   599
      READ(IN,880) (XRTC(I),I=1,NRR)                                    A   600
      DO 690 I=1,NRR                                                    A   601
      J=NRTC(I)                                                         A   602
      DO 670 JK=1,IP                                                    A   603
      IF (J.EQ.IPH(JK)) RFCT(JK)=XRTC(I)                                A   604
      IF (J.EQ.IPH(JK)) GO TO 680                                       A   605
  670 CONTINUE                                                          A   606
  680 CONTINUE                                                          A   607
  690 A(J)=XRTC(I)                                                      A   608
      GO TO 820                                                         A   609
  700 DO 710 I=1,NR                                                     A   610
  710 A(I)=0.                                                           A   611
      GO TO 820                                                         A   612
C                                                                       A   613
C  READ DESIRED SIMULATION TIME                                         A   614
C                                                                       A   615
  720 IF (IOPT.NE.ITIM) GO TO 730                                       A   616
      START=0.                                                          A   617
      STOPP=600.                                                        A   618
      JSTRT=800                                                         A   619
      JSTOP=1900                                                        A   620
      IF (ABS(X(2)).EQ.0.) GO TO 820                                    A   621
      JSTRT=IFIX(X(1)+0.1)                                              A   622
      JSTOP=IFIX(X(2)+0.1)+100                                          A   623
      JMIN=JSTRT-((JSTRT/100)*100)                                      A   624
      TMIN1=FLOAT((JSTRT/100)*60+JMIN)                                  A   625
      JMIN=JSTOP-((JSTOP/100)*100)                                      A   626
      TMIN2=FLOAT((JSTOP/100)*60+JMIN)                                  A   627
      STOPP=TMIN2-TMIN1                                                 A   628
```

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      STOPP=STOPP-60.                                                    A   629
C                                                                        A   630
C ******* UPDATED 11/81 FOR 24 HR TIME                                  A   631
C                                                                        A   632
      IF (STOPP.LE.0.) STOPP=1440.+STOPP                                 A   633
      CALL PHOT                                                          A   634
      CALL MIXST                                                         A   635
      CALL SUNTIM                                                        A   636
      GO TO 820                                                          A   637
C                                                                        A   638
C  ZENITH ANGLE OPTION                                                   A   639
C                                                                        A   640
  730 IF (IOPT.NE.IZNI) GO TO 780                                        A   641
      IPZ=IFIX(X(1)+0.1)                                                 A   642
      DO 770 K=1,IPZ                                                     A   643
      READ (IN,880) (XRTC(I),I=1,11)                                     A   644
      IPNW=IFIX(XRTC(1)+0.01)                                            A   645
      DO 740 J=1,IP                                                      A   646
      IF (IPNW.EQ.IPH(J)) GO TO 750                                      A   647
  740 CONTINUE                                                           A   648
      WRITE (IOUT,960) IPNW                                              A   649
      STOP                                                               A   650
  750 DO 760 I=1,10                                                      A   651
      PP(I,J)=XRTC(I+1)                                                  A   652
      IF (J.EQ.1) RTCON(I)=RTCON(I)*XRTC(I+1)                            A   653
      IF (J.EQ.1) PP(I,J)=1.                                             A   654
  760 CONTINUE                                                           A   655
  770 CONTINUE                                                           A   656
      GO TO 820                                                          A   657
C                                                                        A   658
C  INPUT EMISSION REDUCTION CREDITS (CURRENTLY IMPLEMENTED FOR CO ONLY)  A   659
C                                                                        A   660
  780 IF (IOPT.NE.ICRE) GO TO 801                                        A   661
      ICR=1                                                              A   662
      IF (X(1).GT.0.) ICR=IFIX(X(1)+0.1)                                 A   663
      IF (X(1).LT.-0.0001) ICR=0                                         A   664
      IF (X(1).LT.-0.0001) GO TO 820                                     A   665
      IEMCR=IFIX (ABS(X(2))+0.1)                                         A   666
      NEMCR=IFIX (X(2)+0.1)                                              A   667
      DO 800 J=1,ICR                                                     A   668
      READ (IN,840) ISPNCR(J),SPCR69(J),SURFCR(J),ALOFCR(J),REDCR(J),    A   669
     1FSRFCR(J),FALFCR(J)                                                A   670
      JX=J+2                                                             A   671
      EMSP(JX)=ISPNCR(J)                                                 A   672
      READ (IN,880) (EMO(I,JX),I=1,7)                                    A   673
      IF ((IEMCR-7).GT.0) READ (IN,880) (EMO(I,JX),I=8,IEMCR)            A   674
      IF (NEMCR.GT.0) CALL EMISS (IEMCR,EMO(1,JX),ECO(1,JX))             A   675
      IF (NEMCR.GT.0) GO TO 800                                          A   676
      FHT=X(3)*.001                                                      A   677
      Q0=1./(1145.*SPCR69(J)*FHT)                                        A   678
      DO 790 I=1,IEMCR                                                   A   679
      EMO(I,JX)=EMO(I,JX)*Q0                                             A   680
  790 CONTINUE                                                           A   681
      CALL EMISS (IEMCR,EMO(1,JX),ECO(1,JX))                             A   682
  800 CONTINUE                                                           A   683
      GO TO 820                                                          A   684
C                                                                        A  684A
C  INPUT BIOGENIC EMISSIONS                                              A  684B
C                                                                        A  684C
  801 IF (IOPT.NE.IBIO) GO TO 810                                        A  684D
      NBEM=IFIX(ABS(X(1))+0.1)                                           A  684E
      BESTOP=FLOAT(NBEM)*60.                                             A  684F
      IBSP=IFIX(ABS(X(2))+0.1)                                           A  684G
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```
      FHT=X(3)*.001                                                          A   684H
      EFACT1=.024450/FHT                                                     A   684I
      DO 805 J=1,IBSP                                                        A   684J
      CBTOT(J)=0.                                                            A   684K
      READ (IN,840) IBEMSP(J),ACB4(J),SURFBI(J),ALOFBI(J),REDBI(J),          A   684L
     1FSRFBI(J),FALFBI(J)                                                    A   684M
      READ (IN,880) WTMOL(J)                                                 A   684N
      IF (ACB4(J).LE.0.) GO TO 803                                           A   684O
      READ(IN,880) (BFRAC(I,J),I=1,NHC)                                      A   684P
      DO 802 I=1,NHC                                                         A   684Q
      CBTOT(J)=CBTOT(J)+BFRAC(I,J)*CARB(I)                                   A   684R
  802 CONTINUE                                                               A   684S
  803 READ (IN,880) (BEMO(I,J),I=1,NBEM)                                     A   684T
      EFACT=EFACT1/WTMOL(J)                                                  A   684U
      DO 804 I=1,NBEM                                                        A   684V
      BEMO(I,J)=BEMO(I,J)*EFACT                                              A   684W
  804 CONTINUE                                                               A   684X
      CALL EMISS (NBEM,BEMO(1,J),BECO(1,J))                                  A   684Y
  805 CONTINUE                                                               A   684Z
      GO TO 820                                                              A   685
C                                                                            A   685A
C  ALL OPTIONS ARE COMPLETED, END PROGRAM                                    A   686
C   OR OPTION NOT FOUND                                                      A   687
C                                                                            A   688
  810 IF (IOPT.NE.IBLK) WRITE (IOUT,890) IOPT                                A   689
      STOP                                                                   A   690
  820 CONTINUE                                                               A   691
C                                                                            A   692
      STOP                                                                   A   693
C                                                                            A   694
C                                                                            A   695
C                                                                            A   696
  830 FORMAT ('1' /////////)                                                 A   697
  831 FORMAT (1X //////////)                                                 A   698
  832 FORMAT (49X,39H**************************************** /              A   699
     249X,39H*                                    * /                       A   700
     349X,39H*   OZONE ISOPLETH PLOTTING PACKAGE  * /                       A   701
     449X,39H*      WITH OPTIONAL MECHANISMS      * /                       A   702
     549X,39H*                                    * /                       A   703
     649X,39H*     O Z I P M - 4  ( E K M A )     * /                       A   704
     749X,39H*                                    * /                       A   705
     849X,39H*            EKMA(90005)             * /                       A   706
     149X,39H*                                    * /                       A   707
     249X,39H****************************************  )                    A   708
  840 FORMAT (A4,6X,7F10.2)                                                  A   709
  850 FORMAT (36A2)                                                          A   710
  860 FORMAT (10X,36A2)                                                      A   711
  870 FORMAT (1H1//)                                                         A   712
  880 FORMAT (7F10.5)                                                        A   713
  890 FORMAT (1H1,24HTHE OPTIONS INSTRUCTION ,A4,21H CANNOT BE PROCESSEDA    A   714
     1.)                                                                     A   715
  900 FORMAT (1H0,30X,21HMAXIMUM ONE HOUR AVE ,A4,1X,3H = ,F7.5,12H CENTA    A   716
     1ERED AT,F6.0,9H LDT     )                                            A   717
  910 FORMAT (1H1 // 14X,36HTHE FOLLOWING RESULTS WERE READ IN. ////1H ,A    A   718
     112X,2HHC,14X,3HNOX,11X,5HRATIO,13X,A4,4(10X,A4))                       A   719
  920 FORMAT (1H0,8F16.5)                                                    A   720
  930 FORMAT (6A4)                                                           A   721
  940 FORMAT (1H0,30X,8HMAXIMUM ,A4,1X,44H NOT REACHED, THE LAST ONE HOUA    A   722
     1R AVERAGE WAS ,F7.5,5H PPM.)                                           A   723
  950 FORMAT (7(A4,6X))                                                      A   724
  960 FORMAT (1H0, 9HREACTION ,I10,10H NOT FOUND)                            A   725
  970 FORMAT (1H1,39X,8HSPECIES ,A4,38H IS NOT FOUND IN THE KINETIC MECHA    A   726
     1ANISM)                                                                 A   727
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980 FORMAT (1H1//////1H0,28HTHE INPUTS FOR THIS RUN ARE  //)          A   728
990 FORMAT (1X,7E13.4)                                               A   729
    END                                                              A   730-
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```
      BLOCK DATA                                                          B     1
      SAVE                                                                B     2
      COMMON /CALC/    NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),     B     3
     1                 IA(60),JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,   B     4
     2                 TSTEP,ZENI                                         B     5
      COMMON /CNTRL/   SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN, B     6
     1                 FLST,TLST                                          B     7
      COMMON /HEAT/    SC(200,12),ISC(200,3)                              B     8
      COMMON /SPEC/    NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),        B     9
     1                 FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,  B    10
     2                 XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                   B    11
      COMMON /OPTS/    ISPD,ICAL,IACR,IDIL,IPLC,IEMS,IRDY,IBLK,IBCK,IPLT, B    12
     1                 ITRN,ITIT,IRCT,IRAT,ITIM,IMCH,INIT,ISTR,IMIX,ISPC, B    13
     2                 ITMP,IALF,IDEP,IZNI,IMAS,IMOL,ICRE,IBIO,IWAT       B    14
      COMMON /EMIS/    NEM,ISP,ESTRT(5),ESTOP,ESLP,IEMLS(5),EOSLP(5),     B    15
     1                 EMO(26,5),ECI(5),EM(26),EC(125),ECO(125,5)         B    16
      COMMON /MIX/     NMIX,AMIX(26),STRM,STOPM,DC(104)                   B    17
      COMMON /MIXING/  DSTRT,DEND,AMC(5),BMC(5),CMC(5),FD(6),FG(6),       B    18
     1                 AMXX(26),DL,TTMAX,SRISE,SRMIN,DELH,TDIL,NMXX,      B   18A
     2                 HEIGHT,SSET,SSRISE                                 B    19
      COMMON /TEMPER/  TEMEND,NTEMP,QM(30)                                B    20
      COMMON /INOUT/   IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                  B    21
      COMMON /TITL/    ITTL(36)                                           B    22
      COMMON /NEED/    HC,XN,NL,OZP(20),OZN(11,11,5),MR,LS,HCS,XNS        B    23
      COMMON /NEED1/   IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,      B    24
     1                 IIH2O,JPLUS                                        B    25
      COMMON /HOUR/    OZM(5),NGO,TTM,TM(5)                               B    26
      COMMON /PLTVEC/  HCT(20),OT(20),NT,OHC,HCG,PLTGRD,OXN,XNG,HC1,XN1,  B    27
     1                 TICZ,DIGZ,CHRZ,IPLDEV                              B    28
      COMMON /VVLB1/   FCTR,DIST,CHRSIZ,NNCHR,OZBL                        B    29
      COMMON /BK1/     FBK(20),FBKAL(5),HCBK,XNBK,OZBK,H2OBK              B    30
      COMMON /SUNLIT/  Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,      B    31
     1                 ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),       B    32
     2                 XZ(24),K(24),JSTRT,JSTOP,PSPEC,MNLM,MXLM,MAXL,MAXJB    33
      COMMON /ZENITH/  IPZ,ZDEF(10,20),IPHZ(20),IZENP                     B    34
      COMMON /PHOTON/  CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20),  B    35
     1                 IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),      B    36
     2                 IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)         B    37
      COMMON /ALOFT/   IALFT,CALFT(10),LOCALF(10)                         B    38
      COMMON /GEAR1/   TTDUM(5),UROUND,NNDUM(4)                           B    39
      COMMON /PLTND/   JBAR,JSYMB,CVERT(9),TVERT(52,2)                    B    40
      COMMON /EXPVAL/  EXPMAX                                             B    41
      COMMON /CRED/    ICR,ISPCR,SPCR69(3),SURFCR(3),ALOFCR(3),           B    42
     1                 REDCR(3),FSRFCR(3),FALFCR(3),COSFBK,COAFBK         B    43
      COMMON /BIOG/    NBEM,IBSP,WTMOL(5),ACB4(5),SURFBI(5),ALOFBI(5),    B   43A
     1                 REDBI(5),FSRFBI(5),FALFBI(5),BEMO(26,5),           B   43B
     2                 BECO(126,5),CBTOT(5),IBLS(5),BESTOP,BFRAC(20,5)    B   43C
      COMMON /WATER/   WATEND,NWATER,PAMB,QW(30),QR(30),PMILLI,ILH2O      B   43D
C                                                                         B   43E
      INTEGER PSPEC                                                       B    44
C                                                                         B   44A
      COMMON /ALFCHR/ ISPAL(10)                                           B   44B
      COMMON /BIOCHR/ IISOP, IBEMSP(5)                                    B   44C
      COMMON /CALCHR/ SPECIS(61)                                          B   44D
      COMMON /CRECHR/ ISPNCR(3)                                           B   44E
      COMMON /EMSCHR/ EMSP(5)                                             B   44F
      COMMON /NEED1C/ IBZA                                                B   44G
      COMMON /PHTCHR/ ISPDP(10)                                           B   44H
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                      B   44I
C                                                                         B   44J
      CHARACTER*1 JBAR, JSYMB                                             B   44K
      CHARACTER*2 ITTL                                                    B   44L
      CHARACTER*4 ISPAL, ISPDP, ISPNCR, IBEMSP                            B   44M
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      CHARACTER*4 TVERT, CVERT                                                B    44N
      CHARACTER*4 SPECIS, HCSPEC, PLSP, IISOP, EMSP, REACT                    B    44O
      CHARACTER*4  ISPD,ICAL,IACR,IDIL,IPLC,IEMS,IRDY,IBLK,IBCK,IPLT,         B    44P
     1            ITRN,ITIT,IRCT,IRAT,ITIM,IMCH,INIT,ISTR,IMIX,ISPC,         B    44Q
     2            ITMP,IALF,IDEP,IZNI,IMAS,IMOL,ICRE,IBIO,IWAT,              B    44R
     3            IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,              B    44S
     4            IIH2O,IBZA,JPLUS                                           B    44T
C                                                                            B    45
C     PLOTTING DATA                                                          B    46
C                                                                            B    47
      DATA JBAR/'I'/,JSYMB/'O'/                                              B    48
      DATA TVERT/17*'    ',' C  ',' O  ',' N  ',' C  ',' E  ',' N  ',        B    49
     1' T  ',' R  ',' A  ',' T  ',' I  ',' O  ',' N  ','    ',' P  ',        B    50
     2' P  ',' M  ',70*'    '/                                               B    51
C                                                                            B    52
C  UROUND (ROUND-OFF ERROR), EXPMAX IS THE MAXIMUM EXPONENT ALLOWED          B    53
C                                                                            B    54
      DATA UROUND/1.25E-7/,EXPMAX/87.4/                                      B    55
      DATA TEMEND/0./,WATEND/0./                                             B    56
      DATA ISPD/'ISOP'/,ICAL/'CALC'/,IACR/'ACCU'/,IDIL/'DILU'/,              B    57
     1     IPLC/'PLAC'/,IEMS/'EMIS'/,IRDY/'ALRE'/,IBLK/'    '/,              B    58
     2     IPLT/'PLOT'/,ITRN/'TRAN'/,ITIT/'TITL'/,IRCT/'REAC'/,             B    59
     3     IRAT/'RATE'/,ITIM/'TIME'/,IMCH/'MECH'/,INIT/'INIT'/,             B    60
     4     IMIX/'MIXI'/,ISPC/'SPEC'/,ISTR/'EKMA'/,IMOL/'MOLE'/,             B    61
     5     IIO3/'O3  '/,IIHC/'VOC '/,IINX/'NOX '/,IBCK/'BACK'/,             B    62
     6     ITMP/'TEMP'/,IALF/'ALOF'/,IDEP/'DEPO'/,IZNI/'ZENI'/,             B    63
     7     IMAS/'MASS'/,ICRE/'CRED'/,IICO/'CO  '/,IINO2/'NO2 '/,            B    64
     8     IINO/'NO  '/,IIH2O/'H2O '/,MBLANK/'M   '/,IBLANK/'    '/,        B    65
     9     JPLUS/'+   '/,IBIO/'BIOG'/,IWAT/'WATE'/,IISOP/'ISOP'/            B    66
C                                                                            B    67
C  SET DEFAULTS                                                            B    68
C                                                                            B    69
      DATA HC/2.0/,XN/0.14/,NL/11/,MR/5/                                     B    70
      DATA ITTL/'ST','AN','DA','RD',' O','ZO','NE',' I','SO','PL','ET',      B    71
     1         'H ','CO','ND','IT','IO','NS',19*'  '  /                     B    72
C                                                                            B    73
C  FILE I/O UNITS                                                          B    74
C                                                                            B    75
      DATA IN/7/,IOUT/10/,IALN/9/,IALL/8/,IOZC/11/                           B    76
      DATA INFO/0/,NPTO/0/,NGO/1/                                            B    77
      DATA OZP/.08,.12,.16,.20,.24,.28,.30,.32,.34,.36,.40,9*0./             B    78
      DATA TSRT/0.0/,DTIM/420./,Z1/510./,Z2/630./,DCON/0.0/                  B    79
      DATA SIG/2./,SIGMA/2./                                                 B    80
      DATA NMIX/0/,AMIX(1)/-3./,NEM/0/                                       B    81
      DATA DSTRT/800./,DEND/1500./,PLTGRD/0./,OHC/0./,FCTR/0.6/              B    82
      DATA TICZ/0.07/,DIGZ/0.10/,CHRZ/0.10/,HC1/8.5/,XN1/5.95/               B    83
      DATA CHRSIZ/0.07/,QM(1)/-3./,IPLDEV/-1/                                B    84
      DATA NOZ/1/,PLSP/'O3  ',4*'    '/,                                     B    85
     1KOZ/4,4*0/                                                             B    86
      DATA ICR/0/,ISPCR/0/,IBSP/0/                                           B    87
C                                                                            B    88
C  DEFAULT REACTIVITIES                                                    B    89
C                                                                            B    90
      DATA RCTY/.037,.035,.052,.021,.089,.117,.564,.085,12*0./,              B    91
     1    FINHC/.034,.020,.037,.070,.042,.026,.498,.273,12*0./,              B    92
     2    FALHC/.034,.020,.037,.070,.042,.026,.498,.273,12*0./,              B    93
     3XNF/.25,.75/,                                                          B    94
     4FENX/.05,.95/,NI/0/,CARB/2.,2.,2.,1.,7.,8.,1.,1.,12*0./                B    95
      DATA HCSPEC/'ETH ','OLE ','ALD2','FORM','TOL ','XYL ','PAR ',          B    96
     1'NR  ',12*'    '  /                                                   B    97
      DATA IH/25,24,17,16,26,32,21,34,12*0/,INOX/1,2/,NHC/8/                 B    98
C                                                                            B    99
C  SET UP DEFAULT TRANSPORTED CONCENTRATIONS                               B   100
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C
      DATA OZIN/0./,OZAL/0./,HCIN/0./,HCAL/0./,XNIN/0./,XNAL/0./          B   101
C                                                                          B   102
C  SET UP BACKGROUND CONCENTRATIONS (HC,NOX,OZ,H2O,CO)                     B   103
C                                                                          B   104
      DATA HCBK/0./,XNBK/0./,OZBK/0./,FBK/20*-3./,FBKAL/5*-3./             B   105
      DATA H2OBK/20000./,COSFBK/1.2/,COAFBK/.5/                            B   106
C                                                                          B   107
C  SET DEFAULT ERROR TOLERANCE AND DEFAULT TEMPERATURE                     B   108
C                                                                          B   109
      DATA ERR/0.003/,TEMP/303.0/                                          B   110
      DATA ESTOP/0.0/,STOPP/600./,TPRNT/60./,TSTEP/60./                    B   111
      DATA SLA/34.058/,SLO/118.250/,TZ/7.0/,IY/1986/,IM/6/,ID/21/          B   112
      DATA JSTRT/0800/,JSTOP/1900/,IINC/60/                                B   113
      DATA NTEMP/-1/,NWATER/-1/,QW(1)/-3./,PAMB/1.0/,ILH2O/7/              B   114
C                                                                          B   114A
C  MIXING HEIGHT DATA                                                      B   115
C                                                                          B   116
      DATA FD/0.,.07,.14,.33,.50,.70/                                      B   117
      DATA AMC/32.7892,10.9811,-26.3876,7.4405,3.4242/                     B   118
      DATA BMC/0.0,6.8857,9.1918,-5.8492,-2.0545/                          B   119
      DATA CMC/.1251,.6071,1.7325,2.3676,1.0239/                           B   120
      DATA FG/0.,.02,.10,.58,.85,1.0/                                      B   121
C                                                                          B   122
C                                                                          B   123
C  DATA FOR GEAR                                                           B   124
C                                                                          B   125
      DATA NR/82/,NS/35/                                                   B   126
      DATA R/200*0./,INHH/1/                                               B   127
      DATA  ISC/600*1/                                                     B   128
      DATA IP/11/,RFCT/1.,.053,1.,33.9,0.1975,.189,1.,1.,1.,8.40,8.96,     B   129
     1 9*1./                                                               B   130
C                                                                          B   131
C  DATA FOR SUN                                                            B   132
C                                                                          B   133
      DATA IPHZ/1,9,34,38,39,45,69,74,8,14,23,9*0/,IPZ/11/,IZENP/-1/       B   134
      DATA RTCON/0.5893,0.5851,0.5713,0.5470,0.5093,0.4537,0.3740,         B   135
     10.2578,0.1341,0.0242/                                                B   136
C                                                                          B   137
C  SET DEFAULT PHOTOLYTIC VALUES AS FUNCTION OF ZENITH ANGLE               B   138
C                                                                          B   139
      DATA ZDEF/10*1.                                                      B   140
     1,0.00461,0.00448,0.00413,0.00359,0.00287,0.00208,0.001235            B   141
     2,0.00054,0.00022,0.00013                                             B   142
     3,0.00575,0.00573,0.00567,0.00554,0.00535,0.00508,0.00463             B   143
     4,0.00401,0.00347,0.00525                                             B   144
     5,0.00370,0.00366,0.00356,0.00340,0.00314,0.00280,0.002334            B   145
     6,0.001738,0.00128,0.00177                                            B   146
     7,0.00575,0.00573,0.00567,0.00554,0.00535,0.00508,0.00463             B   147
     8,0.00401,0.00347,0.00525                                             B   148
     9,0.000589,0.000578,0.000550,0.000502,0.000435,0.000355               B   149
     1,0.000257,0.000158,0.000091,0.000094                                 B   150
     2,0.00370,0.00366,0.00356,0.00340,0.00314,0.00280,0.002334            B   151
     3,0.001738,0.00128,0.00177                                            B   152
     4,0.00370,0.00366,0.00356,0.00340,0.00314,0.00280,0.002334            B   153
     5,0.001738,0.00128,0.00177,30*1.,90*0./                               B   154
      DATA IPH/1,8,9,14,23,34,38,39,45,69,74,9*0/                          B   155
      DATA MAXL,MAXZ,MAXJ,LAM1,INC/09,10,47,2900,100/                      B   156
      DATA  Z             /0.,10.,20.,30.,40.,50.,60.,70.,78.,86./         B   157
      DATA MNLM,MXLM/2900,4500/                                            B   158
C                                                                          B   159
C  DATA FOR ALOFT AND DEPOSITION                                           B   160
C                                                                          B   161
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      DATA IALFT/0/,IDEPO/0/,DPEND/0./,IDPTIM/0/,DNOWS/0./                  B   163
C                                                                           B   164
C     DATA FOR CBM4.3 MECHANISM                                             B   165
C                                                                           B   166
      DATA SPECIS/'NO2 ','NO  ','O   ','O3  ','NO3 ','O1D ','H2O ',        B   167
     1            'OH  ','HO2 ','N2O5','HNO3','HNO2','PNA ','H2O2',        B   168
     2            'CO  ','FORM','ALD2','C2O3','XO2 ','PAN ','PAR ',        B   169
     3            'XO2N','ROR ','OLE ','ETH ','TOL ','CRES','TO2 ',        B   170
     4            'OPEN','CRO ','MGLY','XYL ','ISOP','NR  ','M   ',        B   171
     5         26*'    ' /                                                  B   172
      DATA KR/1,3,4,3*3,1,4,4,6,6,4,4,4*5,2*10,2,2,2,12,8,12,1,8,9,         B   173
     1  9,13,8,9,9,14,8,8,5*16,4*17,2*18,20,2*18,8,21,3*23,3,8,4,5,3       B   174
     2  ,8,4,26,2*28,8,27,30,3*29,8,8,31,3,8,4,5,19,22,19,34,120*0,2,      B   175
     3  1,1,2,4,3*0,7,8,9,0,2,1,1,7,0,2,1,8,0,2*12,8,11,2,1,0,13,9,9,      B   176
     4  0,14,15,8,0,0,3,5,3,8,5,0,2,1,0,18,9,0,8,0,0,1,4*24,3*25,8,2,0     B   177
     5  ,27,5,1,0,8,4,32,31,0,4*33,2,2,19,139*0,7,11*0,7,167*0,2,4,1,2,    B   178
     6  5,1,5,3,6,3,8,9,8,1,1,2,10,11,5,1,2*12,2,1,2,11,5,8,13,9,1,        B   179
     7  2*14,8,9,3*9,15,8,11,3*18,2*16,20,18,3*16,2*19,9,0,17,16,17,       B   180
     8  19,16,19,16,9,1,27,2*30,0,18,19,17,9,19,18,9,19,16,22,1,0,0,       B   181
     9  34,118*0,3,12*0,3,0,1,0,0,1,3*0,8,0,1,0,0,1,0,1,6*0,2*15,0,9       B   182
     1  ,9,8,0,11,9,1,0,1,3*19,22,17,0,0,9,17,2*16,9,16,15,19,9,9,19,      B   183
     2  11,0,9,15,18,19,18,9,17,16,17,136*0,2,25*0,2*15,3*0,15,9,0,0,       B   184
     3  5*9,0,0,19,21,19,22,15,17,9,27,29,0,9,0,0,15,9,16,27,0,15,24,      B   185
     4  9,25,167*0,2*19,3*0,8,0,17,21,0,0,15,19,8,17,19,9,0,28,0,0,29,     B   186
     5  3*0,18,19,31,0,0,19,22,31,174*0,21,22,0,0,16,9,15,1,8,9*0,16,      B   187
     6  15,21,0,0,15,25,21,174*0,2*23,0,0,22,0,9,21,11*0,8,28,0,0,25,      B   188
     7  31,15,178*0,21,0,21,12*0,9,3*0,21,18,9,178*0,8,14*0,31,4*0,17,     B   189
     8  8,323*0/                                                           B   190
      DATA A/1.0,4.3230E+06,26.64,13750.,2309.,2438.,.04731,.053,1.0,       B   191
     1 424600.,3.26,100.,3.,33.9,44160.,.5901,1853.,1.9E-06,2.776,         B   192
     2 1.5390E-04,1.6E-11,9799.,.1975,9770.,1.5E-05,16820.,217.9,          B   193
     3 12270.,2025.,5.115,6833.,4144.,.2181,.189,2520.,322.,15000.,        B   194
     4 1.0,1.0,237.,.93,636.,24000.,3.7,1.0,18315.,12230.,.0222,3700.,     B   195
     5 9600.,21.,1203.,137100.,95445.,22000.,5920.,42000.,.018,11.35,      B   196
     6 1080.,11920.,2.7020E-03,9150.,12000.,250.,61000.,32500.,20000.,     B   197
     7 8.40,44000.,.015,36200.,26000.,8.96,27000.,142000.,.018,470.,       B   198
     8 12000.,1000.,2000.,1.0,118*0.0/                                     B   199
      DATA S/0.0,-1175.,1370.,0.0,-687.,-602.,2450.,0.0,0.0,-390.,         B   200
     1 0.0,940.,580.,0.0,-250.,1230.,-256.,0.0,10897.,-530.,0.0,           B   201
     2 -806.,3*0.0,-713.,-1000.,-240.,-749.,10121.,-380.,-1150.,           B   202
     3 -5800.,0.0,187.,4*0.0,1550.,0.0,986.,-250.,2*0.0,-250.,-5500.,      B   203
     4 14000.,2*0.0,1710.,0.0,8000.,2*0.0,324.,-504.,2105.,0.0,792.,       B   204
     5 -411.,2633.,-322.,7*0.0,500.,-116.,8*0.,-1300.,119*0.0/             B   205
      DATA SC/610*1.,2.,2*1.,.89,2.,2*1.,2.,1.,2*2.,12*1.,2.,3*1.,        B   206
     1  2.,10*1.,2.,.79,1.,.87,.96,2*1.,.63,1.,.5,.91,3*1.,.44,.9,1.,     B   207
     2  .4,4*1.,.03,.7,2*1.,.6,138*1.,.89,30*1.,2.,3*1.,2.,.79,1.,.13,    B   208
     3  1.1,1.,-2.1,.38,1.,.74,1.,1.7,1.56,.42,.08,.9,1.,.6,1.,.3,1.,2.   B   209
     4  ,.62,.5,2*1.,.8,1.,.4,2*1.,.2,133*1.,.11,34*1.,2.,.79,1.,.11,     B   210
     5  .94,.04,.02,.28,-1.,.22,.09,1.,.22,.12,.36,.9,.56,.6,.3,2*1.,     B   211
     6  2.,.7,.2,2*1.,.55,.67,.55,.1,.1,.06,.1,168*1.,.79 ,1.,.11,        B   212
     7  -2.1,2*1.,.3,1.,.1,1.,.7,2*1.,.56,2*1.,.3,4*1.,.03,.8,2*1.,       B   213
     8  .5,.13,.2,174*1.,-.11,.04,2*1.,.2,1.,.33,1.,.3,10*1.,.69,1.1,     B   214
     9  2*1.,.5,1.,.1,174*1.,.76,.02,2*1.,.02,1.,.44,-1.,11*1.,.08,.3,    B   215
     1  2*1.,.45,.4,.06,178*1.,.22,1.,-1.,12*1.,.76,3*1.,.9,.2,.44,       B   216
     2  178*1.,.2,14*1.,.2,4*1.,.2,.1,323*1./                              B   217
      END                                                                   B   218-
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      SUBROUTINE HDWRIT(IPLACE,IEM)                                          C     1
      SAVE                                                                   C     2
C                                                                            C     3
C  THIS SUBROUTINE WRITES THE HEADER PAGE FOR THE CURRENT CALCULATIONS       C     4
C                                                                            C     5
C                                                                            C     6
      COMMON /CALC/    NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),      C     7
     1                 IA(60),JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,    C     8
     2                 TSTEP,ZENI                                          C     8A
      COMMON /CNTRL/   SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN,   C     9
     1                 FLST,TLST                                           C    10
      COMMON /SPEC/    NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),         C    11
     1                 FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,   C    12
     2                 XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                    C    13
      COMMON /SUNLIT/  Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,       C    14
     1                 ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),        C    15
     2                 XZ(24),KKK(24),JSTRT,JSTOP,PSPEC,MNLM,MXLM,MAXL,    C    15A
     3                 MAXJ                                                C    16
      COMMON /PHOTON/  CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20),   C    17
     1                 IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),       C    18
     2                 IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)          C    19
      COMMON /ZENITH/  IPZ,ZDEF(10,20),IPHZ(20),IZENP                      C    20
      COMMON /EMIS/    NEM,ISP,ESTRT(5),ESTOP,ESLP,IEMLS(5),EOSLP(5),      C    21
     1                 EMO(26,5),ECI(5),EM(26),EC(125),ECO(125,5)          C    22
      COMMON /MIX/     NMIX,AMIX(26),STRM,STOPM,DC(104)                    C    23
      COMMON /MIXING/  DSTRT,DEND,AMC(5),BMC(5),CMC(5),FD(6),FG(6),        C    24
     1                 AMXX(26),DL,TTMAX,SSRISE,SRMIN,DELH,TDIL,NMXX,      C    24A
     2                 HEIGHT,SSET,SRISE                                   C    25
      COMMON /TEMPER/  TEMEND,NTEMP,QM(30)                                 C    26
      COMMON /FRPLOT/  SAVCON(80,5),SAVTIM(80),NTSV,INOW                   C    27
      COMMON /INOUT/   IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                   C    28
      COMMON /TITL/    ITTL(36)                                            C    29
      COMMON /NEED/    HC,XN,NL,OZP(20),OZN(11,11,5),MR,LS,HCS,XNS         C    30
      COMMON /HEAT/    SC(200,12),ISC(200,3)                               C    31
      COMMON /NEED1/   IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,       C    32
     1                 IIH2O,JPLUS                                         C    33
      COMMON /STORE/   AST(60)                                             C    34
      COMMON /HOUR/    OZM(5),NGO,TTM,TM(5)                                C    35
      COMMON /PLTVEC/  HCT(20),OT(20),NT,OHC,HCG,PLTGRD,OXN,XNG,HC1,XN1,   C    36
     1                 TICZ,DIGZ,CHRZ,IPLDEV                               C    37
      COMMON /ALOFT/   IALFT,CALFT(10),LOCALF(10)                          C    38
      COMMON /VVLB1/   FCTR,DIST,CHRSIZ,NNCHR,OZBL                         C    39
      COMMON /BK1/     FBK(20),FBKAL(5),HCBK,XNBK,OZBK,H2OBK               C    40
      COMMON /CRED/    ICR,ISPCR,SPCR69(3),SURFCR(3),ALOFCR(3),            C    41
     1                 REDCR(3),FSRFCR(3),FALFCR(3),COSFBK,COAFBK          C    42
      COMMON /BIOG/    NBEM,IBSP,WTMOL(5),ACB4(5),SURFBI(5),ALOFBI(5),     C    42A
     1                 REDBI(5),FSRFBI(5),FALFBI(5),BEMO(26,5),            C    42B
     2                 BECO(126,5),CBTOT(5),IBLS(5),BESTOP,BFRAC(20,5)     C    42C
      COMMON /WATER/   WATEND,NWATER,PAMB,QW(30),QR(30),PMILLI,ILH2O       C    42D
C                                                                            C    42E
      COMMON /ALFCHR/ ISPAL(10)                                            C    42F
      COMMON /BIOCHR/ IISOP, IBEMSP(5)                                     C    42G
      COMMON /CALCHR/ SPECIS(61)                                           C    42H
      COMMON /CRECHR/ ISPNCR(3)                                            C    42I
      COMMON /EMSCHR/ EMSP(5)                                              C    42J
      COMMON /NEED1C/ IBZA                                                 C    42K
      COMMON /PHTCHR/ ISPDP(10)                                            C    42L
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                       C    42M
C                                                                          C    42N
      CHARACTER*1 AST                                                      C    42O
      CHARACTER*2 ITTL                                                     C    42P
      CHARACTER*4 ISPAL, ISPDP, ISPNCR, IBEMSP                             C    42Q
      CHARACTER*4 IPLACE                                                   C    42R
      CHARACTER*4 SPECIS, HCSPEC, PLSP, IISOP, EMSP, REACT                 C    42S
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      CHARACTER*4 IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,          C    42T
     1   IIH2O,IBZA,JPLUS                                                C    42U
C                                                                        C    42V
      DIMENSION  ITMIX(26), IZC(10), XRTC(100), IPLACE(6)                C    43
      INTEGER PSPEC                                                      C    44
C                                                                        C    45
      DATA IZC/0,10,20,30,40,50,60,70,78,86/,  IFRST/1/                  C    46
C                                                                        C    47
      IF (IZENP.LE.0.OR.IFRST.NE.1) GO TO 30                             C    48
      IFRST=2                                                            C    49
      WRITE (IOUT,140) IZC                                               C    50
      DO 20 K=1,IP                                                       C    51
      J=IPH(K)                                                           C    52
      I=KR(J,1)                                                          C    53
      DO 10 LL=1,10                                                      C    54
      IF (K.EQ.1) XRTC(LL)=RTCON(LL)*RFCT(K)*PP(LL,K)                    C    55
      IF (K.NE.1) XRTC(LL)=PP(LL,K)*RFCT(K)*RTCON(LL)*RFCT(1)            C    56
   10 CONTINUE                                                           C    57
      WRITE (IOUT,150) J,SPECIS(I),(XRTC(LL),LL=1,10)                    C    58
   20 CONTINUE                                                           C    59
   30 CONTINUE                                                           C    60
      WRITE (IOUT,160) (ITTL(I),I=1,36)                                  C    61
      KSTOP=JSTOP-100                                                    C    62
      WRITE (IOUT,170) IPLACE,SLA,SLO,TZ,IM,ID,IY,JSTRT,KSTOP            C    63
      NOON=SPECIE                                                        C    64
      IRISE=SRISE                                                        C    65
      ISET=SSET                                                          C    66
      IF (INFO.EQ.(-1)) WRITE (IOUT,180) NOON,IRISE,ISET                 C    67
      IF (NMIX.GT.0) GO TO 50                                            C    68
      DDTRT=FLOAT(JSTRT)+(TSRT/60.)*100.                                 C    69
      DDEND=DDTRT+(DTIM/60.)*100.                                        C    70
      WRITE (IOUT,190) Z1,Z2,DDTRT,DDEND                                 C    71
      ITMIX(1)=DDTRT                                                     C    72
      NMX=INT(DTIM/60.+0.5)+1                                            C    73
      DO 40 J=2,NMX                                                      C    74
   40 ITMIX(J)=ITMIX(J-1)+100                                            C    75
      WRITE (IOUT,410) (ITMIX(J),J=1,NMX)                                C    76
      WRITE (IOUT,420) (AMXX(J),J=1,NMX)                                 C    77
      IF (DCON.GT.0.) WRITE (IOUT,200) DCON                              C    78
      GO TO 60                                                           C    79
   50 NMIX1=NMIX-1                                                       C    80
      WRITE (IOUT,360) (I,I=1,NMIX1)                                     C    81
      WRITE (IOUT,370) (AMIX(I),I=1,NMIX)                                C    82
   60 IF (QM(1).LT.0.) GO TO 65                                          C    83
      NTEMP1=NTEMP-1                                                     C    84
      WRITE (IOUT,450) (I,I=1,NTEMP1)                                    C    85
      WRITE (IOUT,460) (QM(I),I=1,NTEMP)                                 C    86
   65 IF (QW(1).LT.0.) GO TO 70                                          C    86A
      NWAT1=NWATER-1                                                     C    86B
      WRITE (IOUT,470) (I,I=1,NWAT1)                                     C    86C
      WRITE (IOUT,480) (QR(I),I=1,NWATER)                                C    86D
      WRITE (IOUT,490) (I,I=1,NWAT1)                                     C    86E
      WRITE (IOUT,500) (QW(I),I=1,NWATER)                                C    86F
      WRITE (IOUT,510) PMILLI                                            C    86G
      IF (ILH2O.LE.0) WRITE (IOUT,520)                                   C    86H
   70 WRITE (IOUT,270)                                                   C    87
      IF (NHC.NE.0) WRITE (IOUT,210) (HCSPEC(I),RCTY(I),I=1,NHC)         C    88
      IF (HCIN.GT.0.) WRITE (IOUT,390) (HCSPEC(I),FINHC(I),I=1,NHC)      C    89
      IF (HCAL.GT.0.) WRITE (IOUT,400) (HCSPEC(I),FALHC(I),I=1,NHC)      C    90
      IF (HCBK.GT.0.) WRITE (IOUT,430) (HCSPEC(I),FBK(I),I=1,NHC)        C    91
      WRITE (IOUT,280) XNF(1)                                            C    92
      IF (NHC.EQ.0) WRITE (IOUT,260)                                     C    93
      IF((OZIN+HCIN+XNIN) .GT. 0.0 .OR. (OZAL+HCAL+XNAL) .GT. 0.0)       C    94
     1 WRITE (IOUT,380)                                                  C    95
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      IF (OZIN+HCIN+XNIN.GT.0.) WRITE (IOUT,220) OZIN,HCIN,XNIN          C     96
      IF (NI.NE.0.AND.(OZIN+HCIN+XNIN.LE.0..AND.OZAL+HCAL+XNAL.LE.0.))   C     97
     1WRITE (IOUT,380)                                                   C     98
      IF (NI.NE.0) WRITE (IOUT,290) (REACT(I),C(I),I=1,NI)               C     99
      IF (OZAL+HCAL+XNAL.GT.0.) WRITE (IOUT,230) OZAL,HCAL,XNAL          C    100
      IF (IALFT.GT.0) WRITE (IOUT,300) (ISPAL(I),CALFT(I),I=1,IALFT)     C    101
      IF (OZBK+HCBK+XNBK.GT.0.) WRITE (IOUT,440) OZBK,HCBK,XNBK          C    102
      IF (NEM.GT.0) WRITE (IOUT,240) (I,I=1,NEM)                         C    103
      IF (NEM.GT.0) WRITE (IOUT,250) (EM(I),I=1,NEM)                     C    104
      IF (NEM.GT.(-1).AND.ICR.LE.0) GO TO 110                            C    105
      ISP1=ISP+ICR                                                       C    106
      IB1=1                                                              C    107
      IF (NEM.GT.-1) IB1=3                                               C    108
      DO 90 J=1,NS                                                       C    109
      DO 80 I=IB1,ISP1                                                   C    110
      IF (EMSP(I).EQ.IIHC  .OR.EMSP(I).EQ.IINX  ) GO TO 80               C    111
      IF (SPECIS(J).NE.EMSP(I)) GO TO 80                                 C    112
      IEMLS(I)=J                                                         C    113
      GO TO 90                                                           C    114
   80 CONTINUE                                                           C    115
   90 CONTINUE                                                           C    116
      WRITE (IOUT,310) (J,J=1,IEM)                                       C    117
      DO 100 I=IB1,ISP1                                                  C    118
  100 WRITE (IOUT,330) EMSP(I),(EMO(J,I),J=1,IEM)                        C    119
  110 CONTINUE                                                           C    120
      IF (IBSP.LE.0) GO TO 119                                           C   120A
      WRITE (IOUT,307)                                                   C   120B
      WRITE (IOUT,308) (IBEMSP(I),SURFBI(I),I=1,IBSP)                    C   120C
      WRITE (IOUT,309) (IBEMSP(I),ALOFBI(I),I=1,IBSP)                    C   120D
      XX=0.                                                              C   120E
      DO 111 J=1,IBSP                                                    C   120F
      XX=XX+ACB4(J)                                                      C   120G
  111 CONTINUE                                                           C   120H
      IF (XX.LE.0.) GO TO 115                                            C   120I
      WRITE (IOUT,391)                                                   C   120J
      DO 112 J=1,IBSP                                                    C   120K
      IF (ACB4(J).LE.0.) GO TO 112                                       C   120L
      WRITE (IOUT,392) IBEMSP(J),(HCSPEC(I),BFRAC(I,J),I=1,NHC)          C   120M
  112 CONTINUE                                                           C   120N
  115 CONTINUE                                                           C   120O
      DO 117 I=1,IBSP                                                    C   120P
      DO 116 J=1,NS                                                      C   120Q
      IF (SPECIS(J).NE.IBEMSP(I)) GO TO 116                              C   120R
      IBLS(I)=J                                                          C   120S
      GO TO 117                                                          C   120T
  116 CONTINUE                                                           C   120U
  117 CONTINUE                                                           C   120V
      WRITE (IOUT,311) (J,J=1,NBEM)                                      C   120W
      DO 118 I=1,IBSP                                                    C   120X
  118 WRITE (IOUT,331) IBEMSP(I),(BEMO(J,I),J=1,NBEM)                    C   120Y
  119 CONTINUE                                                           C   120Z
      IF (IDPTIM.LE.0) GO TO 130                                         C   121
      WRITE (IOUT,320) (J,J=1,IDPTIM)                                    C   122
      DO 120 I=1,IDEPO                                                   C   123
  120 WRITE (IOUT,340) ISPDP(I),(RDEP1(J,I),J=1,IDPTIM)                  C   124
  130 CONTINUE                                                           C   125
C                                                                        C   126
      RETURN                                                             C   127
C                                                                        C   128
C  FORMAT STATEMENTS                                                     C   129
C                                                                        C   130
  140 FORMAT (1H1 /// 42X,48HTHE FOLLOWING PHOTOLYSIS RATE CONSTANTS ARE C   131
     1 USED // 10X,8HREACTION,3X,7HSPECIES,43X,18HZENITH ANGLE (DEG) /   C   132
     2 12X,3HNO.,18X,I2,9I10 //)                                         C   133
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150 FORMAT (1H0,11X,I3,8X,A4,1X,1P,10E10.2)                                    C   134
160 FORMAT (1H1 // 40X,36A2)                                                   C   135
170 FORMAT (1H0 // 40X,40HPHOTOLYTIC RATE CONSTANTS CALCULATED FOR ///C   136
   149X,6A4 /// 40X,9HLATITUDE ,F10.3 // 40X, 9HLONGITUDE ,F10.3 //  4C   137
   20X,9HTIME ZONE,F7.1 // 40X,5HDATE ,5X,3(I4,3X) // 40X,5HTIME ,7X,IC   138
   34,3X,2HTO,3X,I4,5X,19HLOCAL DAYLIGHT TIME)                                 C   139
180 FORMAT (1H0,39X,10HSOLAR NOON,I7 / 1H0,39X,10HSUNRISE   ,I7,       C   140
   17X,10HSUNSET    ,I7)                                                       C   141
190 FORMAT (1H0 // 40X,39HDILUTION DETERMINED FROM THE FOLLOWING  // 4C   142
   10X,17HINVERSION HEIGHTS,5X,7HINITIAL,F7.0,5X,5HFINAL,4X,F7.0 // 40C   143
   2X,7HTIMING ,15X,5HSTART,F9.0,5X,4HSTOP,4X,F8.0)                            C   144
200 FORMAT (1H0,39X,55HDILUTION RATE BEFORE AND AFTER THE INVERSION CHC   145
   1ANGE WAS // 37X,1PE12.3,9H PER MIN.)                                       C   146
210 FORMAT ((1H0,39X,10HEMISSIONS ,6X,3(A4,9H FRACTION,F6.3,3X)))      C   147
220 FORMAT (/ 40X,13HSURFACE LAYER,8X,5HOZONE,F9.3,6X,11HHYDROCARBON,FC   148
   17.3,4X,3HNOX,F10.3,4H PPM)                                                 C   149
230 FORMAT (/ 40X,5HALOFT,16X,5HOZONE,F9.3,6X,11HHYDROCARBON,F7.3,4X,3C   150
   1HNOX,F10.3,4H PPM)                                                         C   151
240 FORMAT (1H0 // 40X,50HCONTINUOUS EMISSIONS (EXPRESSED AS THE FRACTC   152
   1ION OF // 40X,54HINITIAL NON-BACKGROUND CONCENTRATION EMITTED PER C   153
   2HOUR) // 40X,4HHOUR,3X,10I6 / 47X,7I6)                                     C   154
250 FORMAT (1H0,39X,8HFRACTION,10F6.3 / 48X,7F6.3)                             C   155
260 FORMAT (1H0,39X,42HTHERE ARE NO HYDROCARBONS IN THE MECHANISM)     C   156
270 FORMAT (// 40X,10HREACTIVITY)                                              C   157
280 FORMAT (1H0,39X,7HNO2/NOX,6X,F6.3)                                         C   158
290 FORMAT ((1H0,39X,13HSURFACE LAYER,8X,A4,1X,F9.3,6X,A4,5X,F9.3      C   159
   1,4X,A4,F9.3,4H PPM))                                                       C   160
300 FORMAT ((1H0,39X,13HALOFT        ,8X,A4,1X,F9.3,6X,A4,5X,F9.3      C   161
   1,4X,A4,F9.3,4H PPM))                                                       C   162
307 FORMAT (1H0,//,40X,36HTRANSPORTED BIOGENIC CONCENTRATIONS      /) C   162A
308 FORMAT ((1H0,39X,13HSURFACE LAYER,8X,A4,1X,F9.3,6X,A4,5X,F9.3      C   162B
   1,4X,A4,F9.3,4H PPM))                                                       C   162C
309 FORMAT ((1H0,39X,13HALOFT        ,8X,A4,1X,F9.3,6X,A4,5X,F9.3      C   162D
   1,4X,A4,F9.3,4H PPM))                                                       C   162E
310 FORMAT (1H0 // 40X,70HCONTINUOUS EMISSIONS (EXPRESSED AS FRACTION C   163
   1OF THE INITIAL PRECURSORS)                                                 C   164
   2     // 40X,7HSPECIES,5X,4HHOUR,5X,10I6 / 61X,10I6 / 61X,10I6)     C   165
311 FORMAT (1H0 // 40X,39HBIOGENIC EMISSIONS (IN UNITS OF PPM/HR)    , C   165A
   1     // 40X,7HSPECIES,5X,4HHOUR,5X,10I6 / 61X,10I6 / 61X,10I6)     C   165B
320 FORMAT (1H0 // 40X,58HSURFACE DEPOSITION RATES (CM/SEC)                  C   166
   1                  // 40X,14H                                              C   167
   2     // 40X,7HSPECIES,5X,4HHOUR,5X,10I6 / 61X,10I6 / 61X,10I6)     C   168
330 FORMAT (1H0,41X,A4,4X,8HFRACTION,4X,10F6.3 / 62X,10F6.3 /          C   169
   1     62X,10F6.3)                                                           C   170
331 FORMAT (1H0,41X,A4,16X,10F6.3,/,62X,10F6.3,/,62X,10F6.3)                   C   170A
340 FORMAT (1H0,41X,A4,4X,8HRATE    ,4X,10F6.3 / 62X,10F6.3 /          C   171
   1     62X,10F6.3)                                                           C   172
350 FORMAT (1H0 // 40X,58HCONTINUOUS EMISSIONS (EXPRESSED AS THE FRACTC   173
   1ION OF INITIAL // 40X,50HNON-BACKGROUND NOX CONCENTRATION EMITTED C   174
   2PER HOUR) // 45X,4HHOUR,3X,11I6 / 52X,4I6)                                 C   175
360 FORMAT (1H0 // 40X,39HDILUTION DETERMINED FROM THE FOLLOWING  // 4C   176
   10X,49HINVERSION HEIGHTS (AT THE BEGINNING OF EACH HOUR) // 40X,4HHC   177
   2OUR,9X,1H0,9I8 / 46X,10I8 / 46X,10I8)                                      C   178
370 FORMAT (1H0,39X,8HHEIGHT   ,10F8.1 / 48X,10F8.1 / 48X,10F8.1)      C   179
380 FORMAT (1H1 // 40X,26HTRANSPORTED CONCENTRATIONS )                         C   180
390 FORMAT ((1H0,39X,13HSURFACE LAYER,3X,3(A4,9H FRACTION,F6.3,3X)))   C   181
391 FORMAT (1H0//40X,  60HTHE FOLLOWING BIOGENIC SPECIES ARE TREATED AC   181A
   1S HYDROCARBONS   /40X,29H(EXPRESSED AS BOND FRACTIONS)   )                 C   181B
392 FORMAT (1H0,39X,A4,12X,3(A4,9H FRACTION,F6.3,3X),/,                        C   181C
   1 7(56X,3(A4,9H FRACTION,F6.3,3X),/))                                       C   181D
400 FORMAT ((1H0,39X,6HALOFT ,10X,3(A4,9H FRACTION,F6.3,3X)))          C   182
410 FORMAT (1H0 //40X,46HMIXING HEIGHTS (AT THE BEGINNING OF EACH HOURC   183
   1) // 40X,4HTIME,2X,10I8/46X,10I8/46X,10I8)                                 C   184
420 FORMAT (1H0,39X,6HHEIGHT,2X,10F8.1/48X,10F8.1/48X,10F8.1)          C   185
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430 FORMAT ((1H0,39X,13HBACKGROUND    ,3X,3(A4,9H FRACTION,F6.3,3X)))  C   186
440 FORMAT (/ 40X,13HBACKGROUND    ,8X,5HOZONE,F9.3,6X,11HHYDROCARBON,FC   187
   17.3,4X,3HNOX,F10.3,4H PPM)                                        C   188
450 FORMAT (1H0 // 40X,43HTEMPERATURE (AT THE BEGINNING OF EACH HOUR) C   189
   1   // 40X,4HHOUR,9X,1H0,9I8 / 46X,10I8 / 46X,10I8)               C   190
460 FORMAT (1H0,39X,8HTEMP        ,10F8.1 / 48X,10F8.1 / 48X,10F8.1)  C   191
470 FORMAT (1H0 // 40X,49HRELATIVE HUMIDITY (AT THE BEGINNING OF EACH C   191A
   1HOUR)   // 40X,4HHOUR,9X,1H0,9I8 / 46X,10I8 / 46X,10I8)          C   191B
480 FORMAT (1H0,39X,8HRH (%)      ,10F8.1 / 48X,10F8.1 / 48X,10F8.1)  C   191C
490 FORMAT (1H0 // 40X,52HWATER CONCENTRATIONS (AT THE BEGINNING OF EAC   191D
   1CH HOUR)  // 40X,4HHOUR,9X,1H0,9I8 / 46X,10I8 / 46X,10I8)        C   191E
500 FORMAT (1H0,39X,8HPPM         ,10F8.0 / 48X,10F8.0 / 48X,10F8.0)  C   191F
510 FORMAT (1H0,39X,8HPRESSURE,5X,F6.2,13H INCHES OF HG)              C   191G
520 FORMAT (1H0,39X,41HNOTE: WATER (H2O) IS NOT IN THE MECHANISM  /   C   191H
   1 40X,46H      THE SYMBOL "H2O" MUST BE USED FOR WATER. )          C   191I
    END                                                              C   192-
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      SUBROUTINE MECH                                                    D      1
      SAVE                                                               D      2
C                                                                        D      3
C  SET DEFAULT MECHANISM CONDITIONS                                      D      4
C                                                                        D      5
      COMMON /CALC/    NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),    D      6
     1                 IA(60),JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,  D     6A
     2                 TSTEP,ZENI                                        D      7
      COMMON /PHOTON/ CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20),  D      8
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),     D      9
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)        D     10
      COMMON /ZENITH/ IPZ,ZDEF(10,20),IPHZ(20),IZENP                     D     11
C                                                                        D     11A
      COMMON /CALCHR/ SPECIS(61)                                         D     11B
      COMMON /PHTCHR/ ISPNCR(10)                                         D     11C
C                                                                        D     11D
      CHARACTER*4 SPECIS                                                 D     11E
C                                                                        D     12
C  PLACE ZENITH ANGLE DEPENDENCE INTO APPROPRIATE SLOT FOR EACH REACTIOND     13
C                                                                        D     14
      DO 40 K=1,IP                                                       D     15
      DO 20 J=1,IPZ                                                      D     16
      IF (IPH(K).NE.IPHZ(J)) GO TO 20                                    D     17
      DO 10 I=1,10                                                       D     18
      PP(I,K)=ZDEF(I,J)                                                  D     19
   10 CONTINUE                                                           D     20
      GO TO 40                                                           D     21
   20 CONTINUE                                                           D     22
      DO 30 I=1,10                                                       D     23
      PP(I,K)=1.0                                                        D     24
   30 CONTINUE                                                           D     25
   40 CONTINUE                                                           D     26
C                                                                        D     27
      DO 50 I=1,IP                                                       D     28
      J=IPH(I)                                                           D     29
      RFCT(I)=A(J)                                                       D     30
   50 CONTINUE                                                           D     31
C                                                                        D     32
      RETURN                                                             D     33
      END                                                                D     34-
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      SUBROUTINE MCHSET (NX,NEPA)                                          E     1
      SAVE                                                                 E     2
C                                                                          E     3
C  READ NEW MECHANISM                                                      E     4
C                                                                          E     5
      COMMON /CALC/ NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),IA(60)   E     6
     1              ,JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENIE  E     7
      COMMON /SPEC/ NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),            E     8
     1              FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,      E     9
     2              XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                       E    10
      COMMON /HEAT/  SC(200,12),ISC(200,3)                                 E    11
      COMMON /NEED1/ IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,         E    12
     1               IIH2O,JPLUS                                           E    13
      COMMON /STORE/ AST(60)                                               E    14
      COMMON /INOUT/ IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                     E    15
      COMMON /GEAR10/ IRS(200,12)                                          E    16
      COMMON /PHOTON/ CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20),    E    17
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),        E    18
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)           E    19
C                                                                          E    19A
      COMMON /CALCHR/ SPECIS(61)                                           E    19B
      COMMON /NEED1C/ IBZA                                                 E    19C
      COMMON /PHTCHR/ ISPDP(10)                                            E    19D
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                       E    19E
C                                                                          E    19F
      CHARACTER*1 JMINUS, AST                                              E    19G
      CHARACTER*4 ISPDP                                                    E    19H
      CHARACTER*4 SPECIS, HCSPEC, PLSP, REACT                              E    19I
      CHARACTER*4 IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,            E    19J
     1            IIH2O,IBZA,JPLUS,                                        E    19K
     2            IPL, IRS, KRS, MORX                                      E    19L
C                                                                          E    19M
      DIMENSION KRS(12),SC1(12),IPL(12)                                    E    20
C                                                                          E    21
      DATA JMINUS/'-'/                                                     E    22
      ICOUNT=0                                                             E    23
      NR=0                                                                 E    24
      NS=1                                                                 E    25
      MORX=IBLANK                                                          E    26
      DO 10 I=1,200                                                        E    27
      A(I)=0.                                                              E    28
      S(I)=0.                                                              E    29
      R(I)=0.                                                              E    30
      DO 10 J=1,12                                                         E    31
      IRS(I,J)=IBLANK                                                      E    32
      IF (I.EQ.1) KRS(J)=IBLANK                                            E    33
      SC(I,J)=1.                                                           E    34
   10 KR(I,J)=0                                                            E    35
   20 NS=NS-1                                                              E    36
      WRITE (IOUT,200)                                                     E    37
   30 IF (NEPA.LE.0)                                                       E    38
     1READ (IN,150) (KRS(I),I=1,3),J,SC1(1),KRS(4),MORX,(SC1(LL-3),KRS(LE  E    39
     2L),LL=5,6),RTE,ENERGY                                                E
C                                                                          E    40
C  CHECK FOR MORE PRODUCTS                                                 E    41
C                                                                          E    42
      IF (MORX.NE.IBLANK.AND.NEPA.LE.0)                                    E    43
     1READ (IN,160) (SC1(II-3),KRS(II),II=7,12)                            E    44
      IF (NEPA.GT.0)                                                       E    45
     1READ (IN,170) J,(KRS(I),I=1,7),RTE,ENERGY                            E    46
      IF (NEPA.GT.0) GO TO 50                                              E    47
      IF (MORX.NE.IBLANK) GO TO 50                                         E    48
      DO 40 II=7,12                                                        E    49
      SC1(II-3)=1.                                                         E    50
                                                                           E    51
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      KRS(II)=IBLANK                                                    E    52
   40 CONTINUE                                                          E    53
   50 DO 60 II=1,12                                                     E    54
   60 IRS(J,II)=KRS(II)                                                 E    55
      A(J)=RTE                                                          E    56
      S(J)=ENERGY                                                       E    57
      DO 70 II=4,12                                                     E    58
   70 SC(J,II)=SC1(II-3)                                                E    59
   80 DO 90 I=1,12                                                      E    60
   90 IF (ABS(SC(J,I)).EQ.0.) SC(J,I)=1.                                E    61
      DO 120 K=1,12                                                     E    62
      NL=K*5                                                            E    63
      NF=NL-4                                                           E    64
      DO 100 LK=NF,NL                                                   E    65
  100 AST(LK)=IBLANK                                                    E    66
      IPL(K)=IBLANK                                                     E    67
      IF (IRS(J,K).EQ.IBLANK) GO TO 110                                 E    68
      IPL(K)=JPLUS                                                      E    69
      IF (K.EQ.1.OR.K.EQ.4) IPL(K)=IBLANK                               E    70
      IF (SC(J,K).LT.0.) IPL(K)=JMINUS                                  E    71
  110 KK = K                                                            E    72
      IF (IRS(J,K).NE.IBLANK) CALL VALU (SC(J,K),NF,NL)                 E    73
  120 CONTINUE                                                          E    74
      ICOUNT=ICOUNT+2                                                   E    75
      IF (IRS(J,8).NE.IBLANK) ICOUNT=ICOUNT+1                           E    76
      IF (IRS(J,12).NE.IBLANK) ICOUNT=ICOUNT+1                          E    77
      IF (ICOUNT.GT.50) WRITE (IOUT,200)                                E    78
      IF (ICOUNT.GT.50) ICOUNT=2                                        E    79
      WRITE (IOUT,180)                                                  E    80
     1           J,IPL(1),(AST(I),I=1,5),IRS(J,1),IPL(2),(AST(I),I=6,10)E    81
     2,IRS(J,2),IPL(3),(AST(I),I=11,15),IRS(J,3),IPL(4),(AST(I),I=16,20)E    82
     3,IRS(J,4),IPL(5),(AST(I),I=21,25),IRS(J,5),IPL(6),(AST(I),I=26,30)E    83
     4,IRS(J,6),IPL(7),(AST(I),I=31,35),IRS(J,7),A(J),S(J)              E    84
      IF (MORX .NE. IBLANK)                                             E    85
     1 WRITE (IOUT,190) IPL(8),(AST(I),I=36,40),                        E    86
     2 IRS(J,8),IPL(9),(AST(I),I=41,45),IRS(J,9),                       E    87
     3 IPL(10),(AST(I),I=46,50),IRS(J,10),                              E    88
     4 IPL(11),(AST(I),I=51,55),IRS(J,11)                               E    89
      IF (MORX.NE.IBLANK.AND.IRS(J,12).NE.IBLANK)                       E    90
     1WRITE (IOUT,190) IPL(12),(AST(I),I=56,60),IRS(J,12)               E    91
      KR(J,1)=100                                                       E    92
      IF (IP.EQ.0) GO TO 140                                            E    93
      DO 130 I=1,IP                                                     E    94
      IF (J.NE.IPH(I)) GO TO 130                                        E    95
      RFCT(I)=A(J)                                                      E    96
      GO TO 140                                                         E    97
  130 CONTINUE                                                          E    98
  140 IF (J.GT.NR) NR=J                                                 E    99
      IF (J.NE.NX) GO TO 30                                             E   100
      CALL MATRX                                                        E   101
      RETURN                                                            E   102
C                                                                       E   103
  150 FORMAT (2(A4,2X),A4,I3,F5.1,A4,A1,1X,2(F5.0,1X,A4,2X),F10.2,1X,F7.E   104
     12)                                                                E   105
  160 FORMAT (6(F5.0,1X,A4,2X))                                         E   106
  170 FORMAT (I3,2X,7(A4,1X),2F10.2)                                    E   107
  180 FORMAT (/2X,I3,1X,3(A1,5A1,1X,A4,2X),1H=,1X,3(A1,5A1,1X,A4,2X),   E   108
     1A1,5A1,1X,A4,3X,1PE11.3,2X,E13.3)                                 E   109
  190 FORMAT (45X,2X,4(A1,5A1,1X,A4,2X))                                E   110
  200 FORMAT (1H1////1H0,14H THE REACTIONS,86X,13HRATE CONSTANT,2X,15HACE   111
     1T. ENERGY(K)  )                                                   E   112
      END                                                               E   113-
```

```
      KRS(II)=IBLANK                                                                    E     52
   40 CONTINUE                                                                          E     53
   50 DO 60 II=1,12                                                                     E     54
   60 IRS(J,II)=KRS(II)                                                                 E     55
      A(J)=RTE                                                                          E     56
      S(J)=ENERGY                                                                       E     57
      DO 70 II=4,12                                                                     E     58
   70 SC(J,II)=SC1(II-3)                                                                E     59
   80 DO 90 I=1,12                                                                      E     60
   90 IF (ABS(SC(J,I)).EQ.0.) SC(J,I)=1.                                                E     61
      DO 120 K=1,12                                                                     E     62
      NL=K*5                                                                            E     63
      NF=NL-4                                                                           E     64
      DO 100 LK=NF,NL                                                                   E     65
  100 AST(LK)=IBLANK                                                                    E     66
      IPL(K)=IBLANK                                                                     E     67
      IF (IRS(J,K).EQ.IBLANK) GO TO 110                                                 E     68
      IPL(K)=JPLUS                                                                      E     69
      IF (K.EQ.1.OR.K.EQ.4) IPL(K)=IBLANK                                               E     70
      IF (SC(J,K).LT.0.) IPL(K)=JMINUS                                                  E     71
  110 KK = K                                                                            E     72
      IF (IRS(J,K).NE.IBLANK) CALL VALU (SC(J,K),NF,NL)                                 E     73
  120 CONTINUE                                                                          E     74
      ICOUNT=ICOUNT+2                                                                   E     75
      IF (IRS(J,8).NE.IBLANK) ICOUNT=ICOUNT+1                                           E     76
      IF (IRS(J,12).NE.IBLANK) ICOUNT=ICOUNT+1                                          E     77
      IF (ICOUNT.GT.50) WRITE (IOUT,200)                                                E     78
      IF (ICOUNT.GT.50) ICOUNT=2                                                        E     79
      WRITE (IOUT,180)                                                                  E     80
     1          J,IPL(1),(AST(I),I=1,5),IRS(J,1),IPL(2),(AST(I),I=6,10)                E     81
     2,IRS(J,2),IPL(3),(AST(I),I=11,15),IRS(J,3),IPL(4),(AST(I),I=16,20)                E     82
     3,IRS(J,4),IPL(5),(AST(I),I=21,25),IRS(J,5),IPL(6),(AST(I),I=26,30)                E     83
     4,IRS(J,6),IPL(7),(AST(I),I=31,35),IRS(J,7),A(J),S(J)                              E     84
      IF (MORX .NE. IBLANK)                                                             E     85
     1 WRITE (IOUT,190) IPL(8),(AST(I),I=36,40),                                        E     86
     2 IRS(J,8),IPL(9),(AST(I),I=41,45),IRS(J,9),                                       E     87
     3 IPL(10),(AST(I),I=46,50),IRS(J,10),                                              E     88
     4 IPL(11),(AST(I),I=51,55),IRS(J,11)                                               E     89
      IF (MORX.NE.IBLANK.AND.IRS(J,12).NE.IBLANK)                                       E     90
     1WRITE (IOUT,190) IPL(12),(AST(I),I=56,60),IRS(J,12)                               E     91
      KR(J,1)=100                                                                       E     92
      IF (IP.EQ.0) GO TO 140                                                            E     93
      DO 130 I=1,IP                                                                     E     94
      IF (J.NE.IPH(I)) GO TO 130                                                        E     95
      RFCT(I)=A(J)                                                                      E     96
      GO TO 140                                                                         E     97
  130 CONTINUE                                                                          E     98
  140 IF (J.GT.NR) NR=J                                                                 E     99
      IF (J.NE.NX) GO TO 30                                                             E    100
      CALL MATRX                                                                        E    101
      RETURN                                                                            E    102
C                                                                                       E    103
  150 FORMAT (2(A4,2X),A4,I3,F5.1,A4,A1,1X,2(F5.0,1X,A4,2X),F10.2,1X,F7.E    104
     12)
  160 FORMAT (6(F5.0,1X,A4,2X))                                                         E    105
  170 FORMAT (I3,2X,7(A4,1X),2F10.2)                                                    E    106
  180 FORMAT (/2X,I3,1X,3(A1,5A1,1X,A4,2X),1H=,1X,3(A1,5A1,1X,A4,2X),                   E    107
     1A1,5A1,1X,A4,3X,1PE11.3,2X,E13.3)                                                 E    108
  190 FORMAT (45X,2X,4(A1,5A1,1X,A4,2X))                                                E    109
  200 FORMAT (1H1////1H0,14H THE REACTIONS,86X,13HRATE CONSTANT,2X,15HACE    110
     1T. ENERGY(K)  )                                                                   E    111
      END                                                                               E    112
                                                                                        E    113-
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      SUBROUTINE MATRX                                                  F     1
      SAVE                                                              F     2
C                                                                       F     3
C  SET UP THE INTERNAL ARRAY FOR THE CURRENT CHEMICAL MECHANISM         F     4
C                                                                       F     5
      COMMON /CALC/ NR,IR(200,12),A(200),S(200),R(200),ITYPE(200),IA(60)F     6
     1,             JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENI F     7
      COMMON /SPEC/  NS,CARB(20),RCTY(20),XNF(2),IH(20),                F     8
     1               INOX(2),FINHC(20),FALHC(20),NHC,OZIN,OZAL,         F     9
     2               HCIN,HCAL,XNIN,XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)    F    10
      COMMON /GEAR1/ TTDUM(5),UROUND,NNDUM(4)                           F    11
      COMMON /HEAT/  SC(200,12),ISC(200,3)                              F    12
      COMMON /NEED1/ IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,      F    13
     1               IIH2O,JPLUS                                        F    14
      COMMON /STORE/ AST(60)                                            F    15
      COMMON /GEAR10/ KR(200,12)                                        F    16
C                                                                       F    16A
      COMMON /CALCHR/ SPECIS(61)                                        F    16B
      COMMON /NEED1C/ IBZA                                              F    16C
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                    F    16D
C                                                                       F    16E
      CHARACTER*1 AST                                                   F    16F
      CHARACTER*4 SPECIS, HCSPEC, PLSP, REACT                           F    16G
      CHARACTER*4 IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,         F    16H
     1            IIH2O, IBZA,JPLUS,                                    F    16I
     2            KR, KCHR                                              F    16J
C                                                                       F    17
      NOLD=NS+1                                                         F    18
      DO 170 I=1,NR                                                     F    19
C                                                                       F    20
C     SKIP REACTIONS ALREADY PROCESSED                                  F    21
C                                                                       F    22
      IF (IR(I,2).EQ.NOLD.OR.IR(I,3).EQ.NOLD) IR(I,3)=99                F    23
      IF (IR(I,2).EQ.NOLD) IR(I,2)=0                                    F    24
      IF (IR(I,1).EQ.NOLD) IR(I,1)=99                                   F    25
      IF (IR(I,1).EQ.NOLD) IR(I,3)=99                                   F    26
      IF (IABS(IR(I,1)).NE.100) GO TO 170                               F    27
C                                                                       F    28
C     ZERO OUT REACTIONS                                                F    29
C                                                                       F    30
      DO 10 J=2,12                                                      F    31
   10 IR(I,J) = 0                                                       F    32
C                                                                       F    33
C     IF LESS THAN THREE REACTANTS, FILL FIRST SLOTS.                   F    34
C                                                                       F    35
      IF (KR(I,1).NE.IBLANK) GO TO 20                                   F    36
      IF (KR(I,3).NE.IBLANK) KR(I,1)=KR(I,3)                            F    37
      IF (KR(I,3).NE.IBLANK) SC(I,1)=SC(I,3)                            F    38
      SC(I,3)=1.                                                        F    39
      KR(I,3)=IBLANK                                                    F    40
      IF (KR(I,1).NE.IBLANK) GO TO 20                                   F    41
      KR(I,1)=KR(I,2)                                                   F    42
      KR(I,2)=IBLANK                                                    F    43
      SC(I,1)=SC(I,2)                                                   F    44
      SC(I,2)=1.                                                        F    45
   20 IF (KR(I,2).NE.IBLANK) GO TO 30                                   F    46
      IF (KR(I,3).NE.IBLANK) SC(I,2)=SC(I,3)                            F    47
      SC(I,3)=1.                                                        F    48
      IF (KR(I,3).NE.IBLANK) KR(I,2)=KR(I,3)                            F    49
      KR(I,3)=IBLANK                                                    F    50
   30 DO 40 K=4,12                                                      F    51
C                                                                       F    52
C     GET RID OF M AS A PRODUCT                                         F    53
C                                                                       F    54
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      IF (KR(I,K).EQ.MBLANK) KR(I,K)=IBLANK                              F     55
   40 CONTINUE                                                           F     56
C                                                                        F     57
C     IF LESS THAN FOUR PRODUCTS, FILL FIRST SLOTS.                      F     58
C                                                                        F     59
      DO 60 K=4,11                                                       F     60
         IF (KR(I,K) .NE. IBLANK) GO TO 60                               F     61
         DO 50 KK=K,11                                                   F     62
            KKK = KK + 1                                                 F     63
            SC(I,KK) = SC(I,KKK)                                         F     64
            KR(I,KK) = KR(I,KKK)                                         F     65
   50    CONTINUE                                                        F     66
         KR(I,12) = IBLANK                                               F     67
         SC(I,12) = 1.0                                                  F     68
   60 CONTINUE                                                           F     69
C                                                                        F     70
   70 DO 160 J=1,12                                                      F     71
      KCHR=KR(I,J)                                                       F     72
C                                                                        F     73
C     PROCESS REACTANTS HERE                                             F     74
C                                                                        F     75
      IF (J.GT.3) GO TO 120                                              F     76
C                                                                        F     77
C     ALL M DEPENDENT REACTIONS ARE TO HAVE A 99 IN THE THIRD SLOT       F     78
C                                                                        F     79
      IF (KCHR.NE.MBLANK) GO TO 110                                      F     80
      GO TO (80,90,100),J                                                F     81
   80 KR(I,1)=KR(I,2)                                                    F     82
      SC(I,1)=SC(I,2)                                                    F     83
   90 KR(I,2)=KR(I,3)                                                    F     84
      SC(I,2)=SC(I,3)                                                    F     85
      SC(I,3)=1.                                                         F     86
      KR(I,3)=MBLANK                                                     F     87
  100 IR(I,3)=99                                                         F     88
  110 KCHR=KR(I,J)                                                       F     89
C                                                                        F     90
C     ZERO ORDER REACTIONS HAVE 99 IN FIRST SLOT                         F     91
C                                                                        F     92
      IF (KR(I,1).EQ.IBLANK) IR(I,1)=99                                  F     93
      IF (KR(I,1).EQ.IBLANK) KCHR='99'                                   F     94
C                                                                        F     95
C     ALL BLANKS ARE SET EQUAL TO ZERO                                   F     96
C                                                                        F     97
      IF (J.EQ.3.AND.KCHR.EQ.MBLANK) KCHR='99'                           F     98
  120 IF (KCHR.EQ.MBLANK.OR.KCHR.EQ.IBLANK) IR(I,J)=0                    F     99
      IF (KCHR.EQ.IBLANK.OR.KCHR.EQ.'99') GO TO 160                      F    100
      IF (NS.NE.0) GO TO 130                                             F    101
      NS=1                                                               F    102
      GO TO 150                                                          F    103
  130 DO 140 L=1,NS                                                      F    104
      IF (KCHR.NE.SPECIS(L)) GO TO 140                                   F    105
C                                                                        F    106
C     SLOT SET TO SPECIES NUMBER                                         F    107
C                                                                        F    108
      IR(I,J)=L                                                          F    109
      GO TO 160                                                          F    110
  140 CONTINUE                                                           F    111
C                                                                        F    112
C     IF NO SPECIES ARE FOUND, ADD ONE TO THE LIST                       F    113
C                                                                        F    114
      IF (SPECIS(NS).NE.MBLANK) NS=NS+1                                  F    115
  150 SPECIS(NS)=KCHR                                                    F    116
      C(NS+1)=C(NS)                                                      F    117
      C(NS)=0.                                                           F    118
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      IR(I,J)=NS                                                        F   119
  160 CONTINUE                                                          F   120
  170 CONTINUE                                                          F   121
      IF (SPECIS(NS).NE.MBLANK) NS=NS+1                                 F   122
      SPECIS(NS)=MBLANK                                                 F   123
      DO 180 IK=1,NR                                                    F   124
      DO 180 MT=1,3                                                     F   125
      J=IFIX(SC(IK,MT)+UROUND)                                          F   126
      ISC(IK,MT)=J                                                      F   127
  180 IF (SC(IK,MT)-FLOAT(J).GT.4.*UROUND) ISC(IK,MT)=-1                F   128
      RETURN                                                            F   129
      END                                                               F   130
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      SUBROUTINE MCHWRT                                                  G     1
      SAVE                                                               G     2
C                                                                        G     3
C  WRITE THE CURRENT MECHANISM TO OUTPUT FILE                            G     4
C                                                                        G     5
      COMMON /CALC/ NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),IA(60) G     6
     1,             JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENI G     7
      COMMON /SPEC/   NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),        G     8
     1                FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,  G     9
     2                XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                   G    10
      COMMON /HEAT/   SC(200,12),ISC(200,3)                              G    11
      COMMON /NEED1/  IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,      G    12
     1                IIH2O,JPLUS                                        G    13
      COMMON /STORE/  AST(60)                                            G    14
      COMMON /INOUT/  IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                  G    15
      COMMON /PHOTON/ CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20),  G    16
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),      G    17
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)         G    18
C                                                                        G    18A
      COMMON /CALCHR/ SPECIS(61)                                         G    18B
      COMMON /NEED1C/ IBZA                                               G    18C
      COMMON /PHTCHR/ ISPDP(10)                                          G    18D
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                     G    18E
C                                                                        G    18F
      CHARACTER*1 JMINUS, AST                                            G    18G
      CHARACTER*4 ISPDP                                                  G    18H
      CHARACTER*4 SPECIS, HCSPEC, PLSP, REACT                            G    18I
      CHARACTER*4 IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,          G    18J
     1            IIH2O,IBZA,JPLUS,                                      G    18K
     2            KRS, IPL                                               G    18L
C                                                                        G    18M
      DIMENSION KRS(12),IPL(12)                                          G    19
C                                                                        G    20
      DATA JMINUS/'-'/                                                   G    21
C                                                                        G    22
      ICOUNT=0                                                           G    23
      WRITE (IOUT,110)                                                   G    24
      DO 50 J=1,NR                                                       G    25
      IR=KR(J,1)                                                         G    26
      IF (IR.EQ.0.OR.A(J).EQ.0.) GO TO 50                                G    27
      DO 10 I=1,12                                                       G    28
      II=KR(J,I)                                                         G    29
      IF (II.GT.0) KRS(I)=SPECIS(II)                                     G    30
      IF (II.LE.0) KRS(I)=IBLANK                                         G    31
   10 CONTINUE                                                           G    32
C                                                                        G    33
      DO 40 K=1,12                                                       G    34
      NL=K*5                                                             G    35
      NF=NL-4                                                            G    36
      DO 20 LK=NF,NL                                                     G    37
   20 AST(LK)=IBLANK                                                     G    38
      IPL(K)=IBLANK                                                      G    39
      IF (KRS(K).EQ.IBLANK) GO TO 30                                     G    40
      IPL(K)=JPLUS                                                       G    41
      IF (K.EQ.1.OR.K.EQ.4) IPL(K)=IBLANK                                G    42
      IF (SC(J,K).LT.0.) IPL(K)=JMINUS                                   G    43
   30 KK = K                                                             G    44
      IF (KRS(K).NE.IBLANK) CALL VALU (SC(J,K),NF,NL)                    G    45
   40 CONTINUE                                                           G    46
      ICOUNT=ICOUNT+2                                                    G    47
      IF (KRS(8).NE.IBLANK) ICOUNT=ICOUNT+1                              G    48
      IF (KRS(12).NE.IBLANK) ICOUNT=ICOUNT+1                             G    49
      IF (ICOUNT.GT.50) WRITE (IOUT,110)                                 G    50
      IF (ICOUNT.GT.50) ICOUNT=2                                         G    51
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      WRITE (IOUT,90)                                                    G     52
     1          J,IPL(1),(AST(I),I=1,5),KRS(1),IPL(2),(AST(I),I=6,10),  G     53
     2KRS(2),IPL(3),(AST(I),I=11,15),KRS(3),IPL(4),(AST(I),I=16,20),    G     54
     3KRS(4),IPL(5),(AST(I),I=21,25),KRS(5),IPL(6),(AST(I),I=26,30),    G     55
     4KRS(6),IPL(7),(AST(I),I=31,35),KRS(7),A(J),S(J)                   G     56
      IF (KRS(8) .NE. IBLANK)                                           G     57
     1 WRITE (IOUT,100) IPL(8),(AST(I),I=36,40),                        G     58
     2 KRS(8),IPL(9),(AST(I),I=41,45),KRS(9),                           G     59
     3 IPL(10),(AST(I),I=46,50),KRS(10),                                G     60
     4 IPL(11),(AST(I),I=51,55),KRS(11)                                 G     61
      IF (KRS(12).NE.IBLANK)                                            G     62
     1WRITE (IOUT,100) IPL(12),(AST(I),I=56,60),KRS(12)                 G     63
   50 CONTINUE                                                          G     64
      RETURN                                                            G     65
C                                                                       G     66
   60 FORMAT (2(A4,2X),A4,I3,F5.1,A4,A1,1X,2(F5.0,1X,A4,2X),F10.2,1X,F7.G     67
     12)                                                                G     68
   70 FORMAT (6(F5.0,1X,A4,2X))                                         G     69
   80 FORMAT (I3,2X,7(A4,1X),2F10.2)                                    G     70
   90 FORMAT (/2X,I3,1X,3(A1,5A1,1X,A4,2X),1H=,1X,3(A1,5A1,1X,A4,2X),   G     71
     1A1,5A1,1X,A4,3X,1PE11.3,2X,E13.3)                                 G     72
  100 FORMAT (45X,2X,4(A1,5A1,1X,A4,2X))                                G     73
  110 FORMAT (1H1////1H0,14H THE REACTIONS,86X,13HRATE CONSTANT,2X,15HACG     74
     1T. ENERGY(K)   )                                                  G     75
      END                                                               G     76-
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      SUBROUTINE MIXST                                                  H     1
      SAVE                                                              H     2
C                                                                       H     3
C  SETUP MIXING HEIGHTS BASED ON MORNING AND AFTERNOON VALUES           H     4
C                                                                       H     5
      COMMON /SUNLIT/ Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,     H     6
     1                ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),     H     7
     2                XZ(24),K(24),JSTRT,JSTOP,PSPEC,MNLM,MXLM,MAXL,MAXJH     8
      COMMON /CNTRL/  SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN, H     9
     1                FLST,TLST                                        H    10
      COMMON /MIXING/ DSTRT,DEND,A(5),B(5),C(5),FD(6),Y(6),AMIX(26),DL, H    11
     1                TTMAX,SRISE,HMIN,DELH,TDIL,NMIX,HTT,SSET,SSRISE  H    12
      INTEGER PSPEC                                                     H    13
C                                                                       H    14
C --- DETERMINE TIME OF SUNRISE (STANDARD TIME)                         H    15
C                                                                       H    16
      T=400.                                                            H    17
   10 CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                             H    18
      IF(D.GE.1.) GO TO 20                                              H    19
      T=CLOCK(T,5)                                                      H    20
      GO TO 10                                                          H    21
C                                                                       H    22
C --- CONVERT SUNRISE TO LOCAL DAYLIGHT TIME                            H    23
C                                                                       H    24
   20 TSR=T                                                             H    25
      IF(TSR.LT.0600.) TSR=0600.                                        H    26
C                                                                       H    27
C --- DETERMINE SOLAR DECLINATION AND DAY LENGTH                        H    28
C                                                                       H    29
      CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,1200.,D,1)                         H    30
      D=D*3.14159/180.                                                  H    31
      ARG1=-TAN(0.67399)*TAN(D)                                         H    32
      DL=ACOS(ARG1)/3.14159*1440.                                       H    33
      IDL=DL                                                            H    34
      TSS=CLOCK(TSR,IDL)                                                H    35
C                                                                       H    36
C --- COMPUTE TIME MAXIMUM HEIGHT IS REACHED                            H    37
C                                                                       H    38
      TMAX=.70*DL                                                       H    39
      ITMAX=TMAX                                                        H    40
      TTMAX=CLOCK(TSR,ITMAX)                                            H    41
C                                                                       H    42
C --- CONVERT ALL 2400 HOUR TIMES TO MINUTES AFTER SUNRISE              H    43
C                                                                       H    44
      SRISE=(FLOAT(IFIX(TSR/100.))*60.)+                                H    45
     1 (TSR-(FLOAT(IFIX(TSR/100.))*100.))                               H    46
      DDSTRT=(FLOAT(IFIX(DSTRT/100.))*60.)+                             H    47
     1 (DSTRT-(FLOAT(IFIX(DSTRT/100.))*100.))                           H    48
      DDEND=(FLOAT(IFIX(DEND/100.))*60.)+                               H    49
     1 (DEND-(FLOAT(IFIX(DEND/100.))*100.))                             H    50
      DDSTRT=DDSTRT-SRISE                                               H    51
      DDEND=DDEND-SRISE                                                 H    52
C                                                                       H    53
C --- COMPUTE HMIN AND DELTA HEIGHT                                     H    54
C                                                                       H    55
      FD1=DDSTRT/DL                                                     H    56
      FD2=DDEND/DL                                                      H    57
      DO 30 J=1,5                                                       H    58
      IF(FD1.GE.FD(J).AND.FD1.LT.FD(J+1)) II=J                          H    59
      IF(FD2.GE.FD(J).AND.FD2.LT.FD(J+1)) JJ=J                          H    60
      J1=JJ                                                             H    61
   30 CONTINUE                                                          H    62
      IF(FD1.GE.0.0) GO TO 40                                           H    63
      FD1=0.0                                                           H    64
```

```
      II=1                                                                  H     65
   40 IF(FD2.LT.0.70) GO TO 50                                              H     66
      FD2=.7                                                                H     67
      JJ=6                                                                  H     68
      J1=5                                                                  H     69
   50 CONTINUE                                                              H     70
      X=FD1-FD(II)                                                          H     71
      XX=FD2-FD(JJ)                                                         H     72
      FG1=((A(II)*X+B(II))*X+C(II))*X+Y(II)                                 H     73
      FG2=((A(J1)*XX+B(J1))*XX+C(J1))*XX+Y(JJ)                              H     74
      DELH=(Z2-Z1)/(FG2-FG1)                                                H     75
      HMIN=Z1-FG1*DELH                                                      H     76
      HMAX=HMIN+DELH                                                        H     77
C                                                                           H     78
C --- COMPUTE MIXING HEIGHTS AT HOURLY INTERVALS                            H     79
C                                                                           H     80
      NMIX=0                                                                H     81
      JJSTP=JSTOP-100                                                       H     82
      IT=JSTRT/100                                                          H     83
      T=IT*100                                                              H     84
      IF (DEND.GT.TTMAX) DEND=TTMAX                                         H     85
      DO 110 J=1,26                                                         H     86
      IF(T.LT.DSTRT) GO TO 80                                               H     87
      IF(T.GE.DEND) GO TO 90                                                H     88
      TT=(FLOAT(IFIX(T/100.))*60.)+(T-(FLOAT(IFIX(T/100.)))*100.)           H     89
      TT=TT-SRISE                                                           H     90
      FDT=TT/DL                                                             H     91
      IF(FDT.LT.0.0) FDT=0.0                                                H     92
      KK=0                                                                  H     93
   60 KK=KK+1                                                               H     94
      IF(FDT.GE.FD(KK).AND.FDT.LT.FD(KK+1)) GO TO 70                        H     95
      IF(KK.LT.5) GO TO 60                                                  H     96
      IF(FDT.GE.FD(6)) GO TO 90                                             H     97
   70 CONTINUE                                                              H     98
      X=FDT-FD(KK)                                                          H     99
      FG=((A(KK)*X+B(KK))*X +C(KK))*X+Y(KK)                                 H    100
      AMIX(J)=HMIN+FG*DELH                                                  H    101
      NMIX=NMIX+1                                                           H    102
      IF (T.GE.FLOAT(JJSTP)) GO TO 120                                      H    103
      GO TO 100                                                             H    104
   80 AMIX(J)=Z1                                                            H    105
      NMIX=NMIX+1                                                           H    106
      GO TO 100                                                             H    107
   90 AMIX(J)=Z2                                                            H    108
      NMIX=NMIX+1                                                           H    109
  100 CONTINUE                                                              H    110
      T=T+100.                                                              H    111
  110 CONTINUE                                                              H    112
  120 CONTINUE                                                              H    113
      IF(DEND.GT.TTMAX) DEND=TTMAX                                          H    114
      RETURN                                                                H    115
      END                                                                   H    116-
```

```
      SUBROUTINE RATES (C,N)                                                    I     1
      SAVE                                                                      I     2
C                                                                               I     3
C  SETUP RATE CONSTANTS FOR THE CURRENT CHEMICAL MECHANISM                      I     4
C                                                                               I     5
      COMMON /CALC/ NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),IA(60)        I     6
     1,             JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENI       I     7
      COMMON /SPEC/ NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),                 I     8
     1              FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,          I     9
     2              XNAL,NOZ,FENX(2),CR(61),NI,KOZ(5)                          I    10
C                                                                               I    10A
      COMMON /CALCHR/ SPECIS(61)                                                I    10B
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                            I    10C
C                                                                               I    10D
      DIMENSION C(1)                                                            I    11
      DIMENSION SIG(61)                                                         I    12
C                                                                               I    12A
      CHARACTER*4 SPECIS, REACT, HCSPEC, PLSP                                   I    13
C                                                                               I    13A
      FCT=(1./298.)-(1./TEMP)                                                   I    14
      DO 10 I=1,51                                                              I    15
   10 SIG(I)=0.                                                                 I    16
      IF (N.LE.0) GO TO 40                                                      I    17
      DO 30 I=1,N                                                               I    18
      DO 20 J=1,NS                                                              I    19
      IF (SPECIS(J).EQ.REACT(I)) SIG(J)=C(I)                                    I    20
      IF (SPECIS(J).EQ.REACT(I)) GO TO 30                                       I    21
   20 CONTINUE                                                                  I    22
      SIG(NS+1)=SIG(NS+1)+C(I)                                                  I    23
   30 CONTINUE                                                                  I    24
   40 N=NS                                                                      I    25
      M=N-1                                                                     I    26
      C(N)=0.                                                                   I    27
      DO 50 I=1,M                                                               I    28
      C(N)=C(N)+SIG(I)                                                          I    29
   50 C(I)=SIG(I)                                                               I    30
      BK=0.                                                                     I    31
      C(N)=C(N)+SIG(NS+1)                                                       I    32
      IF (SIG(N).NE.0.) BK=SIG(N)-C(N)                                          I    33
      IF (SIG(N).NE.0.) C(N)=SIG(N)                                             I    34
      NP=0                                                                      I    35
      DO 70 I=1,NR                                                              I    36
      IF (KR(I,1).EQ.0) GO TO 70                                                I    37
      ITYPE(I)=2                                                                I    38
      IF (KR(I,1).EQ.99.AND.KR(I,3).EQ.99) KR(I,1)=N                            I    39
      IF (KR(I,1).EQ.N.AND.KR(I,3).EQ.99) KR(I,3)=0                             I    40
      IF (KR(I,2).EQ.0.AND.KR(I,3).EQ.99) KR(I,2)=N                             I    41
      IF (KR(I,2).EQ.N.AND.KR(I,3).EQ.99) KR(I,3)=0                             I    42
      IF (KR(I,2).EQ.0) ITYPE(I)=1                                              I    43
      IF (KR(I,3).NE.0) ITYPE(I)=3                                              I    44
      IF (KR(I,3).EQ.99) KR(I,3)=N                                              I    45
      DO 60 J=4,12                                                              I    46
      IF (KR(I,J).LT.0) KR(I,J)=-KR(I,J)                                        I    47
   60 CONTINUE                                                                  I    48
      IF (ABS(S(I)).EQ.0.) R(I)=A(I)                                            I    49
      IF (ABS(S(I)).NE.0.) R(I)=A(I)*EXP(S(I)*FCT)                              I    50
   70 CONTINUE                                                                  I    51
      RETURN                                                                    I    52
      END                                                                       I    53-
```

```
      SUBROUTINE SPARS (IA,JA,N)                                          J     1
      SAVE                                                                J     2
C                                                                         J     3
C  SETUP INTERNAL GEAR POINTER VECTOR                                     J     4
C                                                                         J     5
      COMMON /CALC/ NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),IB(60)  J     6
     1,             JB(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENI J     7
      COMMON /SPEC/ NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),           J     8
     1              FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,     J     9
     2              XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                      J    10
C                                                                         J    10A
      COMMON /CALCHR/ SPECIS(61)                                          J    10B
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                      J    10C
C                                                                         J    10D
      CHARACTER*4 SPECIS, HCSPEC, PLSP, REACT                             J    10E
C                                                                         J    10F
      DIMENSION IA(N), JA(N)                                              J    11
      DO 10 I=1,N                                                         J    12
   10 IA(I)=1                                                             J    13
      KT=0                                                                J    14
      IA(N+1)=1                                                           J    15
      JA(1)=0                                                             J    16
      DO 140 IR=1,NR                                                      J    17
      IF (KR(IR,1).EQ.0.OR.KR(IR,1).EQ.99) GO TO 140                      J    18
      MT=ITYPE(IR)                                                        J    19
      DO 130 K=1,MT                                                       J    20
      I=KR(IR,K)                                                          J    21
      DO 60 L=1,MT                                                        J    22
      J=KR(IR,L)                                                          J    23
      K1=IA(J)                                                            J    24
      K2=IA(J+1)-1                                                        J    25
      IF (K1.GT.K2) GO TO 30                                              J    26
      DO 20 M=K1,K2                                                       J    27
      IF (I.EQ.JA(M)) GO TO 60                                            J    28
   20 CONTINUE                                                            J    29
   30 DO 40 M=J,N                                                         J    30
   40 IA(M+1)=IA(M+1)+1                                                   J    31
      KT=KT+1                                                             J    32
      KD=KT-K2                                                            J    33
      K2=K2+1                                                             J    34
      DO 50 M=1,KD                                                        J    35
         KTM = KT-M                                                       J    36
         JA(KTM+2) = JA(KTM+1)                                            J    37
   50 CONTINUE                                                            J    38
      JA(K2)=I                                                            J    39
   60 CONTINUE                                                            J    40
      K1=IA(I)                                                            J    41
      DO 120 L=4,12                                                       J    42
      K2=IA(I+1)-1                                                        J    43
      J=KR(IR,L)                                                          J    44
      IF (J) 120,130,70                                                   J    45
   70 IF (K1.GT.K2) GO TO 90                                              J    46
      DO 80 M=K1,K2                                                       J    47
      IF (J.EQ.JA(M)) GO TO 120                                           J    48
   80 CONTINUE                                                            J    49
   90 DO 100 M=I,N                                                        J    50
  100 IA(M+1)=IA(M+1)+1                                                   J    51
      KT=KT+1                                                             J    52
      KD=KT-K2                                                            J    53
      K2=K2+1                                                             J    54
      DO 110 M=1,KD                                                       J    55
         KTM = KT-M                                                       J    56
         JA(KTM+2) = JA(KTM+1)                                            J    57
  110 CONTINUE                                                            J    58
```

```
      JA(K2)=J                                                          J     59
  120 CONTINUE                                                          J     60
  130 CONTINUE                                                          J     61
  140 CONTINUE                                                          J     62
      DO 160 I=1,N                                                      J     63
      K1=IA(I)+1                                                        J     64
      K2=IA(I+1)-1                                                      J     65
      IF (K1.GT.K2) GO TO 160                                           J     66
      MT=K2-K1+1                                                        J     67
      DO 150 K=1,MT                                                     J     68
      DO 150 M=K1,K2                                                    J     69
      IF (JA(M).GT.JA(M-1)) GO TO 150                                   J     70
      J=JA(M-1)                                                         J     71
      JA(M-1)=JA(M)                                                     J     72
      JA(M)=J                                                           J     73
  150 CONTINUE                                                          J     74
  160 CONTINUE                                                          J     75
      M=N                                                               J     76
      DO 190 I=1,M                                                      J     77
      IF(IA(I+1).GT.IA(I)) GO TO 190                                    J     78
      NM=I+1                                                            J     79
      NN=N+1                                                            J     80
      KMIN=IA(NM)                                                       J     81
      KMAX=IA(NN)                                                       J     82
      DO 170 J=KMIN,KMAX                                                J     83
      KM=KMAX+KMIN-J                                                    J     84
  170 JA(KM)=JA(KM-1)                                                   J     85
      KNOW=IA(I)                                                        J     86
      JA(KNOW)=I                                                        J     87
      DO 180 LL=NM,NN                                                   J     88
  180 IA(LL)=IA(LL)+1                                                   J     89
  190 CONTINUE                                                          J     90
      RETURN                                                            J     91
      END                                                               J     92-
```

```
      SUBROUTINE CONVT (NUM,L,N)                                        K     1
      SAVE                                                              K     2
C                                                                       K     3
C  SUBROUTINE CONVT CONVERTS INTEGERS TO ALPHANUMERICS                  K     4
C     FOR PRINTING                                                      K     5
C                                                                       K     6
C  ASSUMES VALUE OF INTEGER IS POSITIVE                                 K     7
C                                                                       K     8
      DIMENSION L(5), JDIGIT(10)                                        K     9
C                                                                       K    10
      CHARACTER*1 JDIGIT, JBLANK, L                                     K   10A
      DATA JDIGIT/'0','1','2','3','4','5','6','7','8','9'/             K    11
      DATA JBLANK/' '/                                                  K    12
C                                                                       K    13
      NI=NUM                                                            K    14
      DO 10 I=1,N                                                       K    15
      L(I)=JBLANK                                                       K    16
   10 CONTINUE                                                          K    17
C                                                                       K    18
      DO 20 K=1,N                                                       K    19
      I=N-K+1                                                           K    20
      NEXT=NI/10                                                        K    21
      NDX=(NI-NEXT*10)+1                                                K    22
      L(I)=JDIGIT(NDX)                                                  K    23
      IF (NEXT.LE.0) GO TO 30                                           K    24
      NI=NEXT                                                           K    25
   20 CONTINUE                                                          K    26
C                                                                       K    27
   30 RETURN                                                            K    28
      END                                                               K    29-
```

```
      SUBROUTINE VALU (VAL,NF,NL)                                        L      1
      SAVE                                                               L      2
C                                                                        L      3
C  CONVERT NUMERIC VALUES TO ALPHAS (ONLY USED TO WRITE MECHANISM)       L      4
C                                                                        L      5
      COMMON /STORE/ AST(60)                                             L      6
      COMMON /GEAR1/ T,H,HMIN,HMAX,EPS1,UROUND,NC,MF1,KFLAG1,JSTART      L      7
C                                                                        L      7A
      DIMENSION AC(5), AD(5), BC(5)                                      L      8
      CHARACTER*1 IBLK, IPER, IZRO, IVV, AC, AD, BC, AST                 L      9
      DATA IBLK/' '/,IPER/'.'/,IZRO/'0'/                                 L     10
C                                                                        L     10A
      VAL1=ABS(VAL)                                                      L     11
      AVAL=ALOG10(VAL1)                                                  L     12
      IF (AVAL.EQ.0.) RETURN                                             L     13
      DO 10 I=1,5                                                        L     14
      AC(I)=IBLK                                                         L     15
      AD(I)=IZRO                                                         L     16
   10 BC(I)=IZRO                                                         L     17
      IAD=IFIX(AVAL+UROUND)                                              L     18
      IF (IAD) 60,20,20                                                  L     19
   20 IREM=3-IAD                                                         L     20
      IAD=IAD+1                                                          L     21
      JREM=IFIX(VAL1+UROUND)                                             L     22
      REM=VAL1-FLOAT(JREM)                                               L     23
      IF (REM.GT.UROUND.AND.IREM.GT.0) GO TO 30                          L     24
      CALL CONVT (JREM,AC,5)                                             L     25
      GO TO 100                                                          L     26
   30 CALL CONVT (JREM,AD,IAD)                                           L     27
      JREM=IFIX(REM*(10.**IREM)+0.1)                                     L     28
      CALL CONVT (JREM,BC,IREM)                                          L     29
      DO 40 J=1,IAD                                                      L     30
   40 AC(J)=AD(J)                                                        L     31
      AC(IAD+1)=IPER                                                     L     32
      DO 50 K=1,IREM                                                     L     33
         KIAD1 = K+IAD+1                                                 L     34
      AC(KIAD1)=BC(K)                                                    L     35
   50 CONTINUE                                                           L     36
      GO TO 80                                                           L     37
   60 IAD=IABS(IFIX(AVAL-0.1))-1                                         L     38
      IVAL=IFIX(VAL1*10000.+0.1)                                         L     39
      CALL CONVT (IVAL,AC,5)                                             L     40
      AC(1)=IPER                                                         L     41
      IF (ABS(VAL1+UROUND-0.1).LT.0.00001) GO TO 80                      L     42
      DO 70 I=1,IAD                                                      L     43
   70 AC(I+1)=IZRO                                                       L     44
   80 IF (AC(5).NE.IZRO) GO TO 100                                       L     45
      DO 90 K=1,4                                                        L     46
      L=6-K                                                              L     47
   90 AC(L)=AC(L-1)                                                      L     48
      IF (AC(1).EQ.IPER) IVV=IZRO                                        L     49
      IF (AC(1).NE.IPER) IVV=IBLK                                        L     50
      AC(1)=IVV                                                          L     51
      GO TO 80                                                           L     52
  100 DO 110 I=NF,NL                                                     L     53
      K=I-NF+1                                                           L     54
  110 AST(I)=AC(K)                                                       L     55
      RETURN                                                             L     56
      END                                                                L     57-
```

```
      SUBROUTINE EMISS (N,H,COEFF)                                          M     1
      SAVE                                                                  M     2
C                                                                           M     3
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M     4
C TO HANDLE MORE THAN 16 HISTOGRAM INTERVALS (ASSUMING N IS #INTERVALS)     M     5
C THE DIMENSIONED VARIABLES BELOW MUST HAVE THE FOLLOWING DIMENSIONS        M     6
C H = N; Y,DYDX = N+1; CF,COEFF = 5*N                                       M     7
C SEE ALSO DIMENSION STATEMENT IN STAIR                                     M     8
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M     9
C                                                                           M    10
      DIMENSION H(25), CF(125), Y(26), DYDX(26), COEFF(125)                 M    11
      DOUBLE PRECISION CF, Y, DYDX, HRATIO, EXPONE, FORRAT, FORCDY          M    12
      DOUBLE PRECISION SIGNDY, SMALLV, RATLIM                               M    13
      REAL DELX, H, COEFF                                                   M    14
      INTEGER STARTY, STOPY, INDEX, N, MODE, MODE1I                         M    15
      INTEGER NPLUS1, FIVEN, J, K                                           M    16
C                                                                           M    17
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    18
C   N IS THE NUMBER OF HISTOGRAM INTERVALS                                  M    19
C   N + 1  IS THE NUMBER OF EDGES IN THE HISTOGRAM PLOT                     M    20
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    21
C                                                                           M    22
      RATLIM= 5.001                                                         M    23
      MODE=1                                                                M    24
      DELX=1.0                                                              M    25
      FORRAT= 2.5                                                           M    26
      FORCDY = 5.25                                                         M    27
      NPLUS1 = N + 1                                                        M    28
      FIVEN = 5 * N                                                         M    29
      IF ( FIVEN .LE. 1) GO TO 20                                           M    30
      DO 10 J = 1 , FIVEN                                                   M    31
C                                                                           M    32
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    33
C   SET ALL COEFFICIENTS TO ZERO IN THE CF ARRAY.                           M    34
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    35
C                                                                           M    36
        CF(J) = 0.0                                                         M    37
   10 CONTINUE                                                              M    38
   20 CONTINUE                                                              M    39
      IF ( NPLUS1 .LE. 1) GO TO 40                                          M    40
      DO 30 J = 1 , NPLUS1                                                  M    41
C                                                                           M    42
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    43
C  ZERO OUT ALL THE Y'S AND DYDX'S,  IN THE PROCESS                         M    44
C    FORCING THE EDGE OF THE LAST DELX INTERVAL TO ZERO                     M    45
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    46
C                                                                           M    47
        Y(J) = 0.0                                                          M    48
        DYDX(J) = 0.0                                                       M    49
C                                                                           M    50
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    51
C  LOOK FOR THE FIRST NON-ZERO H                                            M    52
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    53
C                                                                           M    54
   30 CONTINUE                                                              M    55
   40 CONTINUE                                                              M    56
      INDEX = 1                                                             M    57
C     WHILE ((H(INDEX) .LE. 0.0) .AND. (INDEX .LT. N))                      M    58
   50 IF ((H(INDEX) .GT. 0.0) .OR. (INDEX .GE. N)) GO TO 60                 M    59
        INDEX = INDEX + 1                                                   M    60
      GO TO 50                                                              M    61
   60 CONTINUE                                                              M    62
      STARTY = INDEX                                                        M    63
      INDEX = INDEX + 1                                                     M    64
```

```
      MODE1I = 1                                                        M    65
C     IF (MODE .NE. 0)                                                  M    66
      IF (MODE .EQ. 0) GO TO 70                                         M    67
C      THEN                                                             M    68
        MODE1I = STARTY                                                 M    69
        Y(STARTY) = H(STARTY)                                           M    70
        DYDX(STARTY) =  0.0                                             M    71
 70   CONTINUE                                                          M    72
C                                                                       M    73
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M    74
C  STAIR DETERMINES THE COEFFICIENTS OF THE FOURTH DEGREE               M    75
C  POLYNOMIAL F(X)= (((AX+B)X+C)X+D)X+E SUCH THAT F(X) IS               M    76
C  TWICE DIFFERENTIABLE ACROSS HISTOGRAM INTERVAL EDGES,                M    77
C  MATCHES IN VALUE AT THE INTERVAL EDGES, AND SUCH THAT                M    78
C  THE INTEGRAL OF F(X)DX = THE HISTOGRAM INTERVAL HEIGHT               M    79
C  TIMES THE INTERVAL WIDTH (DELX). THE CROSSOVER POINTS                M    80
C  (THE VALUES OF F(X) AT THE EDGES BETWEEN TWO HISTOGRAM               M    81
C  INTERVALS) ARE THE KNOWNS. STAIR SOLVES FOR THE VALUES               M    82
C  OF F'(X) AT THE EDGES GIVEN THE BOUNDARY CONDITIONS OF               M    83
C  F'(X) AT THE TWO ENDS OF EACH STAIR EVALUATION. HISFIT               M    84
C  STEPS THROUGH THE HISTOGRAM IN ONE PASS, BREAKING THE                M    85
C  HISTOGRAM INTO STAIR EVALUATIONS OF 1 OR MORE INTERVALS.             M    86
C  NOTE THAT THE CURVE DEFINED BY THE COEFFICIENTS IS ONLY              M    87
C  ONCE DIFFERENTIABLE AT EDGES BETWEEN STAIR EVALUATIONS.              M    88
C  STAIR EVALUATIONS MAY NOT CROSS POINTS WHERE F'(X) IS                M    89
C  KNOWN OR FIXED E.G. ZERO POINTS (DY/DX = 0), OR FORCE                M    90
C  FITS (WHERE UNRESTRAINED STAIR FITS RESULT IN FUNCTIONS              M    91
C  WITH NEGATIVE VALUES WHICH CORRESPONDS TO NO PHYSICAL                M    92
C  REALITY). AT THESE EDGES, THE CURRENT STAIR EVALUATION               M    93
C  IS TERMINATED AND A NEW STAIR EVALUATION STARTED. IF                 M    94
C  THE RATIO OF ADJACENT HISTOGRAM VALUES IS LESS THAN 5/1              M    95
C  A CROSSOVER POINT IS PICKED ACCORDING TO THE HEURISTIC:              M    96
C          Y =  (RATIO ** 0.50)*(SMALLER VALUE)                        M    97
C  WHERE 5.001 .GT. RATIO .GT. 1. FOR THE SPECIAL CASE OF A VALUE       M    98
C  WHICH HAS A ZERO VALUE TO ONE SIDE, THE OTHER EDGE                   M    99
C  CROSSOVER IS: Y =  (RATIO ** 0.57)*(SMALLER VALUE)                   M   100
C  WHERE 5.001 .GT. RATIO .GT. 1. IF THE RATIO OF ADJACENT              M   101
C  HISTOGRAM VALUES EXCEEDS 5 A FIT IS FORCED BY APPROX-                M   102
C  IMATING A RATIO-OF-5 FIT THROUGH THE SMALLER VALUE.                  M   103
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   104
C                                                                       M   105
C      WHILE (INDEX .LE. N)                                             M   106
 80    IF (INDEX .GT. N) GO TO 240                                      M   107
C                                                                       M   108
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   109
C  STEP THROUGH HISTOGRAM, BREAK INTO STAIR EVALUATIONS                 M   110
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   111
C                                                                       M   112
C       IF (H(INDEX) .LE. 0.0)                                          M   113
        IF (H(INDEX) .GT. 0.0) GO TO 110                                M   114
C        THEN                                                           M   115
C                                                                       M   116
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   117
C CASE OF NEGATIVE OR ZERO HEIGHT                                       M   118
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   119
C                                                                       M   120
          STOPY = INDEX                                                 M   121
C                                                                       M   122
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   123
C FIT A SPLINE TO THIS POINT                                            M   124
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   125
C                                                                       M   126
          CALL STAIR(STARTY,STOPY,DELX,H,Y,DYDX,CF)                     M   127
C                                                                       M   128
```

```
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   129
C LOOK FOR NEXT NON ZERO H                                                                      M   130
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   131
C                                                                                               M   132
C           WHILE ((H(INDEX) .LE. 0.0) .AND. (INDEX .LT. N))                                    M   133
   90       IF ((H(INDEX) .GT. 0.0) .OR. (INDEX .GE. N))                                        M   134
     1        GO TO 100                                                                         M   135
            INDEX = INDEX + 1                                                                   M   136
           GO TO 90                                                                             M   137
  100      CONTINUE                                                                            M   138
C                                                                                               M   139
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   140
C START NEW STAIR EVALUATION                                                                    M   141
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   142
C                                                                                               M   143
           STARTY = INDEX                                                                       M   144
C                                                                                               M   145
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   146
C  GOTO BOTTOM OF LOOP                                                                          M   147
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   148
C                                                                                               M   149
           GO TO 230                                                                            M   150
C                                                                                               M   151
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   152
C  IT IS GUARANTEED THAT H(INDEX-1) AND H(INDEX) ARE .GT. 0.0                                   M   153
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   154
C                                                                                               M   155
  110     CONTINUE                                                                              M   156
C         ELSE                                                                                  M   157
           HRATIO = H(INDEX) / H(INDEX-1)                                                       M   158
           EXPONE= 0.50                                                                         M   159
C          IF (HRATIO .GE. 1.0)                                                                 M   160
           IF (HRATIO .LT. 1.0) GO TO 160                                                       M   161
C           THEN                                                                                M   162
C                                                                                               M   163
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   164
C  BEGIN UP STEP                                                                                M   165
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   166
C                                                                                               M   167
             SIGNDY = 1.0                                                                       M   168
             SMALLV= H(INDEX-1)                                                                 M   169
C            IF ((INDEX .EQ. (MODE1I + 1)) .AND. (MODE .EQ. 0))                                 M   170
             IF ((INDEX .NE. (MODE1I + 1)) .OR. (MODE .NE. 0))                                  M   171
     1          GO TO 120                                                                       M   172
C             THEN                                                                              M   173
              EXPONE = 0.57                                                                     M   174
              GO TO 150                                                                         M   175
  120         CONTINUE                                                                          M   176
C             ELSE                                                                              M   177
C              IF .NOT.((INDEX .EQ. 2) .AND. (MODE .NE. 0))                                     M   178
               IF ((INDEX .EQ. 2) .OR. (MODE .NE. 0)) GO TO 140                                 M   179
C               THEN                                                                            M   180
C                IF (H(INDEX-2) .EQ. 0.0)                                                       M   181
                 IF (H(INDEX-2) .NE. 0.0) GO TO 130                                             M   182
C                 THEN                                                                          M   183
                   EXPONE = 0.57                                                                M   184
  130             CONTINUE                                                                      M   185
  140            CONTINUE                                                                       M   186
  150           CONTINUE                                                                        M   187
             GO TO 200                                                                          M   188
C                                                                                               M   189
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   190
C  END UP STEP                                                                                  M   191
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   192
```

```
C                                                                       M   193
  160         CONTINUE                                                  M   194
C             ELSE                                                      M   195
C                                                                       M   196
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   197
C  BEGIN DOWN STEP                                                      M   198
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   199
C                                                                       M   200
              HRATIO = 1.0 / HRATIO                                     M   201
              SIGNDY = -1.0                                             M   202
              SMALLV= H(INDEX)                                          M   203
C             IF (INDEX .EQ. N)                                         M   204
              IF (INDEX .NE. N) GO TO 170                               M   205
C              THEN                                                     M   206
               EXPONE = 0.57                                            M   207
               GO TO 190                                                M   208
  170          CONTINUE                                                 M   209
C              ELSE                                                     M   210
C              IF (H(INDEX+1) .EQ. 0.0)                                 M   211
               IF (H(INDEX+1) .NE. 0.0) GO TO 180                       M   212
C               THEN                                                    M   213
                EXPONE = 0.57                                           M   214
  180           CONTINUE                                                M   215
  190         CONTINUE                                                  M   216
C                                                                       M   217
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   218
C  END DOWN STEP                                                        M   219
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   220
C                                                                       M   221
  200       CONTINUE                                                    M   222
C           IF (HRATIO .LT. RATLIM)                                     M   223
            IF (HRATIO .GE. RATLIM) GO TO 210                           M   224
C            THEN                                                       M   225
             Y(INDEX) = (HRATIO ** EXPONE) * SMALLV                     M   226
             GO TO 220                                                  M   227
C            ELSE                                                       M   228
  210        CONTINUE                                                   M   229
             Y(INDEX) = FORRAT * SMALLV                                 M   230
             DYDX(INDEX) = SIGNDY * FORCDY * (Y(INDEX) / DELX)          M   231
             STOPY = INDEX                                              M   232
             CALL STAIR(STARTY,STOPY,DELX,H,Y,DYDX,CF)                  M   233
             STARTY = INDEX                                             M   234
  220       CONTINUE                                                    M   235
C                                                                       M   236
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   237
C  BOTTOM OF LOOP, EXAMINE NEXT INTERVAL                                M   238
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   239
C                                                                       M   240
  230     CONTINUE                                                      M   241
          INDEX = INDEX + 1                                             M   242
        GO TO 80                                                        M   243
  240   CONTINUE                                                        M   244
C       ENDWHILE (INDEX .LE. N) LOOP                                    M   245
C                                                                       M   246
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   247
C  FOR THE FINAL SPLINE PORTION, CALL STAIR.                            M   248
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - M   249
C                                                                       M   250
C       IF (STARTY .NE. (N+1)) .AND. (H(N) .NE. 0.0)                    M   251
        IF ((STARTY .EQ. (N+1)) .OR. (H(N) .EQ. 0.0))                   M   252
     1     GO TO 250                                                    M   253
C        THEN                                                           M   254
          STOPY = N + 1                                                 M   255
          CALL STAIR(STARTY,STOPY,DELX,H,Y,DYDX,CF)                     M   256
```

```
250   CONTINUE                                                    M   257
      IF (1 .GT. FIVEN) GO TO 270                                 M   258
      DO 260 K = 1 , FIVEN                                        M   259
        COEFF(K) = CF(K)                                          M   260
260   CONTINUE                                                    M   261
270   CONTINUE                                                    M   262
    RETURN                                                        M   263
    END                                                           M   264-
```

```
      SUBROUTINE STAIR(KSTRT,KSTOP,DELX,H,Y,DYDX,CF)                    N     1
      SAVE                                                              N     2
C                                                                       N     3
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N     4
C TO HANDLE MORE THAN 16 HISTOGRAM INTERVALS (ASSUMING N IS #INTERVALS) N     5
C THE DIMENSIONED VARIABLES BELOW MUST HAVE THE FOLLOWING DIMENSIONS    N     6
C H = N; Y,DYDX,A,B,C = N+1; CF = 5*N                                   N     7
C SEE ALSO DIMENSION STATEMENT IN HISFIT                                N     8
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N     9
C                                                                       N    10
      DIMENSION A(26), B(26), C(26), CF(125), Y(26), DYDX(26), H(25)    N    11
      DOUBLE PRECISION A, B, C, R, S1, S2, T1, T2, U1, U2, V1, V2, Z    N    12
      DOUBLE PRECISION Y, DYDX, CF                                      N    13
      REAL DELX, H                                                      N    14
      INTEGER K,KSTRT,KSTOP,KSTOP1, J1, J2                              N    15
      INTEGER KSTOP2, KDOWN, KSTRT1                                     N    16
      KSTOP1 = KSTOP - 1                                                N    17
C                                                                       N    18
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N    19
C  COMPUTE COEFFICIENTS FOR                                             N    20
C   FK(X)=AK(X-XK)4 + BK(X-XK)3 + CK(X-XK)2 + DK(X-XK) +EK              N    21
C                                                                       N    22
C  STORE IN ARRAY CF AS:                                                N    23
C    CF 5*K =A;       CF 5*K-1 =B;       CF 5*K-2 =C;                  N    24
C    CF 5*K-3 =D=YKP                     CF 5*K-4 =E=YK                N    25
C    CF 5*K-3 =D=YKP                     CF 5*K-4 =E=YK                N    26
C     FOR K=KSTRT TO KSTOP  (WHERE KSTOP-KSTRT IS THE NUMBER            N    27
C                              OF INTERVALS. )                          N    28
C   KSTRT  IS THE LEFT EDGE OF THE STARTING HISTOGRAM BAR               N    29
C   KSTOP  IS THE RIGHT EDGE OF THE STOPPING HISTOGRAM BAR              N    30
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N    31
C                                                                       N    32
      IF (KSTRT .GT. KSTOP1) GO TO 20                                   N    33
      DO 10 K = KSTRT , KSTOP1                                          N    34
        CF(5*K-4)=Y(K)                                                  N    35
   10 CONTINUE                                                          N    36
   20 CONTINUE                                                          N    37
C                                                                       N    38
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N    39
C SET UP AND SOLVE MATRIX                                               N    40
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N    41
C                                                                       N    42
      B(KSTRT)=0.0                                                      N    43
      C(KSTRT)=0.0                                                      N    44
      IF ( KSTRT .GT. KSTOP1) GO TO 70                                  N    45
      DO 60 K = KSTRT , KSTOP1                                          N    46
        J2=K+1                                                          N    47
        U2=1.0/(DELX)                                                   N    48
        A(K)=U2                                                         N    49
        V2=U2*U2                                                        N    50
        S2=20.0*V2*H(K)                                                 N    51
        T2=8.0*V2*(Y(K)+Y(J2))                                          N    52
C       IF (K.GT.KSTRT)                                                 N    53
        IF (K.LE.KSTRT) GO TO 50                                        N    54
C        THEN                                                           N    55
          Z=1.0/(3.0*(U1+U2)+U1*B(J1))                                  N    56
          B(K)= -U2*Z                                                   N    57
          R=S2-S1-T2+T1+4.0*(V1-V2)*Y(K)                                N    58
C         IF (K.EQ.KSTRT+1)                                             N    59
          IF (K.NE.KSTRT+1) GO TO 30                                    N    60
C          THEN                                                         N    61
            R=R+U1*DYDX(KSTRT)                                          N    62
   30     CONTINUE                                                      N    63
C         IF (K.EQ.KSTOP1)                                              N    64
```

```
            IF (K.NE.KSTOP1) GO TO 40                                          N    65
C            THEN                                                              N    66
              R=R+U1*DYDX(KSTOP)                                               N    67
   40        CONTINUE                                                          N    68
             C(K)=Z*(R+U1*C(J1))                                               N    69
   50      CONTINUE                                                            N    70
           J1=K                                                                N    71
           U1=U2                                                               N    72
           V1=V2                                                               N    73
           S1=S2                                                               N    74
           T1=T2                                                               N    75
   60    CONTINUE                                                            N    76
   70    CONTINUE                                                            N    77
C                                                                            N    78
C                                                                            N    79
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N    80
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N    81
C  BACK SUBSTITUTION                                                         N    82
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N    83
C                                                                            N    84
C       IF (KSTOP-KSTRT.GT.1)                                                N    85
        IF (KSTOP-KSTRT.LE.1) GO TO 100                                      N    86
C        THEN                                                                N    87
          DYDX(KSTOP-1)=C(KSTOP-1)                                           N    88
          KSTOPP=KSTOP-1                                                     N    89
          CF(5*KSTOPP-3)=DYDX(KSTOPP)                                        N    90
C         IF (KSTOP-KSTRT.GT.2)                                              N    91
          IF (KSTOP-KSTRT.LE.2) GO TO 90                                     N    92
C          THEN                                                              N    93
            KSTOP2 = KSTOP - 2                                               N    94
            KSTRT1 = KSTRT + 1                                               N    95
            DO 80 K = KSTRT1 , KSTOP2                                        N    96
              KDOWN = KSTRT1 + KSTOP2 - K                                    N    97
              DYDX(KDOWN) = C(KDOWN) - B(KDOWN) * DYDX(KDOWN+1)              N    98
              CF(5*KDOWN-3) = DYDX(KDOWN)                                    N    99
   80         CONTINUE                                                       N   100
   90       CONTINUE                                                         N   101
  100     CONTINUE                                                           N   102
          CF(5*KSTRT-3)=DYDX(KSTRT)                                          N   103
C                                                                            N   104
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N   105
C COMPUTE 2ND, 3RD, 4TH ORDER COEFFICIENTS                                   N   106
C - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - N   107
C                                                                            N   108
        IF ( KSTRT .GT. KSTOP1) GO TO 120                                    N   109
        DO 110 K = KSTRT , KSTOP1                                            N   110
          J2=K+1                                                             N   111
          Z=A(K)                                                             N   112
          CF(5*K-2)= 1.5*Z*(-3.0*DYDX(K) + DYDX(J2) + Z*(-8.0*               N   113
     1    Y(J2) - 12.0*Y(K) + 20.0*H(K)))                                    N   114
          CF(5*K-1)= -4.0*Z*Z*(-1.5*DYDX(K) + DYDX(J2) + Z*(-7.0*            N   115
     1    Y(J2) - 8.0*Y(K) +15.0*H(K)))                                      N   116
          CF(5*K) = 5.0*Z*Z*Z*(0.5*(DYDX(J2)-DYDX(K)) - 3.0*Z*               N   117
     1    (Y(J2) + Y(K) - 2.0*H(K)))                                         N   118
  110   CONTINUE                                                           N   119
  120   CONTINUE                                                           N   120
      RETURN                                                             N   121
      END                                                                N   122-
```

```
      SUBROUTINE PHOT                                                    O     1
      SAVE                                                               O     2
C                                                                        O     3
C     ****    RATE CONSTANT CALCULATIONS FOR FIRST ORDER PHOTOCHEMICAL    O     4
C             REACTIONS                                                  O     5
C             REF: SCHERE AND DEMERJIAN (1977)                           O     6
C                                                                        O     7
      COMMON /SUNLIT/ Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,      O     8
     1                ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),      O     9
     2                XZ(24),K(24),JSTRT,JSTOP,SPEC,MNLM,MXLM,MAXL,MAXJ O     10
      COMMON /PHOTON/ CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20), O     11
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),     O     12
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)        O     13
C                                                                        O     13A
      COMMON /PHTCHR/ ISPDP(10)                                          O     13B
      CHARACTER*4 ISPDP                                                  O     13C
C                                                                        O     13D
      INTEGER SPEC                                                       O     14
      DIMENSION D(2), C(72), W(72), V(5), TMS(25)                        O     15
      DATA D/0.,0./                                                      O     16
C                                                                        O     17
      IEND=24                                                            O     18
      NTM=IEND                                                           O     19
      TIME=JSTRT                                                         O     20
      DO 10 II=1,IEND                                                    O     21
C                                                                        O     22
C     ****    CALL SUBROUTINE TO COMPUTE ZENITH ANGLES FROM TIME OF DAY  O     23
C                                                                        O     24
      XC=0.0                                                             O     25
      TSTD=TIME                                                          O     26
      IF (TSTD.LT.0.) TSTD=TSTD+2400.                                    O     27
      CALL SOLAR (SLA,SLO,TZ,IY,IM,ID,TSTD,XC,5)                         O     28
      ITIME(II)=TIME                                                     O     29
      XZ(II)=90.-XC                                                      O     30
      TIME=CLOCK(TIME,IINC)                                              O     31
C                                                                        O     32
      IF (TIME.GT.2400.) TIME=TIME-2400.                                 O     33
   10 CONTINUE                                                           O     34
C                                                                        O     35
      DO 30 L=1,IP                                                       O     36
      ISTRT=(MNLM-LAM1)/INC+1                                            O     37
      ISTOP=(MXLM-LAM1)/INC+1                                            O     38
C                                                                        O     39
C     ****    CALL FIRST SUBROUTINE FOR SPLINE INTERPOLATION OF RATE CONSO     40
C                                                                        O     41
      IF (L.EQ.1) CALL SPLNA (MAXZ,Z,RTCON,2,D,C,W)                      O     42
      IF (L.GT.1) CALL SPLNA (10,Z,PP(1,L),2,D,C,W)                      O     43
      DO 20 II=1,IEND                                                    O     44
      V(1)=XZ(II)                                                        O     45
      P(II,L)=0.                                                         O     46
      IF (V(1).GT.90.0) GO TO 20                                         O     47
C                                                                        O     48
C     ****    CALL SECOND SUBROUTINE IN SPLINE INTERPOLATION SCHEME      O     49
C                                                                        O     50
      IF (L.EQ.1) CALL SPLNB (MAXZ,Z,RTCON,C,V)                          O     51
      IF (L.GT.1) CALL SPLNB (10,Z,PP(1,L),C,V)                          O     52
      P(II,L)=AMAX1(0.0,V(2))                                            O     53
   20 CONTINUE                                                           O     54
C                                                                        O     55
   30 CONTINUE                                                           O     56
C     DETERMINE TIME OF SOLAR NOON                                       O     57
C                                                                        O     58
      IZMN=IEND                                                          O     59
      XZEM=9999.                                                         O     60
```

```
      DO 40 I=1,IEND                                                    O    61
      IF (XZ(I).GE.XZEM) GO TO 40                                       O    62
      XZEM=XZ(I)                                                        O    63
      IZMN=I                                                            O    64
   40 CONTINUE                                                          O    65
      I=IZMN                                                            O    66
   50 TIME=ITIME(I-1)                                                   O    67
      XA=XZ(I-1)                                                        O    68
      DO 60 I=1,60                                                      O    69
      SPECIE=TIME                                                       O    70
      TIME=CLOCK(TIME,1)                                                O    71
      TSTD=TIME                                                         O    72
      IF (TSTD.LT.0.) TSTD=TSTD+2400.                                   O    73
      XB=XA                                                             O    74
      CALL SOLAR (SLA,SLO,TZ,IY,IM,ID,TSTD,XC,5)                        O    75
      XA=90.-XC                                                         O    76
      IF (XA.GT.XB) GO TO 70                                            O    77
   60 CONTINUE                                                          O    78
   70 DO 80 I=1,IEND                                                    O    79
      TMS(I)=60.*FLOAT(I-1)                                             O    80
   80 CONTINUE                                                          O    81
      DO 100 L=1,IP                                                     O    82
      DO 90 I=2,IEND                                                    O    83
      NMM=IEND+2-I                                                      O    84
      IF (P(NMM-1,L).GT.0.) GO TO 100                                   O    85
   90 CONTINUE                                                          O    86
  100 CALL SPLNA (NMM,TMS,P(1,L),2,D,CF(1,L),W)                         O    87
      RETURN                                                            O    88
      END                                                               O    89-
```

```
      SUBROUTINE SOLAR (SLA,SLO,TZ,IY,IM,ID,TIME,D,NV)                  P     1
      SAVE                                                              P     2
C***                                                                    P     3
C***     SLA...  LATITUDE (DEG)  SOUTH = MINUS                          P     4
C***     SLO...  LONGITUDE (DEG)  EAST = MINUS                          P     5
C***     TZ...  TIME ZONE                                               P     6
C***            ALSO INCLUDES FRACTION IF LOCAL TIME IS NOT             P     7
C***             STANDARD MERIDIAN TIME.  E.G. POONA, INDIA 5.5         P     8
C***     IY..  YEAR                                                     P     9
C***     IM..  MONTH                                                    P    10
C***     ID..  DAY                                                      P    11
C***     TIME.. LOCAL STANDARD TIME IN HOURS AND MINUTES.               P    12
C***            1 30 PM = 1330  ** STANDARD TIME **                     P    13
C***     D..  RETURNED VALUE                                            P    14
C***     NV..  VALUE TO BE RETURNED, SELECTED AS FOLLOWS....            P    15
C***           1...  DECLINATION (DEG.)                                 P    16
C***           2...  EQUATION OF TIME ADJUSTMENT (HRS.)                  P    17
C***           3...  TRUE SOLAR TIME (HRS.)                            P    18
C***           4...  HOUR ANGLE (DEG.)                                  P    19
C***           5...  SOLAR ELEVATION (DEG.)                            P    20
C***           6...  OPTICAL AIRMASS                                    P    21
C***     0 ( NV ( 7.  OTHERWISE, D = 9999.                              P    22
C***                                                                    P    23
      DIMENSION MD(11)                                                  P    24
      DATA MD/31,29,31,30,31,30,2*31,30,31,30/                          P    25
      DATA A,B,C,SIGA/0.15,3.885,1.253,279.9348/                        P    26
      RAD=572957.75913E-4                                               P    27
      SDEC=39784.988432E-5                                              P    28
      RE=1.                                                             P    29
      IF (SLO.LT.0.) RE=-1.                                             P    30
      KZ=TZ                                                             P    31
      TC=(TZ-FLOAT(KZ))*RE                                              P    32
      TZZ=FLOAT(KZ)*RE                                                  P    33
      SLB=SLA/RAD                                                       P    34
      K=ID                                                              P    35
      TIMH=TIME/100.                                                    P    36
      I=TIMH                                                            P    37
      TIMLOC=(TIMH-FLOAT(I))/0.6+FLOAT(I)+TC                            P    38
      IMC=IM-1                                                          P    39
      IF (IMC.LT.1) GO TO 20                                            P    40
      DO 10 I=1,IMC                                                     P    41
   10 K=K+MD(I)                                                         P    42
   20 LEAP=1                                                            P    43
      NL=MOD(IY,4)                                                      P    44
      IF (NL.LT.1) LEAP=2                                               P    45
      SMER=TZZ*15.                                                      P    46
      TK=((SMER-SLO)*4.)/60.                                            P    47
      KR=1                                                              P    48
      IF (K.GE.61.AND.LEAP.LT.2) KR=2                                   P    49
      DAD=(TIMLOC+TZZ)/24.                                              P    50
      DAD=DAD+FLOAT(K-KR)                                               P    51
      DF=DAD*360./365.242                                               P    52
      DE=DF/RAD                                                         P    53
      DESIN=SIN(DE)                                                     P    54
      DECOS=COS(DE)                                                     P    55
      DESIN2=SIN(DE*2.)                                                 P    56
      DECOS2=COS(DE*2.)                                                 P    57
      SIG=SIGA+DF+1.914827*DESIN-0.079525*DECOS+0.019938*DESIN2-0.00162*P    58
     1DECOS2                                                            P    59
      SIG=SIG/RAD                                                       P    60
      DECSIN=SDEC*SIN(SIG)                                              P    61
      EFFDEC=ASIN(DECSIN)                                               P    62
      IF (NV.NE.1) GO TO 30                                             P    63
      D=EFFDEC*RAD                                                      P    64
```

```
      RETURN                                                                    P     65
   30 EQT=0.12357*DESIN-0.004289*DECOS+0.153809*DESIN2+0.060783*DECOS2          P     66
      IF (NV.NE.2) GO TO 40                                                     P     67
      D=EQT                                                                     P     68
      RETURN                                                                    P     69
   40 TST=TK+TIMLOC-EQT                                                         P     70
      IF (NV.NE.3) GO TO 50                                                     P     71
      D=TST                                                                     P     72
      IF (D.LT.0.) D=D+24.                                                      P     73
      IF (D.GE.24.) D=D-24.                                                     P     74
      RETURN                                                                    P     75
   50 HRANGL=ABS(TST-12.)*15.                                                   P     76
      IF (NV.NE.4) GO TO 60                                                     P     77
      D=HRANGL                                                                  P     78
      RETURN                                                                    P     79
   60 HRANGL=HRANGL/RAD                                                         P     80
      SOLSIN=DECSIN*SIN(SLB)+COS(EFFDEC)*COS(SLB)*COS(HRANGL)                   P     81
      SOLEL=ASIN(SOLSIN)*RAD                                                    P     82
      IF (NV.NE.5) GO TO 70                                                     P     83
      D=SOLEL                                                                   P     84
      RETURN                                                                    P     85
   70 IF (NV.NE.6) GO TO 80                                                     P     86
      IF (SOLEL.LE.0.) GO TO 80                                                 P     87
      TK=SOLEL+B                                                                P     88
      E=1./TK**C                                                                P     89
      D=1./(A*E+SOLSIN)                                                         P     90
      RETURN                                                                    P     91
   80 D=9999.                                                                   P     92
      RETURN                                                                    P     93
      END                                                                       P     94-
```

```
      SUBROUTINE SPLNA (N,X,Y,J,D,C,W)                                      Q      1
      SAVE                                                                  Q      2
      DIMENSION X(24), Y(24), D(2), C(72), W(72)                            Q      3
C     ------------------------------------------------------------------    Q      4
C             OVER THE INTERVAL X(I) TO X(I+1), THE INTERPOLATING           Q      5
C             POLYNOMIAL                                                    Q      6
C                  Y=Y(I)+A(I)*Z+B(I)*Z**2+E(I)*Z**3                        Q      7
C             WHERE Z=(X-X(I))/(X(I+1)-X(I))                                Q      8
C             IS USED. THE COEFFICIENTS A(I),B(I) AND E(I) ARE COMPUTED     Q      9
C             BY SPLNA AND STORED IN LOCATIONS C(3*I-2),C(3*I-1) AND        Q     10
C             C(3*I) RESPECTIVELY.                                          Q     11
C             WHILE WORKING IN THE ITH INTERVAL,THE VARIABLE Q WILL         Q     12
C             REPRESENT Q=X(I+1) - X(I), AND Y(I) WILL REPRESENT            Q     13
C             Y(I+1)-Y(I)                                                   Q     14
C     ------------------------------------------------------------------    Q     15
C                                                                           Q     16
      Q=X(2)-X(1)                                                           Q     17
      YI=Y(2)-Y(1)                                                          Q     18
      IF (J.EQ.2) GO TO 10                                                  Q     19
C     ------------------------------------------------------------------    Q     20
C             IF THE FIRST DERIVATIVE AT THE END POINTS IS GIVEN,           Q     21
C             A(1) IS KNOWN, AND THE SECOND EQUATION BECOMES                Q     22
C             MERELY B(1)+E(1)=YI - Q*D(1).                                 Q     23
C     ------------------------------------------------------------------    Q     24
      C(1)=Q*D(1)                                                           Q     25
      C(2)=1.0                                                              Q     26
      W(2)=YI-C(1)                                                          Q     27
      GO TO 20                                                              Q     28
C     ------------------------------------------------------------------    Q     29
C             IF THE SECOND DERIVATIVE AT THE END POINTS IS GIVEN           Q     30
C             B(1) IS KNOWN, THE SECOND EQUATION BECOMES                    Q     31
C             A(1)+E(1)=YI-0.5*Q*Q*D(1). DURING THE SOLUTION OF             Q     32
C             THE 3N-4 EQUATIONS,A1 WILL BE KEPT IN CELL C(2)               Q     33
C             INSTEAD OF C(1) TO RETAIN THE TRIDIAGONAL FORM OF THE         Q     34
C             COEFFICIENT MATRIX.                                           Q     35
C     ------------------------------------------------------------------    Q     36
   10 C(2)=0.0                                                              Q     37
      W(2)=0.5*Q*Q*D(1)                                                     Q     38
   20 M=N-2                                                                 Q     39
      IF (M.LE.0) GO TO 40                                                  Q     40
C     ------------------------------------------------------------------    Q     41
C             UPPER TRIANGULARIZATION OF THE TRIDIAGONAL SYSTEM OF          Q     42
C             EQUATIONS FOR THE COEFFICIENT MATRIX FOLLOWS--                Q     43
C     ------------------------------------------------------------------    Q     44
      DO 30 I=1,M                                                           Q     45
      AI=Q                                                                  Q     46
      Q=X(I+2)-X(I+1)                                                       Q     47
      H=AI/Q                                                                Q     48
      C(3*I)=-H/(2.0-C(3*I-1))                                              Q     49
      W(3*I)=(-YI-W(3*I-1))/(2.0-C(3*I-1))                                  Q     50
      C(3*I+1)=-H*H/(H-C(3*I))                                              Q     51
      W(3*I+1)=(YI-W(3*I))/(H-C(3*I))                                       Q     52
      YI=Y(I+2)-Y(I+1)                                                      Q     53
      C(3*I+2)=1.0/(1.0-C(3*I+1))                                           Q     54
   30 W(3*I+2)=(YI-W(3*I+1))/(1.0-C(3*I+1))                                 Q     55
C     ------------------------------------------------------------------    Q     56
C             E(N-1) IS DETERMINED DIRECTLY FROM THE LAST EQUATION          Q     57
C             OBTAINED ABOVE, AND THE FIRST OR SECOND DERIVATIVE            Q     58
C             VALUE GIVEN AT THE END POINT.                                 Q     59
C     ------------------------------------------------------------------    Q     60
   40 IF (J.EQ.1) GO TO 50                                                  Q     61
      C(3*N-3)=(Q*Q*D(2)/2.0-W(3*N-4))/(3.0-C(3*N-4))                       Q     62
      GO TO 60                                                              Q     63
   50 C(3*N-3)=(Q*D(2)-YI-W(3*N-4))/(2.0-C(3*N-4))                          Q     64
```

```
   60 M=3*N-6                                                                Q    65
      IF (M.LE.0) GO TO 80                                                   Q    66
C     ---------------------------------------------------------------------Q    67
C            BACK SOLUTION FOR ALL COEFFICENTS EXCEPT                        Q    68
C            A(1) AND B(1) FOLLOWS--                                         Q    69
C     ---------------------------------------------------------------------Q    70
      DO 70 II=1,M                                                           Q    71
      I=M-II+3                                                               Q    72
   70 C(I)=W(I)-C(I)*C(I+1)                                                  Q    73
   80 IF (J.EQ.1) GO TO 90                                                   Q    74
C     ---------------------------------------------------------------------Q    75
C            IF THE SECOND DERIVATIVE IS GIVEN AT THE END POINTS,            Q    76
C            A(1) CAN NOW BE COMPUTED FROM THE KNOWN VALUES OF               Q    77
C            B(1) AND E(1). THEN A(1) AND B(1) ARE PUT INTO THEIR            Q    78
C            PROPER PLACES IN THE C ARRAY.                                   Q    79
C     ---------------------------------------------------------------------Q    80
      C(1)=Y(2)-Y(1)-W(2)-C(3)                                               Q    81
      C(2)=W(2)                                                              Q    82
      RETURN                                                                 Q    83
   90 C(2)=W(2)-C(3)                                                         Q    84
      RETURN                                                                 Q    85
      END                                                                    Q    86-
```

```
      SUBROUTINE SPLNB (N,X,Y,C,V)                                      R     1
      SAVE                                                              R     2
      DIMENSION X(24), Y(24), C(72), V(5)                               R     3
      V(5)=2.0                                                          R     4
      LIM=N-1                                                           R     5
C                  ------------------------------------------------------R     6
C                  DETERMINE IN WHICH INTERVAL THE INDEPENDENT         R     7
C                  VARIABLE,V(1),LIES.                                 R     8
C                  ------------------------------------------------------R     9
      DO 10 I=2,LIM                                                     R    10
      IF (V(1).LT.X(I)) GO TO 20                                        R    11
   10 CONTINUE                                                          R    12
      I=N                                                               R    13
      IF (V(1).GT.X(N)) V(5)=3.0                                        R    14
      GO TO 30                                                          R    15
   20 IF (V(1).LT.X(1)) V(5)=1.0                                        R    16
C                  ------------------------------------------------------R    17
C                  Q IS THE SIZE OF THE INTERVAL CONTAINING V(1).      R    18
C                  ------------------------------------------------------R    19
C                  Z IS A LINEAR TRANSFORMATION OF THE INTERVAL        R    20
C                  ONTO (0,1) AND IS THE VARIABLE FOR WHICH            R    21
C                  THE COEFFICIENTS WERE COMPUTED BY SPLNA.            R    22
C                  ------------------------------------------------------R    23
   30 Q=X(I)-X(I-1)                                                     R    24
      Z=(V(1)-X(I-1))/Q                                                 R    25
      V(2)=((Z*C(3*I-3)+C(3*I-4))*Z+C(3*I-5))*Z+Y(I-1)                  R    26
      V(3)=((3.*Z*C(3*I-3)+2.0*C(3*I-4))*Z+C(3*I-5))/Q                  R    27
      V(4)=(6.*Z*C(3*I-3)+2.0*C(3*I-4))/(Q*Q)                           R    28
      RETURN                                                            R    29
      END                                                               R    30-
```

```
      FUNCTION CLOCK (T1,IINC)                                                S     1
      SAVE                                                                    S     2
C                                                                             S     3
C     ****    ADD A TIME IN MINUTES TO A 2400 HOUR TIME AND RETURN A 2400S     4
C     ****    HOUR TIME                                                       S     5
C                                                                             S     6
      T2=IINC                                                                 S     7
      I100=INT(T1/100.)                                                       S     8
      T3=T1-100.0*FLOAT(I100)+T2                                              S     9
      I100=I100+INT(T3/60.)                                                   S    10
      CLOCK=FLOAT(I100)*100.0+T3-60.0*FLOAT(INT(T3/60.0))                     S    11
      RETURN                                                                  S    12
      END                                                                     S    13-
```

```
      SUBROUTINE SUNTIM                                                  T     1
      SAVE                                                               T     2
C                                                                        T     3
C   FIND SUNRISE AND SUNSET VALUES                                       T     4
C                                                                        T     5
      COMMON /SUNLIT/ Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,      T     6
     1                ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),XZ(24)T     7
     2,               KJ(24),JSTRT,JSTOP,PSPEC,MNLM,MXLM,MAXL,MAXJ      T     8
      COMMON /MIXING/ DSTRT,DEND,AMC(5),BMC(5),CMC(5),FD(6),FG(6),       T     9
     1                AMXX(26),DL,TTMAX,SSRISE,SRMIN,DELH,TDIL,NMXX,     T     9A
     2                HEIGHT,SSET,SRISE                                  T    10
      INTEGER PSPEC                                                      T    11
C                                                                        T    12
C  FIND SUNRISE                                                          T    13
C                                                                        T    14
      T=0.                                                               T    15
   10 CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                              T    16
      IF (D.GE.0.000001) GO TO 20                                        T    17
      T=CLOCK(T,60)                                                      T    18
      GO TO 10                                                           T    19
C                                                                        T    20
C  FIND HALF HOUR VALUE                                                  T    21
C                                                                        T    22
   20 T=T-150.                                                           T    23
      CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                              T    24
      IF (D.GE.0.000001) GO TO 40                                        T    25
C                                                                        T    26
   30 T=CLOCK(T,1)                                                       T    27
      CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                              T    28
      IF (D.GE.0.000001) GO TO 60                                        T    29
      GO TO 30                                                           T    30
C                                                                        T    31
   40 T=T-30.                                                            T    32
   50 T=CLOCK(T,1)                                                       T    33
      CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                              T    34
      IF (D.LT.0.000001) GO TO 60                                        T    35
      GO TO 50                                                           T    36
C                                                                        T    37
   60 SRISE=T                                                            T    38
C                                                                        T    39
C  FIND SUNSET                                                           T    40
C                                                                        T    41
      T=1200.                                                            T    42
   70 CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                              T    43
      IF (D.LT.0.000001) GO TO 80                                        T    44
      T=CLOCK(T,60)                                                      T    45
      GO TO 70                                                           T    46
C                                                                        T    47
C  FIND HALF HOUR VALUE                                                  T    48
C                                                                        T    49
   80 T=T-150.                                                           T    50
      CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                              T    51
      IF (D.LT.0.000001) GO TO 100                                       T    52
C                                                                        T    53
   90 T=CLOCK(T,1)                                                       T    54
      CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                              T    55
      IF (D.LT.0.000001) GO TO 120                                       T    56
      GO TO 90                                                           T    57
C                                                                        T    58
  100 T=T-30.                                                            T    59
  110 T=CLOCK(T,1)                                                       T    60
      CALL SOLAR(SLA,SLO,TZ,IY,IM,ID,T,D,5)                              T    61
      IF (D.GE.0.000001) GO TO 120                                       T    62
      GO TO 110                                                          T    63
```

```
C                                                                       T     64
  120 SSET=T                                                            T     65
C                                                                       T     66
      RETURN                                                            T     67
      END                                                               T     68-
```

```
      SUBROUTINE EKCALC (X)                                                  U     1
      SAVE                                                                   U     2
C                                                                            U     3
C     THIS SUBROUTINE PERFORMS VOC CONTROL REQUIREMENTS AS OUTLINED          U     4
C   IN THE 1981 EPA GUIDELINES ON THE USE OF CITY-SPECIFIC EKMA.  THIS       U     5
C   ROUTINE ALSO INCLUDES PROCEDURES DESCRIBED IN APPENDIX B OF THE          U     6
C   1981 GUIDELINES.                                                         U     7
C                                                                            U     8
C    THIS ROUTINE WAS MODIFIED OCT 1986 BY HH/SAI TO:                        U     9
C                                                                            U     10
C       ALLOW FOR TWO OCCURANCES OF OZONE ON A NMOC/NOX LINE                 U     11
C       TO SKIP BASE YEAR CALCULATION IF LOCATION IS KNOWN                   U     12
C                                                                            U     13
C    MODIFIED JUNE 1987 HH/SAI TO:                                           U     14
C                                                                            U     15
C       ALLOW FOR CO EMISSION CREDITS                                        U     16
C                                                                            U     17
      COMMON /CALC/ NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),IA(60)     U     18
     1,             JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENI     U     19
      COMMON /CNTRL/ SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN,       U     20
     1               FLST,TLST                                               U     21
      COMMON /SPEC/ NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),              U     22
     1              FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,        U     23
     2              XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                         U     24
      COMMON /SUNLIT/ Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,          U     25
     1                ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),XZ(24)     U     26
     2                ,KKK(24),JSTRT,JSTOP,PSPEC,MNLM,MXLM,MAXL,MAXJ         U     27
      COMMON /PHOTON/ CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20),      U     28
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),          U     29
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)             U     30
      COMMON /ZENITH/ IPZ,ZDEF(10,20),IPHZ(20),IZENP                         U     31
      COMMON /EMIS/   NEM,ISP,ESTRT(5),ESTOP,ESLP,IEMLS(5),EOSLP(5),         U     32
     1                EMO(26,5),ECI(5),EM(26),EC(125),ECO(125,5)             U     33
      COMMON /MIX/    NMIX,AMIX(26),STRM,STOPM,DC(104)                       U     34
      COMMON /MIXING/ DSTRT,DEND,AMC(5),BMC(5),CMC(5),FD(6),FG(6),           U     35
     1                AMXX(26),DL,TTMAX,SSRISE,SRMIN,DELH,TDIL,NMXX,         U     35A
     2                HEIGHT,SSET,SRISE                                      U     36
      COMMON /TEMPER/ TEMEND,NTEMP,QM(30)                                    U     37
      COMMON /FRPLOT/ SAVCON(80,5),SAVTIM(80),NTSV,INOW                      U     38
      COMMON /INOUT/  IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                      U     39
C     COMMON /TITL/   ITTL(36)                                               U     40
      COMMON /NEED/   HC,XN,NL,OZP(20),OZN(11,11,5),MR,LS,HCS,XNS            U     41
      COMMON /HEAT/   SC(200,12),ISC(200,3)                                  U     42
      COMMON /NEED1/  IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,          U     43
     1                IIH2O,JPLUS                                            U     44
C                                                                            U     45
      COMMON /HOUR/   OZM(5),NGO,TTM,TMY(5)                                  U     46
      COMMON /PLTVEC/ HCT(20),OT(20),NT,OHC,HCG,PLTGRD,OXN,XNG,HC1,XN1,      U     47
     1                TICZ,DIGZ,CHRZ,IPLDEV                                  U     48
      COMMON /ALOFT/  IALFT,CALFT(10),LOCALF(10)                             U     49
      COMMON /VVLB1/  FCTR,DIST,CHRSIZ,NNCHR,OZBL                            U     50
      COMMON /BK1/    FBK(20),FBKAL(5),HCBK,XNBK,OZBK,H2OBK                  U     51
      COMMON /CRED/   ICR,ISPCR,SPCR69(3),SURFCR(3),ALOFCR(3),               U     52
     1                REDCR(3),FSRFCR(3),FALFCR(3),COSFBK,COAFBK             U     53
      COMMON /BIOG/   NBEM,IBSP,WTMOL(5),ACB4(5),SURFBI(5),                  U     53A
     1                ALOFBI(5),REDBI(5),FSRFBI(5),FALFBI(5),BEMO(26,5),     U     53B
     2                BECO(126,5),CBTOT(5),IBLS(5),BESTOP,BFRAC(20,5)        U     53C
C                                                                            U     53D
      COMMON /ALFCHR/ ISPAL(10)                                              U     53E
      COMMON /BIOCHR/ IISOP, IBEMSP(5)                                       U     53F
      COMMON /CRECHR/ ISPNCR(3)                                              U     53G
      COMMON /EMSCHR/ EMSP(5)                                                U     53H
      COMMON /NEED1C/ IBZA                                                   U     53I
      COMMON /PHTCHR/ ISPDP(10)                                              U     53J
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      COMMON /CALCHR/ SPECIS(61)                                          U    53K
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                      U    53L
C                                                                         U    53M
      CHARACTER*4 ISPAL, ISPDP, ISPNCR, IBEMSP                            U    53N
      CHARACTER*4 SPECIS, HCSPEC, PLSP, IISOP, EMSP, REACT                U    53O
      CHARACTER*4 IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,           U    53P
     1   IIH2O,IBZA,JPLUS                                                 U    53Q
C                                                                         U    53R
      DIMENSION X(7),OZOUT(11),OZV(10),HCTMP(10),ANXTMP(10),OZSORT(10),   U    54
     1          HCSORT(10),ANSORT(10),YP(20),TM(20),SCRSV(3),ALCRSV(3),   U    55
     2          SPCRSV(3),SBIOSV(5),ABIOSV(5),EM1(26)                     U    56
C                                                                         U    57
      FOZS = OZIN                                                         U    58
      FOZA = OZAL                                                         U    59
      FOCS = HCIN                                                         U    60
      FOCA = HCAL                                                         U    61
      FXNS = XNIN                                                         U    62
      FXNA = XNAL                                                         U    63
      CFHC = 0.0                                                          U    64
      CFNOX = 0.0                                                         U    65
      NPTO=0                                                              U    66
      INFO=-1                                                             U    67
      DOZ = 0.12                                                          U    68
      AOZ=0.12                                                            U    69
      HCTNOX=1.                                                           U    70
      NTRYS = 8                                                           U    71
      ACCU = 0.0005                                                       U    72
      RNMOC=0.60                                                          U    73
      BNMOC = HCBK                                                        U    74
      IF (ABS(X(1)) .NE. 0.0) DOZ = ABS(X(1))                             U    75
      IF (ABS(X(2)) .NE. 0.0) HCTNOX = ABS(X(2))                          U    76
      IF (X(4) .GT. 0.0) READ (IN,400) FOZS,FOZA,FOCS,FOCA,FXNS,FXNA      U    77
C                                                                         U    78
      READ (IN,400) HCMEAS,ANMEAS,ALREHC,ALRENX,HCLV                      U    79
      REDNOX = 1.0 + X(3)*.01                                             U    80
C                                                                         U    81
C                                                                         U    82
C  DO SOME PRELIMINARY CALCULATIONS                                       U    83
C                                                                         U    84
      OZINSV=OZIN                                                         U    85
      OZALSV=OZAL                                                         U    86
      HCINSV=HCIN                                                         U    87
      HCALSV=HCAL                                                         U    88
      XNINSV = XNIN                                                       U    89
      XNALSV=XNAL                                                         U    90
      IF (ICR.LE.0) GO TO 15                                              U    91
      DO 10 J=1,ICR                                                       U    92
      SCRSV(J)=SURFCR(J)                                                  U    93
      ALCRSV(J)=ALOFCR(J)                                                 U    94
      SPCRSV(J)=SPCR69(J)                                                 U    95
   10 CONTINUE                                                            U    96
   15 IF (IBSP.LE.0) GO TO 20                                             U    96A
      DO 16 J=1,IBSP                                                      U    96B
      SBIOSV(J)=SURFBI(J)                                                 U    96C
      ABIOSV(J)=ALOFBI(J)                                                 U    96D
   16 CONTINUE                                                            U    96E
C                                                                         U    97
   20 REDNX1=X(3)                                                         U    98
C                                                                         U    99
C  ESTIMATE FUTURE NMOC IF NOT GIVEN                                      U   100
C                                                                         U   101
      RNMOC1=FOCA                                                         U   102
      IF (FOCA.GE.0.) GO TO 30                                            U   103
      IF (FOCA.GT.(-99.)) RNMOC=ABS(FOCA)*0.01                            U   104
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```
      RNMOC1 = (HCALSV - BNMOC)*RNMOC + BNMOC                          U  105
C                                                                      U  106
C  ESTIMATE FUTURE NMOC IN THE SURFACE LAYER                           U  107
C                                                                      U  108
   30 RNMOC2 = (HCINSV - BNMOC)*RNMOC + BNMOC                          U  109
      IF (FOCS.GE.0.) RNMOC2=FOCS                                      U  110
      IF (FOCS.LT.(-0.00001)) CFHC=ABS(FOCS)                           U  111
      IF (FXNS.LT.(-0.00001)) CFNOX=ABS(FXNS)                          U  112
      CHCNOX = HCTNOX*(1.-CFHC)/(1.-CFNOX)                             U  113
      ROZ1=FOZA                                                        U  114
      IF (FOZA.GE.0.) GO TO 50                                         U  115
C                                                                      U  116
C  USE THE OZONE TRANSPORT CURVES TO ESTIMATE FUTURE OZONE IF          U  117
C  FUTURE OZONE IS NEGATIVE (SEE 1981 CITY-SPECIFIC GUIDELINES P. 54)  U  118
C                                                                      U  119
      ROZ1=OZALSV                                                      U  120
      IF (OZALSV .LE. 0.04) GO TO 50                                   U  121
C                                                                      U  122
C  IF INPUTED FUTURE OZONE VALUE IS LESS -100. THEN USE                U  123
C    DASH LINE OF OZONE CURVE                                          U  124
C                                                                      U  125
      IF (FOZA.LT.(-99.)) GO TO 40                                     U  126
      ROZ1 = 0.7*OZALSV + 0.012                                        U  127
      IF (OZALSV .GT. 0.1543) ROZ1 = 0.12                              U  128
      GO TO 50                                                         U  129
   40 ROZ1 = 0.9*OZALSV + 0.004                                        U  130
      IF (OZALSV .GT. 0.129) ROZ1 = 0.12                               U  131
C                                                                      U  132
C  REPEAT FUTURE OZONE ESTIMATE FOR SURFACE LAYER                      U  133
C                                                                      U  134
   50 ROZ2=FOZS                                                        U  135
      IF (FOZS.GE.0.) GO TO 70                                         U  136
      ROZ2=OZINSV                                                      U  137
      IF (OZINSV .LE. 0.04) GO TO 70                                   U  138
      IF (FOZS.LT.(-99.))  GO TO 60                                    U  139
      ROZ2 = 0.7*OZINSV + 0.012                                        U  140
      IF (OZINSV .GT. 0.1543) ROZ2 = 0.12                              U  141
      GO TO 70                                                         U  142
   60 ROZ2 = 0.9*OZINSV + 0.004                                        U  143
      IF (OZINSV .GT. 0.129) ROZ2 = 0.12                               U  144
C                                                                      U  145
   70 HC1 = -99.0                                                      U  146
      HC2 = 1.0                                                        U  147
      OXN2 = HC2/HCTNOX                                                U  148
      IFL=0                                                            U  149
C                                                                      U  150
      WRITE (IOUT,410) DOZ,HCTNOX,REDNX1,ROZ1,RNMOC1,FXNA              U  151
      IF (ICR.LE.0) GO TO 85                                           U  152
      DO 80 J=1,ICR                                                    U  153
      WRITE (IOUT,450) ISPNCR(J),ISPNCR(J),REDCR(J),                   U  154
     1 ISPNCR(J),FALFCR(J)                                             U  155
   80 CONTINUE                                                         U  156
   85 IF (IBSP.LE.0) GO TO 90                                          U  156A
      DO 86 J=1,IBSP                                                   U  156B
      WRITE (IOUT,451) IBEMSP(J),IBEMSP(J),REDBI(J),IBEMSP(J),         U  156C
     1FSRFBI(J),IBEMSP(J),FALFBI(J)                                    U  156D
   86 CONTINUE                                                         U  156E
   90 CONTINUE                                                         U  157
      IF (CFHC.GT.0..OR.CFNOX.GT.0.) WRITE (IOUT,420) CFHC,CFNOX,      U  158
     1CHCNOX                                                           U  159
      IF (X(2).GT.0.) WRITE (IOUT,430) ROZ2,RNMOC2,FXNS,PLSP(1)        U  160
      IF (X(2).LT.0.) WRITE (IOUT,440) ROZ2,RNMOC2,FXNS,ALREHC,ALRENX, U  161
     1 PLSP(1)                                                         U  162
C                                                                      U  163
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C  IF BASE YEAR PRECURSOR TRANSPORT IS LESS THAN BACKGROUND                U   164
C   THEN SKIP APPENDIX B PROCEDURES                                         U   165
C                                                                           U   166
      IF (X(2).LT.0.) GO TO 270                                             U   167
      IF (HCIN .LE. HCBK) GO TO 150                                         U   168
      IF (CFHC.LE.0..AND.CFNOX.LE.0.) GO TO 150                             U   169
C                                                                           U   170
C  DO APPENDIX B (STEP 3)                                                   U   171
C                                                                           U   172
      HCIN = 0.0                                                            U   173
      DO 110 I=1, NTRYS                                                     U   174
         CALL SIM (HC2,OXN2,ZN2,10)                                         U   175
         OZV(I)=ZN2                                                         U   176
         HCTMP(I)=HC2                                                       U   177
         ANXTMP(I)=HC2                                                      U   178
         DIFF = ABS(ZN2-DOZ)/DOZ                                            U   179
         IF (DIFF .LE. ACCU) GO TO 120                                      U   180
         IF (HC1 .NE. (-99.0)) GO TO 100                                    U   181
      HC1=HC2                                                               U   182
      ZN1=ZN2                                                               U   183
      HC2=HC1*DOZ/ZN2                                                       U   184
      OXN2=HC2/HCTNOX                                                       U   185
      GO TO 110                                                             U   186
  100 B=(DOZ-ZN1)*(HC2-HC1)/(ZN2-ZN1)+HC1                                   U   187
C                                                                           U   188
C     CHECK FOR REVERSING TREND. FIX SO WE DO NOT LOOP                      U   189
C                                                                           U   190
      IF (ZN2.GT.ZN1 .AND. HC2.LT.HC1 .AND. ZN2.GT.DOZ)                     U   191
     1    B = DOZ*HC2/ZN2                                                  U   192
      IF (B.LT.0.) B=HC2/2.0                                                U   193
      HC1=HC2                                                               U   194
      ZN1=ZN2                                                               U   195
      HC2=B                                                                 U   196
      OXN2=HC2/HCTNOX                                                       U   197
  110 CONTINUE                                                              U   198
      IFL=1                                                                 U   199
      GO TO 180                                                             U   200
C                                                                           U   201
C  DO STEPS 4, 5, AND 6 (APPENDIX B)                                        U   202
C                                                                           U   203
  120 HCIN = HC2*CFHC                                                       U   204
      XNIN = OXN2*CFNOX                                                     U   205
      HCTNOX = CHCNOX                                                       U   206
      HC1=-99.                                                              U   206A
      RNMOC2 = (HCIN - BNMOC)*RNMOC + BNMOC                                 U   207
      HC2 = OXN2*HCTNOX                                                     U   208
      IF (CFHC.LE.0..AND.CFNOX.LE.0.) GO TO 150                             U   209
      DO 140 J=1,ISP                                                        U   210
      IF (EMSP(J).NE.IIHC.AND.EMSP(J).NE.IINX) GO TO 140                    U   211
      IF (EMSP(J).EQ.IIHC) CFX=CFHC                                         U   212
      IF (EMSP(J).EQ.IINX) CFX=CFNOX                                        U   213
      IEM = ESTOP/60.                                                       U   213A
      IF (NEM.GT.0) GO TO 131                                               U   213B
      DO 130 I=1,IEM                                                        U   214
      EM1(I)=EMO(I,J)/(1.-CFX)                                              U   215
  130 CONTINUE                                                              U   216
      CALL EMISS(IEM,EM1,ECO(1,J))                                          U   217
      GO TO 140                                                             U   217A
  131 IF (J.GT.1) GO TO 140                                                 U   217B
      DO 132 I=1,NEM                                                        U   217C
      EM1(I)=EM(I)/(1.-CFX)                                                 U   217D
  132 CONTINUE                                                              U   217E
      CALL EMISS (NEM,EM1,EC)                                               U   217F
  140 CONTINUE                                                              U   218
```

```
C
C  NOW DO BASE CASE CALCULATION                                          U   219
C                                                                       U   220
  150 DO 170 I=1, NTRYS                                                 U   221
        CALL SIM (HC2,OXN2,ZN2,10)                                      U   222
        OZV(I)=ZN2                                                      U   223
        HCTMP(I)=HC2                                                    U   224
        ANXTMP(I)=HC2                                                   U   225
        DIFF = ABS(ZN2-DOZ)/DOZ                                         U   226
        IF (DIFF .LE. ACCU) GO TO 270                                   U   227
        IF (HC1 .NE. (-99.0)) GO TO 160                                 U   228
      HC1=HC2                                                           U   229
      ZN1=ZN2                                                           U   230
      HC2=HC1*DOZ/ZN2                                                   U   231
      OXN2=HC2/HCTNOX                                                   U   232
      GO TO 170                                                         U   233
  160 B=(DOZ-ZN1)*(HC2-HC1)/(ZN2-ZN1)+HC1                               U   234
C                                                                       U   235
C     CHECK FOR REVERSING TREND. FIX SO WE DO NOT LOOP                  U   236
C                                                                       U   237
      IF (ZN2.GT.ZN1 .AND. HC2.LT.HC1 .AND. ZN2.GT.DOZ)                 U   238
     1    B = DOZ*HC2/ZN2                                              U   239
      IF (B.LT.0.) B=HC2/2.0                                            U   240
      HC1=HC2                                                           U   241
      ZN1=ZN2                                                           U   242
      HC2=B                                                             U   243
      OXN2=HC2/HCTNOX                                                   U   244
  170 CONTINUE                                                          U   245
      IF (IFL.EQ.3) GO TO 180                                           U   246
      IFL=2                                                             U   247
C                                                                       U   248
C     WAS NOT ABLE TO FIND DESIGN OZONE WITHIN ALLOTTED TRYS            U   249
C                                                                       U   250
  180 IF (IFL.LT.3) WRITE (IOUT,460) DOZ,NTRYS                          U   251
      IF (IFL.EQ.3) WRITE (IOUT,550) DOZ                                U   252
      IF (IFL.EQ.3) GO TO 330                                           U   253
C                                                                       U   254
C  CHECK TO SEE IF THERE IS A MAXIMUM ALONG THIS HC/NOX RATIO.          U   255
C  IF SO, DETERMINE IF DESIGN OZONE OCCURS ON LINE AND IF THERE ARE TWO U   256
C  LOCATIONS.  IF THERE ARE TWO LOCATIONS THEN USE THE LOCATION CLOSEST U   257
C  TO THE MEASURED NMOC AND NOX VALUES.                                 U   258
C                                                                       U   259
C  FIRST SORT VALUES                                                    U   260
C                                                                       U   261
      HMIN1=999.                                                        U   262
      DO 200 J=1,NTRYS                                                  U   263
      DO 190 I=1,NTRYS                                                  U   264
      IF (HCTMP(I).LT.HMIN1) INOW=I                                     U   265
      IF (HCTMP(I).LT.HMIN1) HMIN1=HCTMP(I)                             U   266
  190 CONTINUE                                                          U   267
      HCSORT(J)=HCTMP(INOW)                                             U   268
      ANSORT(J)=ANXTMP(INOW)                                            U   269
      OZSORT(J)=OZV(INOW)                                               U   270
      HCTMP(INOW)=999.                                                  U   271
      HMIN1=999.                                                        U   272
  200 CONTINUE                                                          U   273
C                                                                       U   274
C  NOW FIND MAXIMUM VALUE                                               U   275
C                                                                       U   276
      CALL EDGMX (HCSORT,OZSORT,NTRYS,HMX,OZHX,LHX)                     U   277
      MM=LHX+1                                                          U   278
      IF (MM.LT.NTRYS.AND.OZHX.LT.DOZ) WRITE (IOUT,530) DOZ,OZHX        U   279
      IF (MM.LT.NTRYS.AND.OZHX.LT.DOZ) GO TO 330                        U   280
      IF (MM.GE.NTRYS) GO TO 330                                        U   281
                                                                        U   282
```

```
C                                                                       U   283
C  THERE IS A MAXIMUM ALONG NMOC/NOX                                    U   284
C                                                                       U   285
C  FIND THE LOCATIONS                                                   U   286
C                                                                       U   287
      DO 210 J=1,LHX                                                    U   288
      HCTMP(J)=HCSORT(J)                                                U   289
      OZV(J)=OZSORT(J)                                                  U   290
  210 CONTINUE                                                          U   291
      HCTMP(MM)=HMX                                                     U   292
      OZV(MM)=OZHX                                                      U   293
      SX=-SIG*3.0                                                       U   294
      IF (MM.GT.2) SX=-SIG*60./(FLOAT(MM-2)**2)                         U   295
  220 CALL CURV1(MM,OZV,HCTMP,SP1,SP2,YP,TM,SX)                         U   296
      IT=1                                                              U   297
      HCML1=CURV2(DOZ,MM,OZV,HCTMP,YP,SX,IT)                            U   298
      IF (IT.GT.0) GO TO 230                                            U   299
      SX=SX*10.                                                         U   300
      SX=AMAX1(-50.,SX)                                                 U   301
      GO TO 220                                                         U   302
  230 CONTINUE                                                          U   303
C                                                                       U   304
C NOW DO UPPER PORTION                                                  U   305
C                                                                       U   306
      MDIF=NTRYS-LHX                                                    U   307
      DO 240 J=1,MDIF                                                   U   308
      MJ=NTRYS-J                                                        U   309
      OZV(J)=OZSORT(MJ)                                                 U   310
      HCTMP(J)=HCSORT(MJ)                                               U   311
  240 CONTINUE                                                          U   312
      OZV(MDIF+1)=OZHX                                                  U   313
      HCTMP(MDIF+1)=HMX                                                 U   314
      MDIF=MDIF+1                                                       U   315
      SX=-SIG*3.0                                                       U   316
      IF (MDIF.GT.2) SX=-SIG*60./(FLOAT(MDIF-2)**2)                     U   317
  250 CALL CURV1(MDIF,OZV,HCTMP,SP1,SP2,YP,TM,SX)                       U   318
      IT=1                                                              U   319
      HCML2=CURV2(DOZ,MDIF,OZV,HCTMP,YP,SX,IT)                          U   320
      IF (IT.GT.0) GO TO 260                                            U   321
      SX=SX*10.                                                         U   322
      SX=AMAX1(-50.,SX)                                                 U   323
      GO TO 250                                                         U   324
  260 CONTINUE                                                          U   325
C                                                                       U   326
C  SEE WHICH VALUE IS CLOSEST TO MEASURED NMOC AND NOX                  U   327
C                                                                       U   328
      XNM1=HCML1/HCTNOX                                                 U   329
      XNM2=HCML2/HCTNOX                                                 U   330
      HCD1=SQRT((HCML1-HCMEAS)**2 + (XNM1-ANMEAS)**2)                   U   331
      HCD2=SQRT((HCML2-HCMEAS)**2 + (XNM2-ANMEAS)**2)                   U   332
      WRITE (IOUT,540) HCML1,XNM1,HCML2,XNM2,HCMEAS,ANMEAS,PLSP(1)      U   333
      HC2=HCML1                                                         U   334
      OXN2=XNM1                                                         U   335
      IF (HCD2.LT.HCD1) HC2=HCML2                                       U   336
      IF (HCD2.LT.HCD1) OXN2=XNM2                                       U   337
      IF (HCML1.LT.HCSORT(1).OR.HCML1.GT.HCSORT(NTRYS)) HC2=HCML2       U   338
      IF (HCML1.LT.HCSORT(1).OR.HCML1.GT.HCSORT(NTRYS)) OXN2=XNM2       U   339
      IF (HCML2.LT.HCSORT(1).OR.HCML2.GT.HCSORT(NTRYS)) HC2=HCML1       U   340
      IF (HCML2.LT.HCSORT(1).OR.HCML2.GT.HCSORT(NTRYS)) OXN2=XNM1       U   341
      IF (HC2.LT.HCSORT(1).OR.HC2.GT.HCSORT(NTRYS)) WRITE(IOUT,570)     U   342
      IF (HC2.LT.HCSORT(1).OR.HC2.GT.HCSORT(NTRYS)) GO TO 330           U   343
      IF (IFL.EQ.1) GO TO 120                                           U   344
      IFL=3                                                             U   345
      GO TO 150                                                         U   346
```

```
C
C     FOUND IT.   NOW DO FUTURE YEAR CALCULATION
C
  270 IF (X(2).LT.0.) OXN2=ALRENX
      IF (X(2).LT.0.) HC2=ALREHC
      OXN1 = OXN2*REDNOX
      HCORG = HC2
      IF (X(6).LT.(-0.000001)) GO TO 330
      HCAL=RNMOC1
      HCIN=RNMOC2
      OZAL=ROZ1
      OZIN=ROZ2
      IF (FOCS.GT.(-0.00001)) HCIN=FOCS
      IF (FXNS.GE.(-0.00001)) XNIN=FXNS
      IF (FXNA.GE.(-0.00001)) XNAL=FXNA
C
C  ALLOW FOR OTHER EMISSIONS CREDITS (ONLY FOR CO CURRENTLY)
C
      IF (ICR.LE.0) GO TO 285
      DO 280 J=1,ICR
      SPCR69(J)=SPCR69(J)*(1.+REDCR(J)*0.01)
      SURFCR(J)=FSRFCR(J)
      ALOFCR(J)=FALFCR(J)
  280 CONTINUE
  285 IF (IBSP.LE.0) GO TO 290
      DO 287 J=1,IBSP
      SURFBI(J)=FSRFBI(J)
      ALOFBI(J)=FALFBI(J)
      DO 286 L=1,NBEM
      EM1(L)=BEMO(L,J)*(1.+REDBI(J)*0.01)
  286 CONTINUE
      CALL EMISS (NBEM,EM1,BECO(1,J))
  287 CONTINUE
  290 CONTINUE
C
C  TAKE AN INITIAL GUESS AT VOC REDUCTION (50 PERCENT)
C
      HC1=0.5*HC2
      HC2 = 0.0
      ZN2 = 0.0
      OXN2 = OXN1
      HC3 = 0.5
      DO 310 I=1, NTRYS
         II=I
         CALL SIM (HC1,OXN1,ZN1,10)
         DIFF = ABS(ZN1-AOZ)/AOZ
         IF (DIFF .LE. ACCU) GO TO 320
         IF (ZN1.GT.AOZ.AND.HC3.LE.0.) II=NTRYS+1
         IF (ZN1.GT.AOZ.AND.HC3.LE.0.) GO TO 320
         DELTA = 1.0
         IF (ZN1 .NE. ZN2) DELTA = (HC1 - HC2)/(ZN1 - ZN2)
         IF ((ABS(AOZ-ZN1) .GT. ABS(AOZ-ZN2)) .AND. I .NE. 1) GO TO 300
         HC3 = HC1 + (AOZ - ZN1)*DELTA
         ZN2 = ZN1
         HC2 = HC1
         HC1 = HC3
         IF (HC1 .LT. 0.0) HC1 = 0.0
         GO TO 310
  300    HC1 = HC2 + (AOZ - ZN2)*DELTA
         HC3 = HC1
         IF (HC1 .LT. 0.0) HC1 = 0.0
  310 CONTINUE
C
  320 IF (II.GE.NTRYS) WRITE (IOUT,460) AOZ,I
```

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U   383A
U   383B
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U   389
U   390
U   391
U   392
U   393
U   393A
U   394
U   395
U   396
U   397
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      IF (II.GE.NTRYS) GO TO 330                                        U   398
      REDUC = (HCORG - HC1)*100.0/HCORG                                 U   399
      IF (REDUC.LE.90.) WRITE (IOUT,470) REDUC                          U   400
      IF (REDUC.GT.90.) WRITE (IOUT,560) REDUC                          U   401
C                                                                       U   402
C  DO SINGLE CALC AT THIS POINT BASED ON USER INPUT OF VOC CHANGE       U   403
C                                                                       U   404
  330 IF (ABS(X(6)).EQ.0.) GO TO 340                                    U   405
      HC1=HCORG*(1.+HCLV*0.01)                                          U   406
      WRITE (IOUT,480) HCLV,PLSP(1)                                     U   407
      CALL SIM(HC1,OXN1,ZN1,10)                                         U   408
C                                                                       U   409
C  DO OZIPM-2 EKMA OPTION TO GENERATE CHANGE IN OZONE                   U   410
C                                                                       U   411
  340 IF (X(5).LE.0.) GO TO 360                                         U   412
C                                                                       U   413
C  THE FOLLOWING ALGORITHM WAS DEVELOPED BY EPA (GIPSON, 1984)          U   414
C                                                                       U   415
      WRITE(IOUT,490)                                                   U   416
      WRITE(IOUT,500)                                                   U   417
      DELHC=10.0                                                        U   418
      DO 350 K=1,11                                                     U   419
      DELHC=DELHC-10.                                                   U   420
      HC2=HCORG*(1.0+DELHC/100.)                                        U   421
      CALL SIM(HC2,OXN1,ZN,5)                                           U   422
      DELO3=((ZN-DOZ)/DOZ)*100.                                         U   423
      WRITE(IOUT,510) HC2,OXN1,ZN,DELHC,X(3),DELO3                      U   424
      OZOUT(K)=ZN                                                       U   425
  350 CONTINUE                                                          U   426
      IF (X(5).EQ.2) WRITE(IOZC,520) OZOUT                              U   427
C                                                                       U   428
C  RESET VALUES FOR NEXT OPTION                                         U   429
C                                                                       U   430
  360 CONTINUE                                                          U   431
C                                                                       U   432
C  RESET EMISSIONS IF APPENDIX B WAS USED                               U   433
C                                                                       U   434
      IF (HCINSV.LE.HCBK.AND.XNIN.LE.XNBK) GO TO 380                    U   435
      IF (CFHC.LE.0..AND.CFNOX.LE.0.) GO TO 380                         U   436
      DO 370 J=1,ISP                                                    U   437
      IF (NEM.LT.0) CALL EMISS(IEM,EMO(1,J),ECO(1,J))                   U   438
      IF (NEM.GT.0) CALL EMISS(NEM,EM,EC)                               U   438A
  370 CONTINUE                                                          U   439
  380 CONTINUE                                                          U   440
      NPTO=0                                                            U   441
      INFO=0                                                            U   442
      OZIN=OZINSV                                                       U   443
      OZAL=OZALSV                                                       U   444
      HCIN=HCINSV                                                       U   445
      HCAL=HCALSV                                                       U   446
      XNIN=XNINSV                                                       U   447
      XNAL=XNALSV                                                       U   448
      IF (ICR.LE.0) GO TO 395                                           U   449
      DO 390 J=1,ICR                                                    U   450
      SPCR69(J)=SPCRSV(J)                                               U   451
      SURFCR(J)=SCRSV(J)                                                U   452
      ALOFCR(J)=ALCRSV(J)                                               U   453
  390 CONTINUE                                                          U   454
  395 IF (IBSP.LE.0) RETURN                                             U   454A
      DO 396 J=1,IBSP                                                   U   454B
      SURFBI(J)=SBIOSV(J)                                               U   454C
      ALOFBI(J)=ABIOSV(J)                                               U   454D
      CALL EMISS (NBEM,BEMO(1,J),BECO(1,J))                             U   454E
  396 CONTINUE                                                          U   454F
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C
      RETURN                                                                U   455
C                                                                           U   456
C  FORMAT STATEMENTS                                                        U   457
C                                                                           U   458
  400 FORMAT (7F10.5)                                                       U   459
  410 FORMAT (1H1    // 40X,43HEKMA CALCULATIONS ARE PERFORMED TO ESTIMATU   460
     1E / 1H0,39X,   38HSITE-SPECIFIC VOC CONTROL REQUIREMENTS // 1H0      U   461
     2,39X,  36HBASE YEAR OZONE                    ,F10.3,4H PPM / 1H0,U   462
     339X ,36HBASE YEAR NMOC/NOX                  ,F10.3 / 1H0,39X,       U   463
     4  36HANTICIPATED CHANGE IN NOX            ,F10.3,8H PERCENT / 1H0,U   464
     539X, 36HFUTURE OZONE TRANSPORTED ALOFT       ,F10.3,4H PPM / 1H0,U   465
     639X, 36HFUTURE NMOC TRANSPORTED ALOFT       ,F10.3,5H PPMC / 1H0,U   466
     739X,  36HFUTURE NOX TRANSPORTED ALOFT        ,F10.3,5H PPM  )        U   467
  420 FORMAT (1H0,39X,                                                      U   468
     1  36HMEDIAN CONTRIBUTION FACTOR FOR NMOC ,F10.3 / 1H0,39X,           U   469
     2  36HMEDIAN CONTRIBUTION FACTOR FOR NOX  ,F10.3 / 1H0,39X,           U   470
     3  36HADJUSTED NMOC/NOX                  ,F10.3)                     U   471
  430 FORMAT (1H0,39X,                                                      U   472
     1     36HFUTURE OZONE IN THE SURFACE LAYER     ,F10.3,4H PPM / 1H0,U   473
     239X, 36HFUTURE NMOC IN THE SURFACE LAYER     ,F10.3,5H PPMC / 1H0,U   474
     339X,  36HFUTURE NOX IN THE SURFACE LAYER      ,F10.3,5H PPM  ,       U   475
     4 ////1H1 ///,40X,36HTHE FOLLOWING SIMULATIONS WERE DONE./1H0,         U   476
     5    15X,4HNMOC,17X,3HNOX,15X,5HRATIO,17X,A4,16X,4HTIME)               U   477
  440 FORMAT (1H0,39X,                                                      U   478
     1     36HFUTURE OZONE IN THE SURFACE LAYER     ,F10.3,4H PPM / 1H0,U   479
     239X, 36HFUTURE NMOC IN THE SURFACE LAYER     ,F10.3,5H PPMC / 1H0,U   480
     339X, 36HFUTURE NOX IN THE SURFACE LAYER      ,F10.3,5H PPM  / 1H0,U   481
     439X, 55HBASE YEAR NMOC AND NOX LOCATIONS ARE ALREADY DETERMINED/      U   482
     51H0,                                                                  U   483
     639X, 36HBASE YEAR INITIAL NMOC LOCATION      ,F10.3,5H PPMC / 1H0,U   484
     739X,  36HBASE YEAR NOX LOCATION               ,F10.3,5H PPM  ,       U   485
     8 ////1H1 ///40X,36HTHE FOLLOWING SIMULATIONS WERE DONE./1H0,          U   486
     9    15X,4HNMOC,17X,3HNOX,15X,5HRATIO,17X,A4,16X,4HTIME)               U   487
C                                                                           U   488
                                                                            U   489
  450 FORMAT (1H0,39X,37HEMISSION CREDITS WILL BE ALLOWED FOR ,A4/1H0,      U   490
     1 39X,22HANTICIPATED CHANGE IN ,A4,10X,F10.3,8H PERCENT   /1H0,       U   491
     239X,7HFUTURE ,A4,25H TRANSPORTED ALOFT        ,F10.3,4H PPM  )       U   492
  451 FORMAT (1H0,39X,42HFUTURE BIOGENIC EMISSIONS WILL BE SET FOR ,        U   492A
     1A4/1H0,39X,22HANTICIPATED CHANGE IN ,A4,10X,F10.3,8H PERCENT         U   492B
     2/1H0,39X,7HFUTURE ,A4,33H TRANSPORTED IN THE SURFACE LAYER,F10.3,    U   492C
     34H PPM/1H0,39X,7HFUTURE ,A4,25H TRANSPORTED ALOFT       ,           U   492D
     4F10.3,4H PPM    )                                                     U   492E
C                                                                           U   493
  460 FORMAT (1H0 // 40X,15HCOULD NOT FIND ,F10.4,10H OZONE IN ,            U   494
     1        I3,6H TRYS //40X,34HCHECK INPUT CONDITIONS OR GENERATE       U   495
     2        /40X,20HAN ISOPLETH DIAGRAM.  )                              U   496
  470 FORMAT (1H0 // 40X,27HVOC CONTROL REQUIREMENT IS ,F5.1,8H PERCENT)    U   497
  480 FORMAT (1H1 // 40X,41HTHE FOLLOWING SIMULATION WAS DONE WITH A        U   498
     1 / 1H0,39X,F7.2,24H PERCENT CHANGE IN NMOC.    /1H0,                  U   499
     2    15X,4HNMOC,17X,3HNOX,15X,5HRATIO,17X,A4,16X,4HTIME)               U   500
  490 FORMAT(1H1,39X,'EKMA PREDICTED CHANGES IN OZONE')                     U   501
  500 FORMAT(///40X,'HC',6X,'NOX',6X,'O3',4X,'%-CHG HC',3X,                 U   502
     1'%-CHG NOX',3X,'%-CHG O3'/)                                           U   503
  510 FORMAT(38X,F6.3,3X,F5.3,3X,F5.4,4X,F6.1,5X,F6.1,                      U   504
     16X,F6.1)                                                              U   505
  520 FORMAT(11F5.3)                                                        U   506
  530 FORMAT (1H0,39X, 23HTHE BASE YEAR OZONE OF ,F10.3,43H PPM DOES NOTU   507
     1 OCCUR WITH THE GIVEN INPUTS. /40X, 32HTHE MAXIMUM CALCULATED OZONU   508
     2E IS ,F10.3,5H PPM.//)                                                U   509
  540 FORMAT (1H0,39X,44HTHE BASE YEAR OZONE OCCURS AT TWO LOCATIONS /      U   510
     140X,25HALONG THE NMOC/NOX RATIO:/1H0,                                 U   511
     2    39X,4HNMOC,17X,3HNOX/35X,F11.5,7X,F11.5/35X,F11.5,7X,             U   512
     3    F11.5//40X,45HTHE LOCATION CLOSEST TO THE MEASURED NMOC OF ,      U   513
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     4 F10.3, 5H PPMC /40X,11HAND NOX OF ,F10.3,18H PPM WILL BE USED.   U   514
     5 /  40X,50HTHE FOLLOWING SIMULATIONS WERE DONE AT THIS POINT./    U   515
     61H0,14X,4HNMOC,17X,3HNOX,15X,5HRATIO,17X,A4,16X,4HTIME)           U   516
   550 FORMAT (1H0,39X,21HCANNOT FIND OZONE OF ,F5.2,17H AFTER SECOND SETU   517
     1/40X,56HOF ITERATIONS.  CHECK INPUTS OR GENERATE AN ISOPLETH DIA, U   518
     25HGRAM. )                                                         U   519
   560 FORMAT (1H0,39X,33HNOTE THE CALCULATED REDUCTION OF ,F6.2,8H PERCEU   520
     1NT/40X,54HMAYBE UNREALISTIC WITH THE GIVEN INPUTS.                U   521
     2/40X,35HAN ISOPLETH DIAGRAM IS RECOMMENDED. )                     U   522
   570 FORMAT (1H0,39X,44HBOTH CALCULATED NMOC AND NOX LOCATIONS ARE  / U   523
     140X,57HOUTSIDE RANGE OF INTERPOLATION.  CHECK INPUTS OR GENERATE  U   524
     2/40X,20HAN ISOPLETH DIAGRAM.  )                                   U   525
C                                                                       U   526
      END                                                               U   527-
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      SUBROUTINE SIM (HCHH,XNHH,ZN,INX)                                  V     1
C                                                                        V     2
C  THIS ROUTINE CONTROLS THE SIMULATION OF AN INDIVIDUAL CALCULATION      V     3
C                                                                        V     4
      SAVE                                                               V     5
      COMMON /CALC/ NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),IA(60)V     6
     1,             JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENI V     7
      COMMON /TITL/   ITTL(36)                                           V     8
      COMMON /HOUR/   OZM(5),NGO,TTM,TM(5)                               V     9
      COMMON /CNTRL/  SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN,  V    10
     1                FLST,TLST                                         V    11
      COMMON /EMIS/   NEM,IS1,ESTRT(5),ESTOP,ESLP,IEMLS(5),EOSLP(5),     V    12
     1                EMO(26,5),ECI(5),EM(26),EC(125),ECO(125,5)        V    13
      COMMON /HEAT/   SC(200,12),ISC(200,3)                              V    14
      COMMON /NEED1/  IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,      V    15
     1                IIH2O,JPLUS                                       V    16
      COMMON /FRPLOT/ SAVCON(80,5),SAVTIM(80),NT,INOW                    V    17
C                                                                        V    18
      COMMON /INOUT/  INU,IOUT,ITAPE,IALN,IALL,IN1,IOZC                  V    19
      COMMON /SPEC/   NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),        V    20
     1                FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,  V    21
     2                XNAL,NOZ,FENX(2),CI(61),NI,KOZ(5)                  V    22
      COMMON /SUNLIT/ Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,      V    23
     1                ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),       V    24
     2                XZ(24),KK(24),JSTRT,JSTOP,SPEE,MNLM,MXLM,MAXL,MAXJV    25
      COMMON /HJH/    HCSAV,XNSAV                                        V    26
      COMMON /PHOTON/ CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20),  V    27
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),      V    28
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)         V    29
      COMMON /MIX/    NMIX,AMIX(26),STRM,STOPM,DC(104)                   V    30
      COMMON /MIXING/ DSTRT,DEND,AMC(5),BMC(5),CMC(5),FD(6),FG(6),       V    31
     1                AMXX(26),DL,TTMAX,SSRISE,SRMIN,DELH,TDIL,NMXX,     V    32
     2                HEIGHT,SSET,SRISE                                  V    32A
      COMMON /BK1/    FBK(20),FBKAL(5),HCBK,XNBK,OZBK,H2OBK              V    33
      COMMON /CRED/   ICR,ISPCR,SPCR69(3),SURFCR(3),ALOFCR(3),           V    34
     1                REDCR(3),FSRFCR(3),FALFCR(3),COSFBK,COAFBK         V    35
      COMMON /BIOG/   NBEM,IBSP,WTMOL(5),ACB4(5),SURFBI(5),ALOFBI(5),    V    35A
     1                REDBI(5),FSRFBI(5),FALFBI(5),BEMO(26,5),           V    35B
     2                BECO(126,5),CBTOT(5),IBLS(5),BESTOP,BFRAC(20,5)    V    35C
      COMMON /WATER / WATEND,NWATER,PAMB,QW(30),QR(30),PMILLI,ILH2O      V    35D
C                                                                        V    35E
      COMMON /BIOCHR/ IISOP, IBEMSP(5)                                   V    35F
      COMMON /CRECHR/ ISPNCR(3)                                          V    35G
      COMMON /EMSCHR/ EMSP(5)                                            V    35H
      COMMON /NEED1C/ IBZA                                               V    35I
      COMMON /PHTCHR/ ISPDP(10)                                          V    35J
      COMMON /CALCHR/ SPECIS(61)                                         V    35K
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                     V    35L
C                                                                        V    35M
      CHARACTER*2 ITTL                                                   V    35N
      CHARACTER*4 ISPDP, ISPNCR, IBEMSP                                  V    35O
      CHARACTER*4 SPECIS, HCSPEC, PLSP, REACT, IISOP, EMSP               V    35P
      CHARACTER*4 IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,          V    35Q
     1            IIH2O,IBZA,JPLUS,INST                                  V    35R
C                                                                        V    35S
      DIMENSION RT(200), RX(20), C(61), CO3(5), INST(3,5),YY(61,6)       V    36
C                                                                        V    37
      DATA INST/'(INS','TANT',')   ','(INS','TANT',')   ',              V    38
     1'(INS','TANT',')   ','(INS','TANT',')   ','(INS','TANT',')   '/V    39
      ISP=IS1+ICR                                                        V    39A
      TCI=FLOAT(JSTRT)                                                   V    40
      HC=HCHH                                                            V    41
      XN=XNHH                                                            V    42
      START=0.                                                           V    43
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      T=START                                                          V    44
      TDIL=0.                                                          V    45
      TTRS=CLKMIN (TCI)                                                V    46
      TTR1=CLKMIN (SRISE)                                              V    47
      TTR2=CLKMIN (SSET)                                               V    48
      TR1=TTR1-TTRS                                                    V    49
      TR2=TTR2-TTRS                                                    V    50
      IF (TR2.LE.0.) TR2=2000.                                         V    51
      IF (TR1.GE.0..OR.((JSTOP-JSTRT).GT.100)) GO TO 10                V    52
      TR2=1440.+TR1                                                    V    53
      TR1=TTR2-TTRS                                                    V    54
      IF (TR1.LT.0.) TR1=0.                                            V    55
      IF (TR2.LE.0.) TR2=2000.                                         V    56
   10 IF (IN1.EQ.1) SAV=STOPP                                          V    57
      STOPP=SAV                                                        V    58
      FLST=1.0                                                         V    59
      TLST=START                                                       V    60
      EHC=HC                                                           V    61
      EXN=XN                                                           V    62
      HCSAV=HC                                                         V    63
      XNSAV=XN                                                         V    64
      TDC=STOPP/80.                                                    V    65
      TD=0.                                                            V    66
      DO 20 I=2,80                                                     V    67
      TD=TD+TDC                                                        V    68
   20 SAVTIM(I)=TD                                                     V    69
      SAVTIM(1)=0.                                                     V    70
      IF (NPTO.EQ.0) TPRNT=STOPP                                       V    71
      IF (NPTO.NE.0) TTM=5.0                                           V    72
      H=1.E-10                                                         V    73
      N=NI                                                             V    74
      M=NS-1                                                           V    75
      DO 30 J=1,5                                                      V    76
   30 ECI(J)=1.                                                        V    77
      IF (ISP.LE.2) GO TO 60                                           V    78
      DO 50 I=3,ISP                                                    V    79
      DO 40 J=1,M                                                      V    80
      IF (EMSP(I).EQ.IIHC.OR.EMSP(I).EQ.IINX) GO TO 40                 V    81
      IF (SPECIS(J).NE.EMSP(I)) GO TO 40                               V    82
      ECI(I)=SPRSE(I)                                                  V    83
      IF (ICR.GT.0.AND.I.GT.2) ECI(I)=SPCR69(I-2)                      V    84
      GO TO 50                                                         V    85
   40 CONTINUE                                                         V    86
   50 CONTINUE                                                         V    87
   60 IFH2O=0                                                          V    88
      IFCO=0                                                           V    89
      IFISOP=0                                                         V    89A
      IF (N.LE.0) GO TO 80                                             V    90
      DO 70 I=1,N                                                      V    91
      C(I)=CI(I)                                                       V    92
      IF (REACT(I).EQ.IIH2O) IFH2O=1                                   V    93
      IF (REACT(I).EQ.IICO) IFCO=1                                     V    94
      IF (REACT(I).EQ.IISOP) IFISOP=1                                  V    94A
   70 CONTINUE                                                         V    95
   80 CONTINUE                                                         V    96
      IF (IFH2O.NE.0) GO TO 90                                         V    97
      N=N+1                                                            V    98
      IF (N.LE.0) N=1                                                  V    99
      REACT(N)=IIH2O                                                   V   100
      C(N)=H2OBK                                                       V   101
      IF (QW(1).GT.0.) C(N)=QW(1)                                      V   101A
   90 IF (IFCO.NE.0.OR.ICR.GT.0) GO TO 100                             V   102
      N=N+1                                                            V   103
      IF (N.LE.0) N=1                                                  V   104
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      REACT(N)=IICO                                                      V   105
      C(N)=COSFBK                                                        V   106
  100 CALL RATES (C,N)                                                   V   107
      IF (IN1.NE.0) CALL SPARS (IA,JA,M)                                 V   108
      DHC=HCIN-HCBK                                                      V   109
      DXN=XNIN-XNBK                                                      V   110
      IF (DHC.LT.0.) HCIN=HCBK                                           V   111
      IF (DXN.LT.0.) XNIN=XNBK                                           V   112
      DO 110 J=1,NHC                                                     V   113
      K=IH(J)                                                            V   114
      FBKS=FINHC(J)                                                      V   115
      IF (FBK(J).GT.(-0.00001)) FBKS=FBK(J)                              V   116
      C(K)=(HC*RCTY(J)+HCIN*FINHC(J))/CARB(J)                            V   117
  110 CONTINUE                                                           V   118
      DO 120 K=1,2                                                       V   119
      I=INOX(K)                                                          V   120
      IF (SPECIS(I).EQ.IINO2) C(I)=XN*XNF(K)+XNIN                        V   121
      IF (SPECIS(I).NE.IINO2) C(I)=XN*XNF(K)                             V   122
  120 CONTINUE                                                           V   123
      IF (OZIN.EQ.0.) GO TO 160                                          V   124
      DO 130 I=1,NOZ                                                     V   125
      IF (PLSP(I).NE.IIO3  ) GO TO 130                                   V   126
      JOZ=KOZ(I)                                                         V   127
      C(JOZ)=OZIN                                                        V   128
      GO TO 160                                                          V   129
  130 CONTINUE                                                           V   130
  140 DO 150 I=1,N                                                       V   131
      IF (SPECIS(I).NE.IIO3  ) GO TO 150                                 V   132
      C(I)=OZIN                                                          V   133
      GO TO 160                                                          V   134
  150 CONTINUE                                                           V   135
  160 IF (ICR.LE.0) GO TO 190                                            V   136
      DO 180 J=1,ICR                                                     V   137
      DO 170 I=1,N                                                       V   138
      IF (SPECIS(I).NE.ISPNCR(J)) GO TO 170                              V   139
C     C(I)=SURFCR(J)+SPCR69(J)                                           V   140
      C(I)=SPCR69(J)                                                     V   140
      GO TO 180                                                          V   141
  170 CONTINUE                                                           V   142
  180 CONTINUE                                                           V   143
  190 IF (ISP.LE.2.OR.ICR.GT.0) GO TO 195                                V   143A
      DO 194 J=3,ISP                                                     V   143B
      DO 193 I=1,N                                                       V   143C
      IF (SPECIS(I).NE.EMSP(J)) GO TO 193                                V   143D
      IF (SPECIS(I).NE.IICO) GO TO 192                                   V   143E
      IF (IFCO.NE.0) C(I)=C(I)+SPRSE(J)                                  V   143F
      IF (IFCO.EQ.0) C(I)=SPRSE(J)                                       V   143G
      GO TO 194                                                          V   143H
  192 C(I)=C(I)+SPRSE(J)                                                 V   143I
      GO TO 194                                                          V   143J
  193 CONTINUE                                                           V   143K
  194 CONTINUE                                                           V   143L
  195 IF (IBSP.LE.0) GO TO 199                                           V   143M
      DO 198 J=1,IBSP                                                    V   143N
      IF (ACB4(J).LE.0.) GO TO 197                                       V   143O
      DO 196 L=1,NHC                                                     V   143P
      K=IH(L)                                                            V   143Q
      C(K)=C(K)+SURFBI(J)*BFRAC(L,J)/CBTOT(J)                            V   143R
  196 CONTINUE                                                           V   143S
      GO TO 198                                                          V   143T
  197 L=IBLS(J)                                                          V   143U
      C(L)=SURFBI(J)                                                     V   143V
  198 CONTINUE                                                           V   143W
  199 CALL DIFFUN (N,START,C,RT,2,START)                                 V   144
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      HC=HCSAV                                                                  V  145
      XN=XNSAV                                                                  V  146
      IF (NPTO.EQ.0) GO TO 210                                                  V  147
      WRITE (IOUT,520)                                                          V  148
      WRITE (IOUT,540) (ITTL(I),I=1,36)                                         V  149
      IF (INFO.LT.1) WRITE (IOUT,600) (PLSP(I),I=1,NOZ)                         V  150
      IF (INFO.LT.1) WRITE (IOUT,610) ((INST(I,KI),I=1,3),KI=1,NOZ)             V  151
      IF (INFO.LT.1) GO TO 210                                                  V  152
      IF (NI.NE.0) WRITE (IOUT,630) (REACT(I),I=1,NI)                           V  153
      IF (NI.NE.0) WRITE (IOUT,640) (CI(I),I=1,NI)                              V  154
      WRITE (IOUT,560) ERR,TEMP,HEIGHT                                          V  155
      WRITE (IOUT,570) (R(IR),IR=1,NR)                                          V  156
      IF (IP.EQ.0) GO TO 210                                                    V  157
      DO 200 I=1,IP                                                             V  158
      K=IPH(I)                                                                  V  159
  200 RX(I)=R(K)                                                                V  160
      WRITE (IOUT,580) (IPH(IR),IR=1,IP)                                        V  161
      WRITE (IOUT,590) (RX(IR),IR=1,IP)                                         V  162
  210 IN=1                                                                      V  163
      IF (IN1.EQ.0) IN=4                                                        V  164
      IN1=0                                                                     V  165
      DILUT=DCON                                                                V  166
      IF (TSRT.LE.START.AND.DTIM.NE.0.) DILUT=ALOG(Z2/Z1)/DTIM                  V  167
      ERRSAV=ERR                                                                V  168
      TNEXT=1.                                                                  V  169
      IF (NPTO.EQ.0) GO TO 310                                                  V  170
      IF (T-START) 390,390,310                                                  V  171
  220 IF (AMIX(1).GT.(-1.).AND.T.GE.TDIL) TDIL=TDIL+60.                         V  172
      TTIM=TR1                                                                  V  173
      IF (T.GE.TTIM) TTIM=TR2                                                   V  174
      IF (T.GE.TR2) TTIM=2000.                                                  V  175
      IF (DTIM.EQ.0.) GO TO 300                                                 V  176
      IF (T.GE.TSRT) GO TO 250                                                  V  177
      DILUT=DCON                                                                V  178
      IF (TSRT-TPRNT-20.) 230,230,240                                           V  179
  230 TNEXT=AMIN1(TSRT,TTIM)                                                    V  180
      IN=2                                                                      V  181
      GO TO 310                                                                 V  182
  240 TNEXT=AMIN1(TPRNT,TTIM)                                                   V  183
      IN=0                                                                      V  184
      GO TO 310                                                                 V  185
  250 IF (AMIX(1).LT.(-1.)) GO TO 260                                           V  186
      TNEXT=AMIN1(TDIL,TPRNT,TTIM)                                              V  187
      IF (T.GE.TSRT+DTIM) GO TO 300                                             V  188
      GO TO 270                                                                 V  189
  260 IF (T.GE.TSRT+DTIM) GO TO 300                                             V  190
      DILUT=ALOG(Z2/Z1)/DTIM                                                    V  191
      FLST=EXP(-DCON*TSRT)                                                      V  192
      TLST=TSRT                                                                 V  193
      TNEXT=TSRT+DTIM                                                           V  194
      TNEXT=AMIN1(TNEXT,TTIM)                                                   V  195
  270 IF (TNEXT-TPRNT-20.) 280,280,290                                          V  196
  280 IN=2                                                                      V  197
      GO TO 310                                                                 V  198
  290 TNEXT=AMIN1(TPRNT,TTIM)                                                   V  199
      IN=0                                                                      V  200
      GO TO 310                                                                 V  201
  300 TNEXT=AMIN1(TPRNT,TTIM,STOPP)                                             V  202
      FLST=EXP(-DCON*TSRT)*Z1/Z2                                                V  203
      TLST=TSRT+DTIM                                                            V  204
      DILUT=DCON                                                                V  205
      IN=2                                                                      V  205A
      IF(TNEXT.EQ.TTIM) IN=0                                                    V  205B
  310 IF (ERR.NE.ERRSAV) IN=-1                                                  V  206
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```
      ERR=ERRSAV                                                          V   207
  320 CALL DRIVES (M,T,H,C,TNEXT,ERR,21,IN,IA,JA,YY)                      V   208
      T=TNEXT                                                             V   209
      IF (NPTO.NE.0) GO TO 350                                            V   210
      IF (T.LT.STOPP) GO TO 220                                           V   211
      IF (INX.GT.(-1)) GO TO 350                                          V   212
      IF (INX.EQ.(-1).AND.OZM(1).GT.0.75*ZN) GO TO 350                    V   213
C     IF (INX.NE.(-3)) GO TO 330                                          V   214
C     TOL=1.0-(0.17/(SQRT(FLOAT(ITAPE))))                                 V   215
C     IF (OZM(1).GE.TOL*ZN.AND.OZM(1).LE.ZN/TOL) GO TO 350                V   216
  330 CONTINUE                                                            V   217
      IF (INX.NE.(-2)) GO TO 340                                          V   218
      IF (OZM(1).LT.1.1*ZN.AND.OZM(1).GT.0.9*ZN) GO TO 350                V   219
  340 ZN=OZM(1)                                                           V   220
      RETURN                                                              V   221
  350 ZN=OZM(1)                                                           V   222
      IF (NPTO.NE.0) GO TO 380                                            V   223
      IF (INX.LT.5) INX=1                                                 V   224
      IF (T.LT.STOPP) GO TO 220                                           V   225
      IF (XN.EQ.0.) RR=0.                                                 V   226
      IF (XN.NE.0.) RR=HC/XN                                              V   227
      IF (INFO.LT.0) GO TO 360                                            V   228
      IF (TM(1).GT.0.) WRITE (IOUT,470) HC,XN,RR,(OZM(J),J=1,NOZ)         V   229
      IF (TM(1).LE.0.) WRITE (IOUT,510) HC,XN,RR,(OZM(J),J=1,NOZ)         V   230
      WRITE (IALN,680) HC,XN,(OZM(J),J=1,NOZ)                             V   231
      RETURN                                                              V   232
  360 CONTINUE                                                            V   233
      CTEND=CLOCK(TCI,IFIX(STOPP))                                        V   234
      IF (CTEND.GT.2400.) CTEND=CTEND-2400.                               V   235
      DO 370 J=1,NOZ                                                      V   236
      IF (TM(J).LE.0.) RT(J)=CTEND                                        V   237
      IF (TM(J).GT.0.) RT(J)=CLOCK(TCI,IFIX(TM(J)))                       V   238
      IF (RT(J).GT.2400.) RT(J)=RT(J)-2400.                               V   239
  370 CONTINUE                                                            V   240
      IF (INX.LT.5)                                                       V   241
     1WRITE (IOUT,550) HC,XN,RR,(OZM(IIC),RT(IIC),IIC=1,NOZ)              V   242
      IF (TM(1).GT.0..AND.INX.GT.5) WRITE (IOUT,660) HC,XN,RR,OZM(1)      V   243
     1,RT(1)                                                              V   244
      IF (TM(1).LE.0..AND.INX.GT.5) WRITE (IOUT,670) HC,XN,RR,OZM(1)      V   245
      IF (INX.LT.5) WRITE (IALN,680) HC,XN,(OZM(J),J=1,NOZ)               V   246
      RETURN                                                              V   247
  380 IF (IN.NE.0) RETURN                                                 V   248
      IF (T.GE.STOPP) TPRNT=STOPP                                         V   249
      IF (T.LT.TPRNT) GO TO 220                                           V   250
  390 HCC=0.                                                              V   251
      DO 400 I=1,NHC                                                      V   252
      K=IH(I)                                                             V   253
  400 HCC=HCC+CARB(I)*C(K)                                                V   254
      CNOX=0.                                                             V   255
      DO 410 I=1,2                                                        V   256
      K=INOX(I)                                                           V   257
      IF (I.EQ.1) FNO2=C(K)                                               V   258
  410 CNOX=CNOX+C(K)                                                      V   259
      IF (CNOX.LE.0.0000001) FNO2=0.                                      V   260
      IF (CNOX.GT.0.0000001) FNO2=FNO2/CNOX                               V   261
      IF (CNOX.LE.0.000001) RNX=0.                                        V   262
      IF (CNOX.GT.0.000001) RNX=HCC/CNOX                                  V   263
      DO 420 I=1,NOZ                                                      V   264
      JOZ=KOZ(I)                                                          V   265
      CO3(I)=C(JOZ)                                                       V   266
  420 CONTINUE                                                            V   267
      IF (INFO.GT.0) WRITE (IOUT,520)                                     V   268
      IF (INFO.GT.0) WRITE (IOUT,600) (PLSP(I),I=1,NOZ)                   V   269
      IF (INFO.GT.0) WRITE (IOUT,610) ((INST(I,KI),I=1,3),KI=1,NOZ)       V   270
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      IF (T.EQ.START) TIMNW=START                                          V   271
      IF (T.NE.START) TIMNW=TPRNT                                          V   272
      CTIME=CLOCK(TCI,IFIX(TIMNW))                                         V   273
C                                                                          V   274
C  ****** UPDATED 11/81 FOR 24 HR RUNS                                     V   275
C                                                                          V   276
      IF (CTIME.GT.2400.) CTIME=CTIME-2400.                                V   277
      WRITE (IOUT,620) CTIME,HCC,RNX,CNOX,FNO2,(CO3(I),I=1,NOZ)            V   278
      IF (INFO.LE.0) GO TO 460                                             V   279
      WRITE (IOUT,500) (SPECIS(I),I=1,M)                                   V   280
      WRITE (IOUT,530) CTIME,(C(I),I=1,10),H,(C(I),I=11,M)                 V   281
      CALL DIFFUN (N,TIMNW,C,RT,1,TIMNW)                                   V   282
      WRITE (IOUT,480) (RT(I),I=1,M)                                       V   283
      DO 440 I=1,NR                                                        V   284
      J=KR(I,1)                                                            V   285
      IF (J.EQ.0) RT(I)=0.                                                 V   286
      IF (J.EQ.0) GO TO 440                                                V   287
      JT=ITYPE(I)                                                          V   288
      XT=1.                                                                V   289
      DO 430 L=1,JT                                                        V   290
      J=KR(I,L)                                                            V   291
      XJ=1.                                                                V   292
      IF (J.GT.0) XJ=C(J)**ISC(I,L)                                        V   293
      IF (ISC(I,L).EQ.(-1)) XJ=C(J)**SC(I,L)                               V   294
      XT=XT*XJ                                                             V   295
  430 CONTINUE                                                             V   296
      RT(I)=XT*R(I)                                                        V   297
  440 CONTINUE                                                             V   298
      WRITE (IOUT,490) (RT(I),I=1,NR)                                      V   299
      IF (IP.EQ.0) GO TO 460                                               V   300
      DO 450 I=1,IP                                                        V   301
      K=IPH(I)                                                             V   302
  450 RX(I)=R(K)                                                           V   303
      WRITE (IOUT,590) (RX(I),I=1,IP)                                      V   304
      WRITE (IOUT,650) HEIGHT,TEMP,ZENI                                    V   305
  460 IF (TNEXT.EQ.1.) ERR=AMIN1(1.,100.*ERR)                              V   306
      IF (TIMNW.EQ.START) GO TO 320                                        V   307
      IF (NPTO.NE.0) IN1=1                                                 V   308
      IF (T.GE.STOPP) RETURN                                               V   309
      TPRNT=TPRNT+TSTEP                                                    V   310
      GO TO 220                                                            V   311
C                                                                          V   312
C  FORMAT STATEMENTS                                                       V   313
C                                                                          V   314
  470 FORMAT (1H0,F11.5,4X,F11.5,5X,F11.5,5X,5(1P,E12.5,3X))               V   315
  480 FORMAT (/10H NET RATES,1X,1P,10E12.3/(11X,1P,10E12.3))               V   316
  490 FORMAT (//1X,22HTHE REACTION RATES ARE/(1H ,1P,10E13.2))             V   317
  500 FORMAT (//3X,5HTIME ,4X,10(4X,A4,4X)/1X,8HINTERVAL,3X,10(4X,A4,      V   318
     14X)/(12X,10(4X,A4,4X)))                                              V   319
  510 FORMAT (1H0,F11.5,4X,F11.5,5X,F11.5,5X,5(1P,E12.5,3X),8H NOT MAX)    V   320
  520 FORMAT (1H1/)                                                        V   321
  530 FORMAT (/1P,E11.3,10E12.3/E11.3,10E12.3/(11X,10E12.3))               V   322
  540 FORMAT (46X,36A2)                                                    V   323
  550 FORMAT (1H0,F11.5,F9.5,F11.5,2X,4(1P,E10.4,3X,0P,F5.0,2X),1P,        V   324
     1E10.4,3X,0P,F5.0)                                                    V   325
  560 FORMAT (24H0THE ERROR TOLERANCE IS ,1P,E10.3/                        V   326
     125H0THE TEMPERATURE USED IS ,E10.3/                                  V   327
     221H0THE MIXING HEIGHT IS ,E10.2)                                     V   328
  570 FORMAT (29H0THE RATE CONSTANTS USED WERE//(1H0,1P,10E13.3))          V   329
  580 FORMAT (29H0THE PHOTOLYSIS REACTIONS ARE/(1H0,9I13))                 V   330
  590 FORMAT (34H0THE PHOTOLYTIC RATE CONSTANTS ARE/(5X,1P,9E13.3))        V   331
  600 FORMAT (1H0,10X,4HTIME,6X,4HNMOC,7X,5HNMOC/,8X,3HNOX, 9X,3HNO2,9X,   V   332
     1A4,4(8X,A4))                                                         V   333
  610 FORMAT(10X,6H(LDT ),4X,5HTOTAL,8X,3HNOX,8X,5HTOTAL,6X,8HFRACTION,    V   334
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   13X,5(3A4))                                                                    V   335
620 FORMAT (1H0,8X,F6.0,1X,F10.5,2X,F10.5,2X,F10.5,2X,F10.5,2X,F10.5,            V   336
   15(2X,F10.5))                                                                  V   337
630 FORMAT (1H0,22HINITIAL CONCENTRATIONS//(12X,10(4X,A4,4X)))                    V   338
640 FORMAT (/(10X,1P,10E12.3))                                                    V   339
650 FORMAT (//30H0THE CURRENT MIXING HEIGHT IS  ,F10.2/                           V   340
   130H0THE CURRENT TEMPERATURE IS   ,F10.2/                                      V   341
   230H0THE CURRENT ZENITH ANGLE IS  ,F10.2)                                      V   342
660 FORMAT (1H0,4F20.5,F21.0)                                                     V   343
670 FORMAT (1H0,4F20.5,14X,7HNOT MAX)                                             V   344
680 FORMAT (1X,7E13.4)                                                            V   345
690 FORMAT (1X,F8.5,2X,F8.5,2X,F8.5,3X,5(1P,E8.5,2X))                             V   346
700 FORMAT (1X,F8.5,2X,F8.5,2X,F8.5,3X,5(1P,E8.5,2X),8H NOT MAX)                  V   347
710 FORMAT (1X,F8.5,F9.5,F8.5,2X,4(1P,E8.4,2X,0P,F6.0,2X),1P,E8.4,                V   348
   12X,0P,F6.0)                                                                   V   349
720 FORMAT (1X,4HTIME,6X,4HNMOC,7X,5HNMOC/,8X,3HNOX,  9X,3HNO2,9X,               V   350
   1A4,4(8X,A4))                                                                  V   351
730 FORMAT(6H(LDT ),4X,5HTOTAL,8X,3HNOX,8X,5HTOTAL,6X,8HFRACTION,                V   352
   13X,5(3A4))                                                                    V   353
740 FORMAT (1X,F6.0,1X,F10.5,2X,F10.5,2X,F10.5,2X,F10.5,2X,F10.5,                 V   354
   15(2X,F10.5))                                                                  V   355
750 FORMAT (1X,4F10.5,F11.0)                                                      V   356
760 FORMAT (1X,4F10.5,4X,7HNOT MAX)                                               V   357
    END                                                                           V   358-
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      SUBROUTINE DRIVES (N,T0,H0,Y0,TOUT,EPS,MF,INDEX,IA,JA,Y)          W     1
C                                                                       W     2
C  THIS IS THE DRIVER ROUTINE FOR THE GEAR INTEGRATION SCHEME           W     3
C                                                                       W     4
C  REF: SPELLMANN AND HINDMARSH (1975)                                  W     5
C                                                                       W     6
      SAVE                                                              W     7
      COMMON /CNTRL/ SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN,  W     8
     1               FLST,TLST                                          W     9
      COMMON /SPEC/  NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),        W    10
     1               FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,  W    11
     2               XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                   W    12
      COMMON /HJH/   HCSAV,XNSAV                                        W    13
      COMMON /GEAR1/ T,H,HMIN,HMAX,EPSC,UROUND,NC,MFC,KFLAG,JSTART      W    14
      COMMON /GEAR2/ YMAX(100) /GEAR3/ERROR(100) /GEAR4/W1(60,3)        W    15
      COMMON /GEAR5/ IW1(61,9) /GEAR6/W2(2400)    /GEAR7/IW2(2400)      W    16
      COMMON /GEAR8/ EPSJ,IPTI2,IPTI3,IPTI4,IPTR2,IPTR3,NGRP            W    17
      COMMON /GEAR9/ HUSED,NQUSED,NSTEP,NFE,NJE,NZA,NPL,NPU,NZL,NZU,NZROW    18
      COMMON /INOUT/ INP,LOUT,ITAPE,IALN,IALL,INHH,IOZC                 W    19
C                                                                       W    19A
      COMMON /CALCHR/ SPECIS(61)                                        W    19B
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                    W    19C
      CHARACTER*4 SPECIS, HCSPEC, REACT, PLSP                           W    19D
C                                                                       W    19E
      DIMENSION IA(1), JA(1), Y0(N)                                     W    20
      DIMENSION Y(N,6)                                                  W    21
C                                                                       W    22
      DATA NMX/60/,LENW2/2400/,LENIW2/2400/                             W    23
      NGP=0                                                             W    24
      IF (INDEX.EQ.4) GO TO 30                                          W    25
      IF (INDEX.EQ.0) GO TO 60                                          W    26
      IF (INDEX.EQ.2) GO TO 70                                          W    27
      IF (INDEX.EQ.(-1)) GO TO 80                                       W    28
      IF (INDEX.EQ.3) GO TO 90                                          W    29
      IF (INDEX.NE.1) GO TO 270                                         W    30
      IF (EPS.LE.0.) GO TO 240                                          W    31
      IF (N.LE.0) GO TO 250                                             W    32
      IF ((T0-TOUT)*H0.GE.0.) GO TO 260                                 W    33
      MITER=MF-10*(MF/10)                                               W    34
      IF ((MITER.NE.1).AND.(MITER.NE.2)) GO TO 30                       W    35
      NP1=N+1                                                           W    36
      NZA=IA(NP1)-1                                                     W    37
      MAX=LENIW2/2                                                      W    38
      IPTI2=MAX+1                                                       W    39
      CALL SORDER (N,IA,JA,IW1,IW1(1,5),MAX,IW2,IW2(IPTI2),IER)         W    40
      IPTI2=NZA+1                                                       W    41
      IF (IPTI2+NZA-1.GT.LENIW2) GO TO 290                              W    42
      DO 10 I=1,NP1                                                     W    43
   10 IW1(I,2)=IA(I)                                                    W    44
      DO 20 I=1,NZA                                                     W    45
   20 IW2(I)=JA(I)                                                      W    46
      CALL NSCORD (N,IW1(1,2),IW2,IW1(1,3),IW2(IPTI2),IW1,IW1(1,5),IW1(1W    47
     1,8))                                                              W    48
      MAXPL=(LENIW2-NZA)/2                                              W    49
      IPTI3=IPTI2+MAXPL                                                 W    50
      MAXPU=LENIW2-IPTI3+1                                              W    51
      CALL NSSFAC (N,IW1(1,2),IW2,MAXPL,IW1(1,3),IW2(IPTI2),IW1(1,4),MAXW    52
     1PU,IW1(1,5),IW2(IPTI3),IW1(1,6),Y(1,6),IW1(1,9),Y,Y(1,2),Y(1,3),IWW    53
     21(1,7),IW1(1,8),Y(1,4),Y(1,5),IER)                                W    54
      NPL=IW1(N,4)                                                      W    55
      NPU=IW1(N,6)                                                      W    56
      NZL=IW1(N+1,3)                                                    W    57
      NZU=IW1(N+1,5)                                                    W    58
      IPTR2=NZA+1                                                       W    59
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      IPTR3=IPTR2+MAX0(NZA,NZL)                                          W     60
      IF (IPTR3+MAX0(NZA,NZU)-1.GT.LENW2) GO TO 290                      W     61
   30 DO 40 I=1,N                                                        W     62
      YMAX(I)=ABS(Y0(I))                                                 W     63
      IF (YMAX(I).EQ.0.) YMAX(I)=1.E-10                                  W     64
   40 Y(I,1)=Y0(I)                                                       W     65
      NC=N                                                               W     66
      T=T0                                                               W     67
      H=H0                                                               W     68
      NZRO=0                                                             W     69
      TST=EPS*1.E-10                                                     W     70
      DO 50 I=1,N                                                        W     71
   50 IF (Y(I,1).GT.TST) NZRO=NZRO+1                                     W     72
      NZRO=MAX0(NZRO,1)                                                  W     73
      NOLD=NZRO                                                          W     74
      HMIN=ABS(H0)                                                       W     75
      HMAX=ABS(T0-TOUT)*10.                                              W     76
      HMAX=AMIN1(HMAX,20.)                                               W     77
      EPSC=EPS                                                           W     78
      MFC=MF                                                             W     79
      JSTART=0                                                           W     80
      N0=N                                                               W     81
      CALL OZMX (Y,TL,TOUT,N0)                                           W     82
      NMX1=NMX+1                                                         W     83
      EPSJ=SQRT(UROUND)                                                  W     84
      NHCUT=0                                                            W     85
      GO TO 100                                                          W     86
   60 HMAX=ABS(TOUT-TOUTP)*10.                                           W     87
      HMAX=AMIN1(HMAX,20.)                                               W     88
      GO TO 160                                                          W     89
   70 HMAX=ABS(TOUT-TOUTP)*10.                                           W     90
      HMAX=AMIN1(HMAX,20.)                                               W     91
      IF ((T-TOUT)*H.GE.0.) GO TO 300                                    W     92
      GO TO 170                                                          W     93
   80 IF ((T-TOUT)*H.GE.0.) GO TO 280                                    W     94
      JSTART=-1                                                          W     95
      NC=N                                                               W     96
      EPSC=EPS                                                           W     97
      TST=EPS*1.E-10                                                     W     98
      MFC=MF                                                             W     99
   90 CONTINUE                                                           W    100
  100 CONTINUE                                                           W    101
      CALL STIFFS (Y,N0,IA,JA,W1,NMX,IW1,NMX1)                           W    102
      JOZ=KOZ(1)                                                         W    103
      KGO=1-KFLAG                                                        W    104
      GO TO (110,190,220,200),KGO                                        W    105
  110 CONTINUE                                                           W    106
      IF (T.GE.TL) CALL OZMX (Y,TL,TOUT,N0)                              W    107
      D=0.                                                               W    108
      NZRO=0                                                             W    109
      DO 140 I=1,NC                                                      W    110
      IF (Y(I,1).GE.0.) GO TO 130                                        W    111
      NGP=NGP+1                                                          W    112
      DO 120 J=1,6                                                       W    113
C     K=(J-1)*N+I                                                        W    114
C 120 Y(K,1)=0.                                                          W    115
  120 Y(I,J)=0.                                                          W    115
  130 CONTINUE                                                           W    116
      IF (Y(I,1).GT.TST) NZRO=NZRO+1                                     W    117
      AYI=ABS(Y(I,1))                                                    W    118
      YMAX(I)=AMAX1(1.E-10,AYI)                                          W    119
  140 D=D+(AYI/YMAX(I))**2                                               W    120
      NZRO=MAX0(NZRO,1)                                                  W    121
      DO 150 II=1,NC                                                     W    122
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  150 Y0(II)=Y(II,1)                                                    W   123
      CALL SAVIT (T,Y0)                                                 W   124
      IF (NZRO.NE.NOLD) JSTART=-1                                       W   125
      IF (NZRO.NE.NOLD) NOLD=NZRO                                       W   126
      D=D*(UROUND/EPS)**2                                               W   127
      IF (D.GT.FLOAT(N)) GO TO 230                                      W   128
      IF (INDEX.EQ.3) GO TO 300                                         W   129
      IF (INDEX.EQ.2) GO TO 170                                         W   130
  160 IF ((T-TOUT)*H.LT.0.) GO TO 90                                    W   131
      CALL INTERP (TOUT,Y,N0,Y0)                                        W   132
      GO TO 320                                                         W   133
  170 IF (T.GE.TOUT) GO TO 180                                          W   134
      IF (((T+H)-TOUT).LE.1..AND.T.GT.1.) GO TO 90                      W   135
      H=(TOUT-T)*(1.+4.*UROUND)                                         W   136
      JSTART=-1                                                         W   137
      GO TO 90                                                          W   138
  180 JSTART=-1                                                         W   139
      H=AMIN1(H,1.)                                                     W   140
      GO TO 300                                                         W   141
  190 CONTINUE                                                          W   142
  200 IF (NHCUT.EQ.10) GO TO 210                                        W   143
      NHCUT=NHCUT+1                                                     W   144
      HMIN=.1*HMIN                                                      W   145
      H=.1*H                                                            W   146
      JSTART=-1                                                         W   147
      GO TO 90                                                          W   148
  210 WRITE (LOUT,330)                                                  W   149
      IF (KGO.EQ.4) WRITE (LOUT,360) T                                  W   150
      STOP                                                              W   151
  220 WRITE (LOUT,340) T,H                                              W   152
      STOP                                                              W   153
  230 WRITE (LOUT,350) T                                                W   154
      KFLAG=-2                                                          W   155
      STOP                                                              W   156
  240 WRITE (LOUT,370)                                                  W   157
      STOP                                                              W   158
  250 WRITE (LOUT,380)                                                  W   159
      STOP                                                              W   160
  260 WRITE (LOUT,390)                                                  W   161
      STOP                                                              W   162
  270 WRITE (LOUT,400) INDEX                                            W   163
      STOP                                                              W   164
  280 WRITE (LOUT,410) T,TOUT,H                                         W   165
      STOP                                                              W   166
  290 WRITE (LOUT,420)                                                  W   167
      STOP                                                              W   168
  300 TOUT=T                                                            W   169
      DO 310 I=1,N                                                      W   170
  310 Y0(I)=Y(I,1)                                                      W   171
      CALL SAVIT (TOUT,Y0)                                              W   172
  320 INDEX=KFLAG                                                       W   173
      TOUTP=TOUT                                                        W   174
      H0=HUSED                                                          W   175
      IF (KFLAG.NE.0) H0=H                                              W   176
      RETURN                                                            W   177
C                                                                       W   178
C  FORMAT STATEMENTS                                                    W   179
C                                                                       W   180
  330 FORMAT (//44H PROBLEM APPEARS UNSOLVABLE WITH GIVEN INPUT//)      W   181
  340 FORMAT (//35H KFLAG = -2 FROM INTEGRATOR AT T = ,E16.8,5H  H =,E16W   182
     1.8/52H  THE REQUESTED ERROR IS SMALLER THAN CAN BE HANDLED//)     W   183
  350 FORMAT (//37H INTEGRATION HALTED BY DRIVER AT T = ,E16.8/56H  EPS W   184
     1TOO SMALL TO BE ATTAINED FOR THE MACHINE PRECISION/)              W   185
  360 FORMAT (//35H KFLAG = -3 FROM INTEGRATOR AT T = ,E16.8/45H  CORRECW   186
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   1TOR CONVERGENCE COULD NOT BE ACHIEVED/)                                W   187
370 FORMAT (//28H ILLEGAL INPUT.. EPS .LE. 0.//)                           W   188
380 FORMAT (//25H ILLEGAL INPUT.. N .LE. 0//)                              W   189
390 FORMAT (//36H ILLEGAL INPUT.. (T0-TOUT)*H .GE. 0.//)                   W   190
400 FORMAT (//24H ILLEGAL INPUT.. INDEX =,I5//)                            W   191
410 FORMAT (//44H INDEX = -1 ON INPUT WITH (T-TOUT)*H .GE. 0./4H T =,EW    192
   116.8,9H   TOUT =,E16.8,6H   H =,E16.8)                                 W   193
420 FORMAT (//42H INSUFFICIENT WORKING STORAGE IN IW2 OR W2//)              W   194
    END                                                                    W   195-
```

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      SUBROUTINE STIFFS (Y,N0,IA,JA,W1,NMX,IW1,NMX1)                    X     1
C                                                                       X     2
C  THE GEAR PREDICTOR/SOLVER ROUTINE FOR STIFF EQUATIONS                X     3
C                                                                       X     4
      SAVE                                                              X     5
      COMMON /GEAR1/  T,H,HMIN,HMAX,EPS,UROUND,N,MF,KFLAG,JSTART        X     6
      COMMON /GEAR2/  YMAX(100)     /GEAR3/ERROR(100)                   X     7
      COMMON /GEAR6/  W2(2400)      /GEAR7/IW2(2400)                    X     8
      COMMON /GEAR8/  EPSJ,IPTI2,IPTI3,IPTI4,IPTR2,IPTR3,NGRP           X     9
      COMMON /GEAR9/  HUSED,NQUSED,NSTEP,NFE,NJE,IDUMMY(5),NZRO         X    10
      COMMON /HEAT/   SC(200,12),ISC(200,3)                             X    11
      COMMON /CALC/   NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),    X    12
     1                IB(60),JB(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,   X    12A
     2                TSTEP,ZENI                                         X    13
      COMMON /PHOTON/ CF(72,20),PX(24,20),IPH(20),IP,RFCT(20),PP(10,20),X    14
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),      X    15
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)         X    16
      COMMON /CALCHR/ SPECIS(61)                                        X    16A
C                                                                       X    16B
      CHARACTER*4   SPECIS                                              X    16C
C                                                                       X    16D
      DIMENSION     Y(N0,6), IA(1), JA(1), W1(NMX,3), IW1(NMX1,9)       X    17
      DIMENSION     EL(13), TQ(4), RT(3)                                X    18
C                                                                       X    19
      DATA EL(2)/1./,OLDL0/1./                                          X    20
      KFLAG=0                                                           X    21
      TOLD=T                                                            X    22
      IF (JSTART.GT.0) GO TO 100                                        X    23
      IF (JSTART.NE.0) GO TO 20                                         X    24
      CALL DIFFUN (N,T,Y,W1,1,TOLD)                                     X    25
      DO 10 I=1,N                                                       X    26
   10 Y(I,2)=H*W1(I,1)                                                  X    27
      METH=MF/10                                                        X    28
      MITER=MF-10*METH                                                  X    29
      NQ=1                                                              X    30
      L=2                                                               X    31
      IDOUB=3                                                           X    32
      RMAX=1.E4                                                         X    33
      RC=0.                                                             X    34
      CRATE=1.                                                          X    35
      HOLD=H                                                            X    36
      MFOLD=MF                                                          X    37
      NSTEP=0                                                           X    38
      NSTEPJ=0                                                          X    39
      NFE=1                                                             X    40
      NJE=0                                                             X    41
      IRET=3                                                            X    42
      GO TO 30                                                          X    43
   20 IF (MF.EQ.MFOLD) GO TO 50                                         X    44
      MEO=METH                                                          X    45
      MIO=MITER                                                         X    46
      METH=MF/10                                                        X    47
      MITER=MF-10*METH                                                  X    48
      MFOLD=MF                                                          X    49
      IF (MITER.NE.MIO) IWEVAL=MITER                                    X    50
      IF (METH.EQ.MEO) GO TO 50                                         X    51
      IDOUB=L+1                                                         X    52
      IRET=1                                                            X    53
   30 CALL COSET (METH,NQ,EL,TQ,MAXDER)                                 X    54
      LMAX=MAXDER+1                                                     X    55
      RC=RC*EL(1)/OLDL0                                                 X    56
      OLDL0=EL(1)                                                       X    57
   40 FN=FLOAT(NZRO)                                                    X    58
      EDN=FN*(TQ(1)*EPS)**2                                             X    59
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```
      E=FN*(TQ(2)*EPS)**2                                                X     60
      EUP=FN*(TQ(3)*EPS)**2                                              X     61
      BND=FN*(TQ(4)*EPS)**2                                              X     62
      EPSOLD=EPS                                                         X     63
      NOLD=NZRO                                                          X     64
      GO TO (60,70,100),IRET                                             X     65
   50 IF (EPS.EQ.EPSOLD.AND.NZRO.EQ.NOLD) GO TO 60                       X     66
      IRET=1                                                             X     67
      GO TO 40                                                           X     68
   60 IF (H.EQ.HOLD) GO TO 100                                           X     69
      RH=H/HOLD                                                          X     70
      H=HOLD                                                             X     71
      IREDO=3                                                            X     72
      GO TO 80                                                           X     73
   70 RH=AMAX1(RH,HMIN/ABS(H))                                           X     74
   80 RH=AMIN1(RH,HMAX/ABS(H),RMAX)                                      X     75
      R1=1.                                                              X     76
      DO 90 J=2,L                                                        X     77
      R1=R1*RH                                                           X     78
      DO 90 I=1,N                                                        X     79
   90 Y(I,J)=Y(I,J)*R1                                                   X     80
      H=H*RH                                                             X     81
      RC=RC*RH                                                           X     82
      IDOUB=L+1                                                          X     83
      IF (IREDO.EQ.0) GO TO 550                                          X     84
  100 IF (ABS(RC-1.).GT.0.3) IWEVAL=MITER                                X     85
      IF (NSTEP.GE.NSTEPJ+20) IWEVAL=MITER                               X     86
      T=T+H                                                              X     87
      DO 110 J1=1,NQ                                                     X     88
      DO 110 J2=J1,NQ                                                    X     89
      J=(NQ+J1)-J2                                                       X     90
      DO 110 I=1,N                                                       X     91
  110 Y(I,J)=Y(I,J)+Y(I,J+1)                                             X     92
  120 DO 130 I=1,N                                                       X     93
      IF (Y(I,1).LT.1.E-5) GO TO 130                                     X     94
      IF (Y(I,1).LT.(-2.*Y(I,2))) GO TO 290                              X     95
  130 ERROR(I)=0.                                                        X     96
      M=0                                                                X     97
      CALL DIFFUN (N,T,Y,W1(1,2),1,TOLD)                                 X     98
      NFE=NFE+1                                                          X     99
      IF (IWEVAL.LE.0) GO TO 250                                         X    100
      IWEVAL=0                                                           X    101
      RC=1.                                                              X    102
      NJE=NJE+1                                                          X    103
      NSTEPJ=NSTEP                                                       X    104
      CON=-H*EL(1)                                                       X    105
      ISV=M                                                              X    106
      LSV=L                                                              X    107
      NZ=IA(N+1)-1                                                       X    108
      DO 140 I=1,NZ                                                      X    109
  140 W2(I)=0.                                                           X    110
      DO 220 IR=1,NR                                                     X    111
      IF (KR(IR,1).EQ.0.OR.KR(IR,1).EQ.99) GO TO 220                     X    112
      MT=ITYPE(IR)                                                       X    113
      DO 150 I=1,MT                                                      X    114
      JX=I+1-I/3*3                                                       X    115
      KX=I+2-I/2*3                                                       X    116
      J=KR(IR,JX)                                                        X    117
      K=KR(IR,KX)                                                        X    118
      IF (J.EQ.0) XX=1.                                                  X    119
      IF (J.GT.0) XX=Y(J,1)                                              X    120
      IF (K.EQ.0) XK=1.                                                  X    121
      IF (K.GT.0) XK=Y(K,1)                                              X    122
  150 RT(I)=R(IR)*XX*XK                                                  X    123
```

```
      DO 210 K=1,MT                                                          X   124
      I=KR(IR,K)                                                             X   125
      DO 170 L=1,MT                                                          X   126
      J=KR(IR,L)                                                             X   127
      M=IA(J)-1                                                              X   128
  160 M=M+1                                                                  X   129
      IF (I-JA(M)) 160,170,160                                               X   130
  170 W2(M)=W2(M)-RT(L)                                                      X   131
      DO 200 L=4,12                                                          X   132
      J=KR(IR,L)                                                             X   133
      M=IA(I)-1                                                              X   134
      IF (J) 200,210,180                                                     X   135
  180 M=M+1                                                                  X   136
      IF (J-JA(M)) 180,190,180                                               X   137
  190 W2(M)=W2(M)+RT(K)*SC(IR,L)                                             X   138
  200 CONTINUE                                                               X   139
  210 CONTINUE                                                               X   140
  220 CONTINUE                                                               X   141
      DO 240 J=1,N                                                           X   142
      KMIN=IA(J)                                                             X   143
      KMAX=IA(J+1)-1                                                         X   144
      DO 230 K=KMIN,KMAX                                                     X   145
      W2(K)=W2(K)*CON                                                        X   146
      IF (JA(K).EQ.J) W2(K)=W2(K)+1.-CON*DILUT-CON*DNOWS                     X   147
  230 CONTINUE                                                               X   148
  240 CONTINUE                                                               X   149
      CALL NSCORA (N,IA,JA,W2,IW1(1,2),W2(IPTR3),W2(IPTR2),IW1,IW1(1,7),X    150
     1IW1(1,8))                                                              X   151
      CALL NSNFAC (N,IW1(1,2),IW2,W2,IW1(1,3),IW2(IPTI2),IW1(1,4),W2(IPTX    152
     1R2),W1(1,3),IW1(1,5),IW2(IPTI3),IW1(1,6),W2(IPTR3),W1,IW1(1,7),IW1X   153
     2(1,8),IER)                                                             X   154
      M=ISV                                                                  X   155
      L=LSV                                                                  X   156
      IF (IER.NE.0) GO TO 290                                                X   157
  250 DO 260 I=1,N                                                           X   158
  260 W1(I,1)=H*W1(I,2)-(Y(I,2)+ERROR(I))                                    X   159
      CALL NSBSLV (N,IW1,IW1,IW1(1,3),IW2(IPTI2),IW1(1,4),W2(IPTR2),W1(1X    160
     1,3),IW1(1,5),IW2(IPTI3),IW1(1,6),W2(IPTR3),W1(1,2),W1,W2)              X   161
      D=0.                                                                   X   162
      DO 270 I=1,N                                                           X   163
      ERROR(I)=ERROR(I)+W1(I,2)                                              X   164
      D=D+(W1(I,2)/YMAX(I))**2                                               X   165
  270 W1(I,1)=Y(I,1)+EL(1)*ERROR(I)                                          X   166
      IF (M.NE.0) CRATE=AMAX1(.9*CRATE,D/D1)                                 X   167
      IF ((D*AMIN1(1.,2.*CRATE)).LE.BND) GO TO 320                           X   168
      D1=D                                                                   X   169
      M=M+1                                                                  X   170
      IF (M.EQ.3) GO TO 280                                                  X   171
      CALL DIFFUN (N,T,W1,W1(1,2),1,TOLD)                                    X   172
      GO TO 250                                                              X   173
  280 NFE=NFE+2                                                              X   174
      IF (IWEVAL.EQ.(-1)) GO TO 310                                          X   175
  290 T=TOLD                                                                 X   176
      RMAX=2.                                                                X   177
      DO 300 J1=1,NQ                                                         X   178
      DO 300 J2=J1,NQ                                                        X   179
      J=(NQ+J1)-J2                                                           X   180
      DO 300 I=1,N                                                           X   181
  300 Y(I,J)=Y(I,J)-Y(I,J+1)                                                 X   182
      IF (ABS(H).LE.HMIN*1.00001) GO TO 540                                  X   183
      RH=.25                                                                 X   184
      IREDO=1                                                                X   185
      GO TO 70                                                               X   186
  310 IWEVAL=MITER                                                           X   187
```

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      GO TO 120                                                          X   188
  320 IF (MITER.NE.0) IWEVAL=-1                                          X   189
      NFE=NFE+M                                                          X   190
      D=0.                                                               X   191
      DO 330 I=1,N                                                       X   192
  330 D=D+(ERROR(I)/YMAX(I))**2                                          X   193
      IF (D.GT.E) GO TO 360                                              X   194
      KFLAG=0                                                            X   195
      IREDO=0                                                            X   196
      NSTEP=NSTEP+1                                                      X   197
      HUSED=H                                                            X   198
      NQUSED=NQ                                                          X   199
      DO 340 J=1,L                                                       X   200
      DO 340 I=1,N                                                       X   201
  340 Y(I,J)=Y(I,J)+EL(J)*ERROR(I)                                       X   202
      IF (IDOUB.EQ.1) GO TO 380                                          X   203
      IDOUB=IDOUB-1                                                      X   204
      IF (IDOUB.GT.1) GO TO 560                                          X   205
      IF (L.EQ.LMAX) GO TO 560                                           X   206
      DO 350 I=1,N                                                       X   207
  350 Y(I,LMAX)=ERROR(I)                                                 X   208
      GO TO 560                                                          X   209
  360 KFLAG=KFLAG-1                                                      X   210
      T=TOLD                                                             X   211
      DO 370 J1=1,NQ                                                     X   212
      DO 370 J2=J1,NQ                                                    X   213
      J=(NQ+J1)-J2                                                       X   214
      DO 370 I=1,N                                                       X   215
  370 Y(I,J)=Y(I,J)-Y(I,J+1)                                             X   216
      RMAX=2.                                                            X   217
      IF (ABS(H).LE.HMIN*1.00001) GO TO 520                              X   218
      IF (KFLAG.LE.(-3)) GO TO 500                                       X   219
      IREDO=2                                                            X   220
      PR3=1.E+20                                                         X   221
      GO TO 400                                                          X   222
  380 PR3=1.E+20                                                         X   223
      IF (L.EQ.LMAX) GO TO 400                                           X   224
      D1=0.                                                              X   225
      DO 390 I=1,N                                                       X   226
  390 D1=D1+((ERROR(I)-Y(I,LMAX))/YMAX(I))**2                            X   227
      ENQ3=.5/FLOAT(L+1)                                                 X   228
      PR3 = ((D1/EUP)**ENQ3) * 1.4 + 1.4E-6                              X   229
  400 ENQ2=.5/FLOAT(L)                                                   X   230
      PR2=((D/E)**ENQ2)*1.2+1.2E-6                                       X   231
      PR1=1.E+20                                                         X   232
      IF (NQ.EQ.1) GO TO 420                                             X   233
      D=0.                                                               X   234
      DO 410 I=1,N                                                       X   235
  410 D=D+(Y(I,L)/YMAX(I))**2                                            X   236
      ENQ1=.5/FLOAT(NQ)                                                  X   237
      PR1=((D/EDN)**ENQ1)*1.3+1.3E-6                                     X   238
  420 IF (PR2.LE.PR3) GO TO 430                                          X   239
      IF (PR3.LT.PR1) GO TO 450                                          X   240
      GO TO 440                                                          X   241
  430 IF (PR2.GT.PR1) GO TO 440                                          X   242
      NEWQ=NQ                                                            X   243
      RH=1./PR2                                                          X   244
      GO TO 480                                                          X   245
  440 NEWQ=NQ-1                                                          X   246
      RH=1./PR1                                                          X   247
      GO TO 480                                                          X   248
  450 NEWQ=L                                                             X   249
      RH=1./PR3                                                          X   250
      IF (RH.LT.1.1) GO TO 470                                           X   251
```

```
      DO 460 I=1,N                                                      X   252
  460 Y(I,NEWQ+1)=ERROR(I)*EL(L)/FLOAT(L)                               X   253
      GO TO 490                                                         X   254
  470 IDOUB=10                                                          X   255
      GO TO 560                                                         X   256
  480 IF ((KFLAG.EQ.0).AND.(RH.LT.1.1)) GO TO 470                       X   257
      IF (NEWQ.EQ.NQ) GO TO 70                                          X   258
  490 NQ=NEWQ                                                           X   259
      L=NQ+1                                                            X   260
      IRET=2                                                            X   261
      GO TO 30                                                          X   262
  500 IF (KFLAG.EQ.(-9)) GO TO 530                                      X   263
      RH=10.**KFLAG                                                     X   264
      RH=AMAX1(HMIN/ABS(H),RH)                                          X   265
      H=H*RH                                                            X   266
      CALL DIFFUN (N,T,Y,W1,1,TOLD)                                     X   267
      NFE=NFE+1                                                         X   268
      DO 510 I=1,N                                                      X   269
  510 Y(I,2)=H*W1(I,1)                                                  X   270
      IWEVAL=MITER                                                      X   271
      IDOUB=10                                                          X   272
      IF (NQ.EQ.1) GO TO 100                                            X   273
      NQ=1                                                              X   274
      L=2                                                               X   275
      IRET=3                                                            X   276
      GO TO 30                                                          X   277
  520 KFLAG=-1                                                          X   278
      GO TO 560                                                         X   279
  530 KFLAG=-2                                                          X   280
      GO TO 560                                                         X   281
  540 KFLAG=-3                                                          X   282
      GO TO 560                                                         X   283
  550 RMAX=100.                                                         X   284
  560 HOLD=H                                                            X   285
      JSTART=NQ                                                         X   286
      RETURN                                                            X   287
      END                                                               X   288-
```

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      SUBROUTINE DIFFUN (L,T,X,XT,IENTRY,TXLD)                          Y     1
C                                                                       Y     2
C  THIS ROUTINE CALCULATES THE RATE OF CHANGE OF EACH SPECIES DUE TO    Y     3
C  DILUTION, EMISSIONS, SURFACE DEPOSITION, AND CHEMISTRY               Y     4
C                                                                       Y     5
      SAVE                                                              Y     6
      COMMON /CALC/   NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),    Y     7
     1                IA(60),JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,  Y     8
     2                TSTEP,ZENI                                        Y     8A
      COMMON /CNTRL/  SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN, Y     9
     1                FLST,TLST                                         Y    10
      COMMON /SPEC/   NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),       Y    11
     1                FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN, Y    12
     2                XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                  Y    13
      COMMON /HEAT/   SC(200,12),ISC(200,3)                             Y    14
      COMMON /NEED1/  IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,     Y    15
     1                IIH2O,JPLUS                                       Y    16
C                                                                       Y    17
      COMMON /TEMPER/ TEMEND,NTEMP,QM(30)                               Y    18
      COMMON /SUNLIT/ ZZ1(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,   Y    19
     1                ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),XZ(24)Y    20
     2                ,KK1(24),JSRT,JSTOP,PSPEC,MNLM,MXLM,MAXL,MAXJ     Y    21
      COMMON /PHOTON/ CF(72,20),P(24,20),IPH(20),IP,RFCT(20),PP(10,20), Y    22
     1                IDEPO,RDEPO(26,10),LOCDEP(10),RDCOEF(125,10),     Y    23
     2                IDPTIM,DPEND,RDEP1(26,10),DNOWS,SPRSE(300)        Y    24
      COMMON /EMIS/   NEM,IS1,ESTRT(5),ESTOP,ESLP,IEMLS(5),EOSLP(5),    Y    25
     1                EMO(26,5),ECI(5),EM(26),EC(125),ES(125,5)         Y    26
      COMMON /MIX/    NMIX,AMIX(26),STRM,STOPM,DC(104)                  Y    27
      COMMON /MIXING/ DSTRT,DEND,AMC(5),BMC(5),CMC(5),FD(6),FG(6),      Y    28
     1                AMXX(26),DL,TTMAX,SRISE,SRMIN,DELH,TDIL,NMXX,HT,  Y    28A
     2                SSET,SSRISE                                       Y    29
      COMMON /ALOFT/  IALFT,CALFT(10),LOCALF(10)                        Y    30
      COMMON /CRED/   ICR,ISPCR,SPCR69(3),SURFCR(3),ALOFCR(3),          Y    31
     1                REDCR(3),FSRFCR(3),FALFCR(3),COSFBK,COAFBK        Y    32
      COMMON /BIOG/   NBEM,IBSP,WTMOL(5),ACB4(5),SURFBI(5),             Y    32A
     1                ALOFBI(5),REDBI(5),FSRFBI(5),FALFBI(5),BEMO(26,5),Y    32B
     2                BECO(126,5),CBTOT(5),IBLS(5),BESTOP,BFRAC(20,5)   Y    32C
      COMMON /WATER/  WATEND,NWATER,PAMB,QW(30),QR(30),PMILLI,ILH2O     Y    32D
C                                                                       Y    32E
      COMMON /ALFCHR/ ISPAL(10)                                         Y    32F
      COMMON /BIOCHR/ IISOP, IBEMSP(5)                                  Y    32G
      COMMON /CRECHR/ ISPNCR(3)                                         Y    32H
      COMMON /EMSCHR/ EMSP(5)                                           Y    32I
      COMMON /NEED1C/ IBZA                                              Y    32J
      COMMON /PHTCHR/ ISPDP(10)                                         Y    32K
      COMMON /CALCHR/ SPECIS(61)                                        Y    32L
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                    Y    32M
      CHARACTER*4 SPECIS, HCSPEC, REACT, PLSP                           Y    32N
C                                                                       Y    32O
      CHARACTER*4 ISPAL, ISPDP, ISPNCR, IBEMSP                          Y    32P
      CHARACTER*4 IISOP, EMSP                                           Y    32Q
      CHARACTER*4 IBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,         Y    32R
     1   IIH2O,IBZA,JPLUS                                               Y    32S
C                                                                       Y    32T
      DIMENSION XT(L), X(L), ENOWS(5), ENWS1(5)                         Y    33
      INTEGER PSPEC                                                     Y    34
      COMMON /BK1/ FBK(20),FBKAL(5),HCBK,XNBK,OZBK,H2OBK                Y    35
C                                                                       Y    36
C     EMULATE MULTIPLE ENTRY WITH COMPUTED GO TO                        Y    37
      GO TO (10,380),IENTRY                                             Y    38
C                                                                       Y    39
C     MAIN ENTRY POINT                                                  Y    40
   10 CONTINUE                                                          Y    41
      N=L                                                               Y    42
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      DILU=DILUT                                                        Y    43
      IF(T.LT.TSRT.OR.TXLD.GT.TSRT+DTIM) DILU=0.                        Y    44
      IF(T.LT.TSRT.OR.TXLD.GT.TSRT+DTIM) GO TO 60                       Y    45
      IF (AMIX(1).GT.(-1.)) GO TO 50                                    Y    46
      TT=CLOCK(TCI,IFIX(T))                                             Y    47
      TT=CLKMIN(TT)                                                     Y    48
      TT=TT-SRISE                                                       Y    49
      FDT=TT/DL                                                         Y    50
      IF(FDT.LT.0.0) FDT=0.0                                            Y    51
      K=0                                                               Y    52
   20 K=K+1                                                             Y    53
      IF(FDT.GE.FD(K).AND.FDT.LT.FD(K+1)) GO TO 30                      Y    54
      IF(K.LT.5) GO TO 20                                               Y    55
      IF(FDT.LT.FD(2)) GO TO 40                                         Y    56
      FGG=1.0                                                           Y    57
      FGSLP=0.0                                                         Y    58
      GO TO 40                                                          Y    59
   30 CONTINUE                                                          Y    60
      XFD=FDT-FD(K)                                                     Y    61
      FGG=((AMC(K)*XFD+BMC(K))*XFD+CMC(K))*XFD+FG(K)                    Y    62
      FGSLP=(3.*AMC(K)*XFD+2.*BMC(K))*XFD+CMC(K)                        Y    63
   40 HT=SRMIN+FGG*DELH                                                 Y    64
      DILU=(FGSLP*DELH)/(HT*DL)                                         Y    65
      GO TO 60                                                          Y    66
   50 IF (AMIX(1).LT.0.) GO TO 60                                       Y    67
C                                                                       Y    68
C          CALCULATE DILUTION FOR CURRENT TIME STEP                     Y    69
C                                                                       Y    70
      I=IFIX(T/60.+1.9999995)                                           Y    71
      IF (T.LE.TOLD.AND.I.LT.IOLD) I=IOLD                               Y    72
      IOLD=I                                                            Y    73
      IF (I.LE.1) I=2                                                   Y    74
      Z=T-FLOAT(I-2)*60.                                                Y    75
      HT=((Z*DC(3*I-3)+DC(3*I-4))*Z+DC(3*I-5))*Z+AMIX(I-1)              Y    76
      DILU=((3.0*Z*DC(3*I-3)+2.0*DC(3*I-4))*Z+DC(3*I-5))/HT             Y    77
   60 DILUT=AMAX1(DILU,0.)                                              Y    78
      TNOW=TEMP                                                         Y    79
      ZNOW=ZENI                                                         Y    80
      DO 70 I=1,N                                                       Y    81
      XT(I)=-DILUT*X(I)                                                 Y    82
      IF (SPECIS(I).EQ.IICO) XT(I)=XT(I)+DILUT*COAFBK                   Y    83
      IF (SPECIS(I) .EQ. IIH2O ) XT(I)=XT(I)+DILUT*X(I)                 Y    84
   70 IF (SPECIS(I).EQ.IIO3    ) XT(I)=DILUT*(OZAL-X(I))                Y    85
      IF (T.LT.TSRT.OR.T.GT.TSRT+DTIM) GO TO 140                        Y    86
      DO 80 K=1,2                                                       Y    87
      J=INOX(K)                                                         Y    88
      IF (SPECIS(J).NE.IINO2 ) GO TO 80                                 Y    89
      XT(J)=DILUT*(XNAL-X(J))                                           Y    90
      GO TO 90                                                          Y    91
   80 CONTINUE                                                          Y    92
   90 DO 100 K=1,NHC                                                    Y    93
      J=IH(K)                                                           Y    94
      FBKS=FALHC(K)                                                     Y    95
      IF (FBK(K).GT.(-0.00001)) FBKS=FBK(K)                             Y    96
      XT(J)=DILUT*(FALHC(K)*HCAL/CARB(K)-X(J))                          Y    97
  100 CONTINUE                                                          Y    98
C                                                                       Y    99
C  ENTRAIN OTHER SPECIES                                                Y   100
C                                                                       Y   101
      IF (IALFT.LE.0) GO TO 120                                         Y   102
      DO 110 K=1,IALFT                                                  Y   103
      J=LOCALF(K)                                                       Y   104
      XT(J)=DILUT*(CALFT(K)-X(J))                                       Y   105
  110 CONTINUE                                                          Y   106
```

```
  120 IF (ICR.LE.0) GO TO 131                                                    Y   107
      DO 130 JJ=1,ICR                                                            Y   108
      J=IEMLS(JJ+2)                                                              Y   109
      XT(J)=DILUT*(ALOFCR(JJ)-X(J))                                              Y   110
  130 CONTINUE                                                                   Y   111
  131 IF (IBSP.LE.0) GO TO 140                                                   Y   111A
      DO 134 J=1,IBSP                                                            Y   111B
      IF (ACB4(J).LE.0.) GO TO 133                                               Y   111C
      DO 132 LL=1,NHC                                                            Y   111D
      K=IH(LL)                                                                   Y   111E
      XT(K)=DILUT*(FALHC(LL)*HCAL/CARB(LL)+ALOFBI(J)*                            Y   111F
     1       BFRAC(LL,J)/CBTOT(J)-X(K))                                          Y   111G
  132 CONTINUE                                                                   Y   111H
      GO TO 134                                                                  Y   111I
  133 K=IBLS(J)                                                                  Y   111J
      XT(K)=DILUT*(ALOFBI(J)-X(K))                                               Y   111K
  134 CONTINUE                                                                   Y   111L
C                                                                                Y   112
C  INPUT EMISSIONS                                                               Y   113
C                                                                                Y   114
  140 IF (T.GE.ESTOP) GO TO 221                                                  Y   115
      FNOW=Z1/HT                                                                 Y   116
      IF (AMIX(1).GE.0.) FNOW=AMIX(1)/HT                                         Y   117
  150 I=IFIX(T/60.)                                                              Y   118
      ENOW=0.                                                                    Y   119
      ZZ=(T-FLOAT(I*60))/60.                                                     Y   120
      I=(I+1)*5                                                                  Y   121
      IF (NEM.GT.0) ENOW=((((ZZ*EC(I)+EC(I-1))*ZZ+EC(I-2))*ZZ+EC(I-3             Y   122
     1))*ZZ+EC(I-4))*FNOW/60.                                                    Y   123
      DO 160 J=1,ISP                                                             Y   124
      IF (NEM.GT.0.AND.J.LE.2) ENOWS(J)=ENOW                                     Y   125
      IF (NEM.LE.-1)                                                             Y   126
     1ENOWS(J)=((((ZZ*ES(I,J)+ES(I-1,J))*ZZ+ES(I-2,J))*ZZ                        Y   127
     2  +ES(I-3,J))*ZZ+ES(I-4,J))*FNOW/60.                                      Y   128
  160 CONTINUE                                                                   Y   129
  170 DO 220 LL=1,ISP                                                            Y   130
      IF (EMSP(LL).NE.IINX ) GO TO 190                                           Y   131
      DO 180 K=1,2                                                               Y   132
      J=INOX(K)                                                                  Y   133
  180 XT(J)=XT(J)+ENOWS(LL)*EXN*FENX(K)                                          Y   134
      GO TO 220                                                                  Y   135
  190 IF (EMSP(LL).NE.IIHC  ) GO TO 210                                          Y   136
      DO 200 K=1,NHC                                                             Y   137
      J=IH(K)                                                                    Y   138
  200 XT(J)=XT(J)+ENOWS(LL)*EHC*RCTY(K)/CARB(K)                                  Y   139
      GO TO 220                                                                  Y   140
  210 J=IEMLS(LL)                                                                Y   141
      XT(J)=XT(J)+ENOWS(LL)*ECI(LL)                                              Y   142
  220 CONTINUE                                                                   Y   143
  221 IF (IBSP.LE.0) GO TO 230                                                   Y   143A
      IF (T.GE.BESTOP) GO TO 230                                                 Y   143B
      FNOW=Z1/HT                                                                 Y   143C
      IF (AMIX(1).GE.0.) FNOW=AMIX(1)/HT                                         Y   143D
      I=IFIX(T/60.)                                                              Y   143E
      ZZ=(T-FLOAT(I*60))/60.                                                     Y   143F
      I=(I+1)*5                                                                  Y   143G
      DO 222 J=1,IBSP                                                            Y   143H
      ENWS1(J)=((((ZZ*BECO(I,J)+BECO(I-1,J))*ZZ+BECO(I-2,J))*ZZ                  Y   143I
     1  +BECO(I-3,J))*ZZ+BECO(I-4,J))*FNOW/60.                                   Y   143J
  222 CONTINUE                                                                   Y   143K
      DO 225 J=1,IBSP                                                            Y   143L
      IF (ACB4(J).LE.0.) GO TO 224                                               Y   143M
      DO 223 LL=1,NHC                                                            Y   143N
      K=IH(LL)                                                                   Y   143O
```

```
      XT(K)=XT(K)+ENWS1(J)*BFRAC(LL,J)/CBTOT(J)                          Y   143P
  223 CONTINUE                                                           Y   143Q
      GO TO 225                                                          Y   143R
  224 K=IBLS(J)                                                          Y   143S
      XT(K)=XT(K)+ENWS1(J)                                               Y   143T
  225 CONTINUE                                                           Y   143U
C                                                                        Y   144
C  DO PHOTOLYSIS                                                        Y   145
C                                                                        Y   146
  230 IF (T.EQ.TOLD) GO TO 290                                           Y   147
      IF (IP.EQ.0) GO TO 280                                             Y   148
      TC=CLOCK(TCI,IFIX(T))                                              Y   149
      IF (TC.GT.2400.) TC=TC-2400.                                       Y   150
      IF (TC.LT.SSRISE) IBST1=1                                          Y   150A
      IF (TC.GT.SSRISE) IBST2=1                                          Y   150B
      IF (TC.GT.SSET) IPST=1                                             Y   150C
      IF (IPST.GT.0) GO TO 231                                           Y   150D
      IF (TC.GE.SSRISE.AND.TC.LE.SSET) GO TO 250                         Y   151E
      IF (IBST1.GT.0.AND.IBST2.GT.0) GO TO 250                           Y   151F
  231 DO 240 JK=1,IP                                                     Y   152
      IR=IPH(JK)                                                         Y   153
      R(IR)=0.                                                           Y   154
  240 CONTINUE                                                           Y   155
      ZNOW=90.                                                           Y   156
      GO TO 280                                                          Y   157
  250 I=IFIX(T/60.+2.0)                                                  Y   158
      TTM=-1.                                                            Y   158A
      IF (TC.GE.SSRISE) GO TO 251                                        Y   158B
      TTC=CLOCK(SSRISE,1)                                                Y   158C
      TTM=CLKMIN(TTC)-CLKMIN(TCI)                                        Y   158D
      I=IFIX(TTM/60.+2.0)                                                Y   158E
  251 CONTINUE                                                           Y   158F
      IF (I.GT.24) I=24                                                  Y   159
      Z=T/60.-FLOAT(I-2)                                                 Y   160
      IF (TTM.GT.0.) Z=TTM/60.-FLOAT(I-2)                                Y   160A
      IR=IPH(1)                                                          Y   161
      R1=(((Z*CF(3*I-3,1)+CF(3*I-4,1))*Z+CF(3*I-5,1))*Z+P(I-1,1))*A(IR)  Y   162
      IF (R1.LT.0.0) R1=0.                                               Y   163
      R(IR)=R1                                                           Y   164
      DO 270 J=2,IP                                                      Y   165
      IR=IPH(J)                                                          Y   166
      IF (PP(1,J).LT.0.) GO TO 260                                       Y   167
      R(IR)=((Z*CF(3*I-3,J)+CF(3*I-4,J))*Z+CF(3*I-5,J))*Z+P(I-1,J)       Y   168
      R(IR)=R(IR)*RFCT(J)*R1                                             Y   169
      GO TO 270                                                          Y   170
  260 CONTINUE                                                           Y   171
      R(IR)=R1*RFCT(J)                                                   Y   172
  270 IF (R(IR).LT.0.) R(IR)=0.                                          Y   173
      IZ=IFIX(T/60.)+1                                                   Y   174
      Z=T/60.-FLOAT(IZ-1)                                                Y   175
      IF (T.LT.60.) ZNOW=XZ(1)+(0.5*XZ(3)*(Z-1.)+0.5*XZ(1)*(Z-3.)        Y   176
     1  -XZ(2)*(Z-2.))*Z                                                 Y   177
      IF (T.GE.60..AND.IZ.LT.23)                                         Y   178
     1 ZNOW=XZ(IZ)+0.25*Z*((5.*XZ(IZ+1)-3.*XZ(IZ)-XZ(IZ-1)               Y   179
     2  -XZ(IZ+2))+(XZ(IZ-1)-XZ(IZ)-XZ(IZ+1)+XZ(IZ+2))*Z)               Y   180
      IF (IZ.GT.22) ZNOW=(XZ(IZ+1)-XZ(IZ))*Z+XZ(IZ)                      Y   181
C                                                                        Y   182
C  DO TEMPERATURES                                                      Y   183
C                                                                        Y   184
  280 IF (T.GT.TEMEND) GO TO 281                                         Y   185
      IZ=IFIX(T*TINV)+1                                                  Y   186
      Z=T*TINV-FLOAT(IZ-1)                                               Y   187
      IF (T.LE.60.) TNOW=QM(1)+(0.5*QM(3)*(Z-1.)+0.5*QM(1)*(Z-3.)        Y   188
     1  -QM(2)*(Z-2.))*Z                                                 Y   189
```

```
      IF (T.GT.60.) TNOW=QM(IZ)+0.25*Z*((5.*QM(IZ+1)-3.*QM(IZ)-QM(IZ-1)  Y   190
     1  -QM(IZ+2))+(QM(IZ-1)-QM(IZ)-QM(IZ+1)+QM(IZ+2))*Z)                 Y   191
      IF (TNOW.NE.TEMP.AND.TNOW.GT.0.) FCT=((3355.7046E-6)*TNOW-1.)/TNO   Y   192
     1W                                                                   Y   193
C                                                                         Y   193A
C  DO VARYING WATER CONCENTRATIONS                                        Y   193B
C                                                                         Y   193C
  281 IF (T.GT.WATEND) GO TO 290                                          Y   193D
      IF (ILH2O.LE.0) GO TO 290                                           Y   193E
      IZ=IFIX(T*TINV)+1                                                   Y   193F
      Z=T*TINV-FLOAT(IZ-1)                                                Y   193G
      IF (T.LE.60.) WNOW=QW(1)+(0.5*QW(3)*(Z-1.)+0.5*QW(1)*(Z-3.)         Y   193H
     1  -QW(2)*(Z-2.))*Z                                                  Y   193I
      IF (T.GT.60.) WNOW=QW(IZ)+0.25*Z*((5.*QW(IZ+1)-3.*QW(IZ)-QW(IZ-1)  Y   193J
     1  -QW(IZ+2))+(QW(IZ-1)-QW(IZ)-QW(IZ+1)+QW(IZ+2))*Z)                 Y   193K
      X(ILH2O)=WNOW                                                       Y   193L
C                                                                         Y   194
C  DO SURFACE DEPOSITION                                                  Y   195
C                                                                         Y   196
  290 IF (T.GE.DPEND) GO TO 330                                           Y   197
      FNOW=1./HT                                                          Y   198
C     IF (AMIX(1).GE.0.) FNOW=AMIX(1)/HT                                  Y   199
      I=IFIX(T/60.)                                                       Y   200
      Z=(T-FLOAT(I*60))/60.                                               Y   201
      I=(I+1)*5                                                           Y   202
      DO 320 J=1,IDEPO                                                    Y   203
      DNOWS=((((Z*RDCOEF(I,J)+RDCOEF(I-1,J))*Z+RDCOEF(I-2,J))*Z           Y   204
     1  +RDCOEF(I-3,J))*Z+RDCOEF(I-4,J))*FNOW/60.                         Y   205
      IF (ISPDP(J).NE.IIHC) GO TO 310                                     Y   206
      DO 300 K=1,NHC                                                      Y   207
      LL=IH(K)                                                            Y   208
  300 XT(LL)=XT(LL)-DNOWS*X(LL)                                           Y   209
      GO TO 320                                                           Y   210
  310 LL=LOCDEP(J)                                                        Y   211
      XT(LL)=XT(LL)-DNOWS*X(LL)                                           Y   212
  320 CONTINUE                                                            Y   213
C                                                                         Y   214
C  DO REACTION RATES                                                      Y   215
C                                                                         Y   216
  330 DO 370 IR=1,NR                                                      Y   217
      I=KR(IR,1)                                                          Y   218
      IF (I.EQ.0.OR.R(IR).EQ.0.) GO TO 370                                Y   219
      RT=1.                                                               Y   220
      JT=ITYPE(IR)                                                        Y   221
      DO 340 LL=1,JT                                                      Y   222
      I=KR(IR,LL)                                                         Y   223
      IF (I.NE.99.AND.I.NE.0) RT=RT*X(I)                                  Y   224
  340 CONTINUE                                                            Y   225
      IF (ABS(S(IR)).NE.0.) R(IR)=A(IR)*EXP(S(IR)*FCT)                    Y   226
      RT=RT*R(IR)                                                         Y   227
      DO 350 LL=1,JT                                                      Y   228
      I=KR(IR,LL)                                                         Y   229
      IF (I.NE.0) XT(I)=XT(I)-RT                                          Y   230
  350 CONTINUE                                                            Y   231
      DO 360 K=4,12                                                       Y   232
      I=KR(IR,K)                                                          Y   233
      IF (I.EQ.0) GO TO 370                                               Y   234
      XT(I)=XT(I)+SC(IR,K)*RT                                             Y   235
  360 CONTINUE                                                            Y   236
  370 CONTINUE                                                            Y   237
      TOLD=T                                                              Y   238
      TEMP=TNOW                                                           Y   239
      ZENI=ZNOW                                                           Y   240
      RETURN                                                              Y   241
```

```
C     ENTRY DIFSET                                                      Y   242
  380 CONTINUE                                                          Y   243
      TOLD=T                                                            Y   244
      TINV=1./60.                                                       Y   245
      FCT=((3355.7046E-6)*TEMP-1.)/TEMP                                 Y   246
      IOLD=0                                                            Y   247
      TCI=FLOAT(JSRT)                                                   Y   248
      DHC=HCAL-HCBK                                                     Y   249
      DXN=XNAL-XNBK                                                     Y   250
      DO3=OZAL-OZBK                                                     Y   251
      IF (DHC.LT.0.) HCAL=HCBK                                          Y   252
      IF (DXN.LT.0.) DXN=0.                                             Y   253
      IF (DO3.LT.0.) DO3=0.                                             Y   254
      HT=AMIX(1)                                                        Y   255
      IF (HT.LT.0.) HT=AMXX(1)                                          Y   256
      IF (IP.EQ.0) RETURN                                               Y   257
      IPST=0                                                            Y   257A
      IBST1=0                                                           Y   257B
      IBST2=0                                                           Y   257C
      II=0                                                              Y   258
      DO 390 J=1,IP                                                     Y   259
      IR=IPH(J)                                                         Y   260
      R(IR)=P(1,J)*RFCT(J)                                              Y   261
      IF (J.GT.1) R(IR)=R(IR)*R(1)                                      Y   262
      IF (R(IR).LT.0.) R(IR)=0.                                         Y   263
  390 CONTINUE                                                          Y   264
      ZENI=XZ(1)                                                        Y   265
      ISP=IS1+ICR                                                       Y   265A
      RETURN                                                            Y   266
      END                                                               Y   267-
```

```
      SUBROUTINE COSET (METH,NQ,EL,TQ,MAXDER)                          Z     1
C                                                                      Z     2
C  PART OF THE GEAR ROUTINES                                           Z     3
C                                                                      Z     4
      SAVE                                                             Z     5
      DIMENSION PERTST(12,2,3), EL(13), TQ(4)                          Z     6
      DATA PERTST/1.,1.,2.,1.,.3158,.07407,.01391,.002182,.0002945,.0000Z     7
     13492,.000003692,.0000003524,1.,1.,.5,.1667,.04167,1.,1.,1.,1.,1.,1Z     8
     2.,1.,2.,12.,24.,37.89,53.33,70.08,87.97,106.9,126.7,147.4,168.8,19Z     9
     31.0,2.0,4.5,7.333,10.42,13.7,1.,1.,1.,1.,1.,1.,12.0,24.0,37.89,Z     10
     453.33,70.08,87.97,106.9,126.7,147.4,168.8,191.0,1.,3.0,6.0,9.167,1Z     11
     52.5,1.,1.,1.,1.,1.,1.,1./                                        Z     12
   10 MAXDER=5                                                         Z     13
      GO TO (20,30,40,50,60),NQ                                        Z     14
   20 EL(1)=1.0                                                        Z     15
      GO TO 70                                                         Z     16
   30 EL(1)=6.6666666666667E-01                                        Z     17
      EL(3)=3.3333333333333E-01                                        Z     18
      GO TO 70                                                         Z     19
   40 EL(1)=5.4545454545455E-01                                        Z     20
      EL(3)=EL(1)                                                      Z     21
      EL(4)=9.0909090909091E-02                                        Z     22
      GO TO 70                                                         Z     23
   50 EL(1)=0.48                                                       Z     24
      EL(3)=0.7                                                        Z     25
      EL(4)=0.2                                                        Z     26
      EL(5)=0.02                                                       Z     27
      GO TO 70                                                         Z     28
   60 EL(1)=4.3795620437956E-01                                        Z     29
      EL(3)=8.2116788321168E-01                                        Z     30
      EL(4)=3.1021897810219E-01                                        Z     31
      EL(5)=5.4744525547445E-02                                        Z     32
      EL(6)=3.6496350364964E-03                                        Z     33
   70 DO 80 K=1,3                                                      Z     34
   80 TQ(K)=PERTST(NQ,METH,K)                                          Z     35
      TQ(4)=.5*TQ(2)/FLOAT(NQ+2)                                       Z     36
      RETURN                                                           Z     37
      END                                                              Z     38-
```

```
      FUNCTION CLKMIN (X)                                                AA    1
C                                                                        AA    2
C  CALCULATE THE NUMBER OF MINUTES BASED ON A 24 HR CLOCK               AA    3
C                                                                        AA    4
      SAVE                                                               AA    5
      JSTRT=IFIX(X+0.1)                                                  AA    6
      JMIN=JSTRT-((JSTRT/100)*100)                                       AA    7
      CLKMIN=FLOAT((JSTRT/100)*60+JMIN)                                  AA    8
      RETURN                                                             AA    9
      END                                                                AA   10-
```

```
      SUBROUTINE INTERP (TOUT,Y,N0,Y0)                                  AB     1
C                                                                       AB     2
C  PERFORM EXACT INTERPOLATION IN TIME                                  AB     3
C                                                                       AB     4
      SAVE                                                              AB     5
      COMMON /GEAR1/ T,H,DUMMY(4),N,IDUMMY(2),JSTART                    AB     6
      DIMENSION Y0(N0), Y(N0,1)                                         AB     7
      DO 10 I=1,N                                                       AB     8
   10 Y0(I)=Y(I,1)                                                      AB     9
      L=MAX0(JSTART+1,2)                                                AB    10
      S=(TOUT-T)/H                                                      AB    11
      S1=1.                                                             AB    12
      DO 30 J=2,L                                                       AB    13
      S1=S1*S                                                           AB    14
      DO 20 I=1,N                                                       AB    15
   20 Y0(I)=Y0(I)+S1*Y(I,J)                                             AB    16
   30 CONTINUE                                                          AB    17
      RETURN                                                            AB    18
      END                                                               AB    19-
```

```
      SUBROUTINE NSBSLV (N,R,C,IL,JL,ISL,L,D,IU,JU,ISU,U,X,B,Y)
C
C  PART OF THE GEAR ROUTINES
C
      SAVE
      DIMENSION R(1), IL(1), JL(1), IU(1), JU(1), C(1), ISL(1), ISU(1)
      DIMENSION L(1), X(1), B(1), U(1), Y(1), D(1)
      INTEGER R,RK,C,CK
      REAL L
      DO 10 K=1,N
      RK=R(K)
   10 Y(K)=B(RK)
      DO 30 K=1,N
      JMIN=IL(K)
      JMAX=IL(K+1)-1
      YK=-D(K)*Y(K)
      Y(K)=-YK
      IF (JMIN.GT.JMAX) GO TO 30
      ISLB=ISL(K)-1
      DO 20 J=JMIN,JMAX
      ISLB=ISLB+1
      JLJ=JL(ISLB)
   20 Y(JLJ)=Y(JLJ)+YK*L(J)
   30 CONTINUE
      K=N
      DO 60 I=1,N
      SUM=-Y(K)
      JMIN=IU(K)
      JMAX=IU(K+1)-1
      IF (JMIN.GT.JMAX) GO TO 50
      ISUB=ISU(K)-1
      DO 40 J=JMIN,JMAX
      ISUB=ISUB+1
      JUJ=JU(ISUB)
   40 SUM=SUM+U(J)*Y(JUJ)
   50 Y(K)=-SUM
      CK=C(K)
      X(CK)=-SUM
   60 K=K-1
      RETURN
      END
```

```
      SUBROUTINE NSCORA (N,IA,JA,A,IAP,JAWORK,AWORK,C,IR,ICT)
C
C  PART OF THE GEAR ROUTINES
C
      SAVE
      INTEGER IA(1),JA(1),IAP(1),C(1),IR(1),ICT(1)
      REAL A(1),AWORK(1),JAWORK(1)
      DO 10 K=1,N
      ICK=C(K)
   10 IR(ICK)=K
      JMIN=1
      DO 30 K=1,N
      ICK=C(K)
      JMAX=JMIN+IA(ICK+1)-IA(ICK)-1
      IF (JMIN.GT.JMAX) GO TO 30
      IAINK=IA(ICK)-1
      DO 20 J=JMIN,JMAX
      IAINK=IAINK+1
      JAOUTJ=JA(IAINK)
      JAOUTJ=IR(JAOUTJ)
      JAWORK(J)=JAOUTJ
   20 AWORK(J)=A(IAINK)
   30 JMIN=JMAX+1
      DO 40 I=1,N
   40 ICT(I)=IAP(I)
      JMIN=1
      DO 60 I=1,N
      ICK=C(I)
      JMAX=JMIN+IA(ICK+1)-IA(ICK)-1
      IF (JMIN.GT.JMAX) GO TO 60
      DO 50 J=JMIN,JMAX
      JAOUTJ=INT(JAWORK(J))
      ICTJ=ICT(JAOUTJ)
      A(ICTJ)=AWORK(J)
      ICT(JAOUTJ)=ICTJ+1
   50 CONTINUE
   60 JMIN=JMAX+1
      RETURN
      END
```

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```

```
      SUBROUTINE NSCORD (N,IA,JA,IAWORK,JAWORK,C,IR,ICT)
C
C  PART OF THE GEAR ROUTINES
C
      SAVE
      INTEGER IA(1),JA(1),IAWORK(1),JAWORK(1),C(1),IR(1),ICT(1)
      DO 10 I=1,N
   10 ICT(I)=0
      IAWORK(1)=1
      DO 30 K=1,N
      ICK=C(K)
      JMIN=IAWORK(K)
      JMAX=JMIN+IA(ICK+1)-IA(ICK)-1
      IAWORK(K+1)=JMAX+1
      IF (JMIN.GT.JMAX) GO TO 30
      IAINK=IA(ICK)-1
      DO 20 J=JMIN,JMAX
      IAINK=IAINK+1
      JAOUTJ=JA(IAINK)
      JAOUTJ=IR(JAOUTJ)
      JAWORK(J)=JAOUTJ
   20 ICT(JAOUTJ)=ICT(JAOUTJ)+1
   30 CONTINUE
      IA(1)=1
      DO 40 I=1,N
      IA(I+1)=IA(I)+ICT(I)
   40 ICT(I)=IA(I)
      DO 60 I=1,N
      JMIN=IAWORK(I)
      JMAX=IAWORK(I+1)-1
      IF (JMIN.GT.JMAX) GO TO 60
      DO 50 J=JMIN,JMAX
      JAOUTJ=JAWORK(J)
      ICTJ=ICT(JAOUTJ)
      JA(ICTJ)=I
   50 ICT(JAOUTJ)=ICTJ+1
   60 CONTINUE
      RETURN
      END
```

```
AE     1
AE     2
AE     3
AE     4
AE     5
AE     6
AE     7
AE     8
AE     9
AE    10
AE    11
AE    12
AE    13
AE    14
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AE    27
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AE    29
AE    30
AE    31
AE    32
AE    33
AE    34
AE    35
AE    36
AE    37
AE    38
AE    39-
```

```
      SUBROUTINE NSNFAC (N,IA,JA,A,IL,JL,ISL,L,D,IU,JU,ISU,U,X,IRL,JRL,IAF     1
     1ER)                                                                      AF     2
C                                                                              AF     3
C  PART OF THE GEAR ROUTINES                                                   AF     4
C                                                                              AF     5
      SAVE                                                                     AF     6
      INTEGER IA(1),JA(1),IL(1),JL(1),ISL(1)                                   AF     7
      INTEGER IU(1),JU(1),ISU(1),IRL(1),JRL(1)                                 AF     8
      REAL A(1),L(1),D(1),U(1),X(1)                                            AF     9
      REAL LKI                                                                 AF    10
      IER=0                                                                    AF    11
      DO 10 K=1,N                                                              AF    12
      IRL(K)=IL(K)                                                             AF    13
   10 JRL(K)=0                                                                 AF    14
      DO 180 K=1,N                                                             AF    15
      X(K)=0.                                                                  AF    16
      I1=0                                                                     AF    17
      IF (JRL(K).EQ.0) GO TO 30                                                AF    18
      I=JRL(K)                                                                 AF    19
   20 I2=JRL(I)                                                                AF    20
      JRL(I)=I1                                                                AF    21
      I1=I                                                                     AF    22
      X(I)=0.                                                                  AF    23
      I=I2                                                                     AF    24
      IF (I.NE.0) GO TO 20                                                     AF    25
   30 JMIN=ISU(K)                                                              AF    26
      JMAX=JMIN+IU(K+1)-IU(K)-1                                                AF    27
      IF (JMIN.GT.JMAX) GO TO 50                                               AF    28
      DO 40 J=JMIN,JMAX                                                        AF    29
      JUJ=JU(J)                                                                AF    30
   40 X(JUJ)=0.                                                                AF    31
   50 JMIN=IA(K)                                                               AF    32
      JMAX=IA(K+1)-1                                                           AF    33
      DO 60 J=JMIN,JMAX                                                        AF    34
      JAJ=JA(J)                                                                AF    35
   60 X(JAJ)=A(J)                                                              AF    36
      I=I1                                                                     AF    37
      IF (I.EQ.0) GO TO 100                                                    AF    38
   70 IRLI=IRL(I)                                                              AF    39
      LKI=-X(I)                                                                AF    40
      L(IRLI)=-LKI                                                             AF    41
      JMIN=IU(I)                                                               AF    42
      JMAX=IU(I+1)-1                                                           AF    43
      IF (JMIN.GT.JMAX) GO TO 90                                               AF    44
      ISUB=ISU(I)-1                                                            AF    45
      DO 80 J=JMIN,JMAX                                                        AF    46
      ISUB=ISUB+1                                                              AF    47
      JUJ=JU(ISUB)                                                             AF    48
   80 X(JUJ)=X(JUJ)+LKI*U(J)                                                   AF    49
   90 I=JRL(I)                                                                 AF    50
      IF (I.NE.0) GO TO 70                                                     AF    51
  100 IF (X(K).EQ.0.) GO TO 190                                                AF    52
      DK=1./X(K)                                                               AF    53
      D(K)=DK                                                                  AF    54
      IF (K.EQ.N) GO TO 180                                                    AF    55
      JMIN=IU(K)                                                               AF    56
      JMAX=IU(K+1)-1                                                           AF    57
      IF (JMIN.GT.JMAX) GO TO 120                                              AF    58
      ISUB=ISU(K)-1                                                            AF    59
      DO 110 J=JMIN,JMAX                                                       AF    60
      ISUB=ISUB+1                                                              AF    61
      JUJ=JU(ISUB)                                                             AF    62
  110 U(J)=X(JUJ)*DK                                                           AF    63
  120 CONTINUE                                                                 AF    64
```

```
      I=I1                                                              AF    65
      IF (I.EQ.0) GO TO 170                                             AF    66
  130 IRL(I)=IRL(I)+1                                                   AF    67
      I1=JRL(I)                                                         AF    68
      IF (IRL(I).GE.IL(I+1)) GO TO 160                                  AF    69
      ISLB=IRL(I)-IL(I)+ISL(I)                                          AF    70
      J=JL(ISLB)                                                        AF    71
  140 IF (I.GT.JRL(J)) GO TO 150                                        AF    72
      J=JRL(J)                                                          AF    73
      GO TO 140                                                         AF    74
  150 JRL(I)=JRL(J)                                                     AF    75
      JRL(J)=I                                                          AF    76
  160 I=I1                                                              AF    77
      IF (I.NE.0) GO TO 130                                             AF    78
  170 ISLK=ISL(K)                                                       AF    79
      IF (IRL(K).GE.IL(K+1)) GO TO 180                                  AF    80
      J=JL(ISLK)                                                        AF    81
      JRL(K)=JRL(J)                                                     AF    82
      JRL(J)=K                                                          AF    83
  180 CONTINUE                                                          AF    84
      RETURN                                                            AF    85
  190 IER=K                                                             AF    86
      RETURN                                                            AF    87
      END                                                               AF    88-
```

```
      SUBROUTINE NSSFAC (N,IA,JA,MAXPL,IL,JL,ISL,MAXPU,IU,JU,ISU,P,V,IRAAG     1
     1,JRA,IRAC,IRL,JRL,IRU,JRU,IER)                                          AG     2
C                                                                             AG     3
C  PART OF THE GEAR ROUTINES                                                  AG     4
C                                                                             AG     5
      SAVE                                                                    AG     6
      INTEGER IA(1),JA(1),IL(1),JL(1),ISL(1)                                  AG     7
      INTEGER IU(1),JU(1),ISU(1),IRL(1),JRL(1),V(1)                           AG     8
C                                                                             AG     9
C  NOTE THE FOLLOWING STATEMENT DECLARATION MUST BE CHANGED TO "REAL"         AG    10
C   INSTEAD OF "INTEGER" ON  IBM, AMDAHL, AND HP COMPUTERS                    AG    11
C                                                                             AG    12
      REAL    P(1),IRAC(1),IRA(1),JRA(1),IRU(1),JRU(1)                        AG    13
C                                                                             AG    13A
C                                                                             AG    13B
      INTEGER VI,VJ,PK,PPK,PI,CEND,REND                                       AG    14
      IER=0                                                                   AG    15
      DO 10 K=1,N                                                             AG    16
      IRAC(K)=0                                                               AG    17
      JRA(K)=0                                                                AG    18
      JRL(K)=0                                                                AG    19
   10 JRU(K)=0                                                                AG    20
      DO 20 K=1,N                                                             AG    21
      IAK=IA(K)                                                               AG    22
      IF (IAK.GT.IA(K+1)) GO TO 400                                           AG    23
      IF (JA(IAK).GT.K) GO TO 20                                              AG    24
      JAIAK=JA(IAK)                                                           AG    25
      JRA(K)=IRAC(JAIAK)                                                      AG    26
      IRAC(JAIAK)=K                                                           AG    27
   20 IRA(K)=IAK                                                              AG    28
      JLPTR=0                                                                 AG    29
      IL(1)=1                                                                 AG    30
      JUPTR=0                                                                 AG    31
      IU(1)=1                                                                 AG    32
      DO 390 K=1,N                                                            AG    33
      P(1)=1                                                                  AG    34
      V(1)=N+1                                                                AG    35
      LSFS=2                                                                  AG    36
      VJ=IRAC(K)                                                              AG    37
      IF (VJ.EQ.0) GO TO 60                                                   AG    38
   30 PPK=1                                                                   AG    39
   40 PK=PPK                                                                  AG    40
      PPK=P(PK)                                                               AG    41
      IF (V(PPK)-VJ) 40,440,50                                                AG    42
   50 P(PK)=LSFS                                                              AG    43
      V(LSFS)=VJ                                                              AG    44
      P(LSFS)=PPK                                                             AG    45
      LSFS=LSFS+1                                                             AG    46
      VJ=JRA(VJ)                                                              AG    47
      IF (VJ.NE.0) GO TO 30                                                   AG    48
   60 LASTI=0                                                                 AG    49
      I=K                                                                     AG    50
   70 I=JRU(I)                                                                AG    51
      IF (I.EQ.0) GO TO 120                                                   AG    52
      PPK=1                                                                   AG    53
      JMIN=IRL(I)                                                             AG    54
      JMAX=ISL(I)+IL(I+1)-IL(I)-1                                             AG    55
      IF (LASTI.GT.I) GO TO 80                                                AG    56
      LASTI=I                                                                 AG    57
      LASTID=JMAX-JMIN                                                        AG    58
      IF (JL(JMIN).NE.K) LASTID=LASTID+1                                      AG    59
   80 IF (JMIN.GT.JMAX) GO TO 70                                              AG    60
      DO 110 J=JMIN,JMAX                                                      AG    61
      VJ=JL(J)                                                                AG    62
```

```
 90 PK=PPK                                                          AG   63
    PPK=P(PK)                                                       AG   64
    IF (V(PPK)-VJ) 90,110,100                                       AG   65
100 P(PK)=LSFS                                                      AG   66
    V(LSFS)=VJ                                                      AG   67
    P(LSFS)=PPK                                                     AG   68
    PPK=LSFS                                                        AG   69
    LSFS=LSFS+1                                                     AG   70
110 CONTINUE                                                        AG   71
    GO TO 70                                                        AG   72
120 PI=P(1)                                                         AG   73
    IF (V(PI).NE.K) GO TO 450                                       AG   74
    IF (LASTI.EQ.0) GO TO 130                                       AG   75
    IF (LASTID.NE.LSFS-3) GO TO 130                                 AG   76
    IRLL=IRL(LASTI)                                                 AG   77
    ISL(K)=IRLL+1                                                   AG   78
    IF (JL(IRLL).NE.K) ISL(K)=ISL(K)-1                              AG   79
    IL(K+1)=IL(K)+LASTID                                            AG   80
    IRL(K)=ISL(K)                                                   AG   81
    GO TO 160                                                       AG   82
130 ISL(K)=JLPTR+1                                                  AG   83
    PI=P(1)                                                         AG   84
    PI=P(PI)                                                        AG   85
    VI=V(PI)                                                        AG   86
140 IF (VI.GT.N) GO TO 150                                          AG   87
    JLPTR=JLPTR+1                                                   AG   88
    IF (JLPTR.GT.MAXPL) GO TO 460                                   AG   89
    JL(JLPTR)=VI                                                    AG   90
    PI=P(PI)                                                        AG   91
    VI=V(PI)                                                        AG   92
    GO TO 140                                                       AG   93
150 IRL(K)=ISL(K)                                                   AG   94
    IL(K+1)=IL(K)+JLPTR-ISL(K)+1                                    AG   95
160 P(1)=1                                                          AG   96
    V(1)=N+1                                                        AG   97
    LSFS=2                                                          AG   98
    JMIN=IRA(K)                                                     AG   99
    JMAX=IA(K+1)-1                                                  AG  100
    IF (JMIN.GT.JMAX) GO TO 200                                     AG  101
    DO 190 J=JMIN,JMAX                                              AG  102
    VJ=JA(J)                                                        AG  103
    PPK=1                                                           AG  104
170 PK=PPK                                                          AG  105
    PPK=P(PK)                                                       AG  106
    IF (V(PPK)-VJ) 170,410,180                                      AG  107
180 P(PK)=LSFS                                                      AG  108
    V(LSFS)=VJ                                                      AG  109
    P(LSFS)=PPK                                                     AG  110
190 LSFS=LSFS+1                                                     AG  111
200 LASTI=0                                                         AG  112
    I=K                                                             AG  113
210 I=JRL(I)                                                        AG  114
    IF (I.EQ.0) GO TO 260                                           AG  115
    PPK=1                                                           AG  116
    JMIN=IRU(I)                                                     AG  117
    JMAX=ISU(I)+IU(I+1)-IU(I)-1                                     AG  118
    IF (LASTI.GT.I) GO TO 220                                       AG  119
    LASTI=I                                                         AG  120
    LASTID=JMAX-JMIN                                                AG  121
    IF (JU(JMIN).NE.K) LASTID=LASTID+1                              AG  122
220 IF (JMIN.GT.JMAX) GO TO 210                                     AG  123
    DO 250 J=JMIN,JMAX                                              AG  124
    VJ=JU(J)                                                        AG  125
230 PK=PPK                                                          AG  126
```

```
      PPK=P(PK)                                                          AG  127
      IF (V(PPK)-VJ) 230,250,240                                         AG  128
  240 P(PK)=LSFS                                                         AG  129
      V(LSFS)=VJ                                                         AG  130
      P(LSFS)=PPK                                                        AG  131
      PPK=LSFS                                                           AG  132
  250 LSFS=LSFS+1                                                        AG  133
      GO TO 210                                                          AG  134
  260 PI=P(1)                                                            AG  135
      IF (V(PI).NE.K) GO TO 420                                          AG  136
      IF (LASTI.EQ.0) GO TO 270                                          AG  137
      IF (LASTID.NE.LSFS-3) GO TO 270                                    AG  138
      IRUL=IRU(LASTI)                                                    AG  139
      ISU(K)=IRUL+1                                                      AG  140
      IF (JU(IRUL).NE.K) ISU(K)=ISU(K)-1                                 AG  141
      IU(K+1)=IU(K)+LASTID                                               AG  142
      IRU(K)=ISU(K)                                                      AG  143
      GO TO 300                                                          AG  144
  270 ISU(K)=JUPTR+1                                                     AG  145
      PI=P(1)                                                            AG  146
      PI=P(PI)                                                           AG  147
      VI=V(PI)                                                           AG  148
  280 IF (VI.GT.N) GO TO 290                                             AG  149
      JUPTR=JUPTR+1                                                      AG  150
      IF (JUPTR.GT.MAXPU) GO TO 430                                      AG  151
      JU(JUPTR)=VI                                                       AG  152
      PI=P(PI)                                                           AG  153
      VI=V(PI)                                                           AG  154
      GO TO 280                                                          AG  155
  290 IRU(K)=ISU(K)                                                      AG  156
      IU(K+1)=IU(K)+JUPTR-ISU(K)+1                                       AG  157
  300 I=K                                                                AG  158
  310 I1=JRL(I)                                                          AG  159
      CEND=ISL(I)+IL(I+1)-IL(I)                                          AG  160
      IF (IRL(I).GE.CEND) GO TO 320                                      AG  161
      IRLI=IRL(I)                                                        AG  162
      J=JL(IRLI)                                                         AG  163
      JRL(I)=JRL(J)                                                      AG  164
      JRL(J)=I                                                           AG  165
  320 I=I1                                                               AG  166
      IF (I.EQ.0) GO TO 330                                              AG  167
      IRL(I)=IRL(I)+1                                                    AG  168
      GO TO 310                                                          AG  169
  330 I=K                                                                AG  170
  340 I1=JRU(I)                                                          AG  171
      REND=ISU(I)+IU(I+1)-IU(I)                                          AG  172
      IF (IRU(I).GE.REND) GO TO 350                                      AG  173
      IRUI=IRU(I)                                                        AG  174
      J=JU(IRUI)                                                         AG  175
      JRU(I)=JRU(J)                                                      AG  176
      JRU(J)=I                                                           AG  177
  350 I=I1                                                               AG  178
      IF (I.EQ.0) GO TO 360                                              AG  179
      IRU(I)=IRU(I)+1                                                    AG  180
      GO TO 340                                                          AG  181
  360 I=IRAC(K)                                                          AG  182
      IF (I.EQ.0) GO TO 390                                              AG  183
  370 I1=JRA(I)                                                          AG  184
      IRA(I)=IRA(I)+1                                                    AG  185
      IF (IRA(I).GE.IA(I+1)) GO TO 380                                   AG  186
      IRAI=IRA(I)                                                        AG  187
      IF (JA(IRAI).GT.I) GO TO 380                                       AG  188
      JAIRAI=JA(IRAI)                                                    AG  189
      JRA(I)=IRAC(JAIRAI)                                                AG  190
```

```
      IRAC(JAIRAI)=I                                                    AG  191
  380 I=I1                                                              AG  192
      IF (I.NE.0) GO TO 370                                             AG  193
  390 CONTINUE                                                          AG  194
      ISL(N)=JLPTR                                                      AG  195
      ISU(N)=JUPTR                                                      AG  196
      RETURN                                                            AG  197
  400 CALL YSMER ('ROW',K,' OF A IS NULL')                              AG  198
      GO TO 470                                                         AG  199
  410 CALL YSMER ('ROW',K,' HAS DUPLICATE ENTRY')                       AG  200
      GO TO 470                                                         AG  201
  420 CALL YSMER ('ROW',K,' HAS A NULL PIVOT')                          AG  202
      GO TO 470                                                         AG  203
  430 CALL YSMER ('ROW',K,' EXCEEDS JU STORAGE')                        AG  204
      GO TO 470                                                         AG  205
  440 CALL YSMER ('COL',K,' HAS DUPLICATE ENTRY')                       AG  206
      GO TO 470                                                         AG  207
  450 CALL YSMER ('COL',K,' HAS A NULL PIVOT')                          AG  208
      GO TO 470                                                         AG  209
  460 CALL YSMER ('COL',K,' EXCEEDS JL STORAGE')                        AG  210
  470 IER=1                                                             AG  211
      RETURN                                                            AG  212
      END                                                               AG  213-
```

```
      SUBROUTINE OZMX (C,TLL,TOUT,NO)                                    AH     1
C                                                                        AH     2
C  CALCULATE THE MAXIMUM 1 HR AVERAGE VALUE USING A RUNNING AVERAGE      AH     3
C                                                                        AH     4
      SAVE                                                               AH     5
      DIMENSION C(NO,6), RUN(61,5), OZ(61,5), OZA(5), TL(5), NT(5)       AH     6
      DIMENSION S2(5),SIX(5)                                             AH     7
      COMMON /GEAR1/ T,H,HMIN,HMAX,EPSC,UROUND,NC,MFC,KFLAG,JSTART       AH     8
      COMMON /HOUR/  OZM(5),NGO,TTM,TM(5)                                AH     9
      COMMON /CALC/ NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),IA(60) AH    10
     1              ,JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,TSTEP,ZENIAH    11
      COMMON /SPEC/ NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),          AH    12
     1              FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,    AH    13
     2              XNAL,NOZ,FENX(2),CR(61),NI,JOZ(5)                    AH    14
C                                                                        AH    15
      COMMON /CALCHR/ SPECIS(61)                                         AH    15A
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                     AH    15B
      CHARACTER*4 SPECIS, HCSPEC, REACT, PLSP                            AH    15C
C                                                                        AH    15D
      NQ=JSTART                                                          AH    16
      IF (T.NE.START) GO TO 20                                           AH    17
      DO 10 I=1,NOZ                                                      AH    18
      KOZ=JOZ(I)                                                         AH    19
      RUN(1,I)=C(KOZ,1)                                                  AH    20
      NT(I)=1                                                            AH    21
      TL(I)=START+1.                                                     AH    22
      OZM(I)=0.                                                          AH    23
      OZA(I)=0.                                                          AH    24
   10 CONTINUE                                                           AH    25
      TLL=TL(1)                                                          AH    26
      RETURN                                                             AH    27
   20 DO 130 JJ=1,NOZ                                                    AH    28
      KOZ=JOZ(JJ)                                                        AH    29
   30 DO 40 I=1,61                                                       AH    30
      RR=(TL(JJ)+FLOAT(I-1)-T)/H                                         AH    31
      IF (RR.GT.0.) GO TO 50                                             AH    32
      IF (TL(JJ)+FLOAT(I-1).GT.STOPP) GO TO 50                           AH    33
      OZ(I,JJ)=C(KOZ,1)                                                  AH    34
      RH=1.                                                              AH    35
      DO 40 J=1,NQ                                                       AH    36
      RH=RH*RR                                                           AH    37
   40 OZ(I,JJ)=OZ(I,JJ)+RH*C(KOZ,J+1)                                    AH    38
      I=61                                                               AH    39
   50 I=I-1                                                              AH    40
      TL(JJ)=TL(JJ)+FLOAT(I)                                             AH    41
      DO 90 J=1,I                                                        AH    42
      IF (NT(JJ).GT.60) GO TO 70                                         AH    43
      NTT=NT(JJ)                                                         AH    44
      RUN(NTT+1,JJ)=OZ(J,JJ)                                             AH    45
      NT(JJ)=NT(JJ)+1                                                    AH    46
      IF (NT(JJ).LT.61) GO TO 90                                         AH    47
      SIX(JJ)=0.                                                         AH    48
      S2(JJ)=RUN(60,JJ)                                                  AH    49
      DO 60 K=1,29                                                       AH    50
      SIX(JJ)=SIX(JJ)+RUN(2*K+1,JJ)                                      AH    51
   60 S2(JJ)=S2(JJ)+RUN(2*K,JJ)                                          AH    52
   70 OZA(JJ)=2.*SIX(JJ)+4.*S2(JJ)+RUN(1,JJ)+OZ(J,JJ)                    AH    53
      SV=SIX(JJ)                                                         AH    54
      SIX(JJ)=S2(JJ)-RUN(2,JJ)                                           AH    55
      S2(JJ)=SV+OZ(J,JJ)                                                 AH    56
      RUN(61,JJ)=OZ(J,JJ)                                                AH    57
      DO 80 K=1,60                                                       AH    58
   80 RUN(K,JJ)=RUN(K+1,JJ)                                              AH    59
      IF (OZA(JJ).GT.OZM(JJ)) OZM(JJ)=OZA(JJ)                            AH    60
```

```
      IF (OZA(JJ).EQ.OZM(JJ)) TM(JJ)=TL(JJ)+FLOAT(J-I-31)                AH   61
   90 CONTINUE                                                           AH   62
      IF (TL(JJ)-T.LT.0..AND.T.LT.STOPP) GO TO 30                        AH   63
      IF (NGO.NE.0) GO TO 100                                            AH   64
      IF (T.GT.360..AND.OZA(JJ).LT.OZM(JJ)) GO TO 110                    AH   65
  100 IF (T.LT.STOPP) GO TO 130                                          AH   66
      GO TO 120                                                          AH   67
  110 TOUT=T                                                             AH   68
      STOPP=T                                                            AH   69
  120 OZM(JJ)=OZM(JJ)/180.                                               AH   70
      OZA(JJ)=OZA(JJ)/180.                                               AH   71
      IF (OZA(JJ).LT.OZM(JJ)) GO TO 130                                  AH   72
      IF (T.GT.STOPP.AND.OZM(JJ).GT.0.00001) TM(JJ)=-TM(JJ)              AH   73
  130 CONTINUE                                                           AH   74
      TLL=TL(1)                                                          AH   75
      RETURN                                                             AH   76
      END                                                                AH   77-
```

```
      SUBROUTINE SAVIT (T,C)                                                 AI     1
C                                                                            AI     2
C  SAVE INTERMEDIATE CONCENTRATIONS FOR PLOTTING PURPOSES                    AI     3
C                                                                            AI     4
      SAVE                                                                   AI     5
      COMMON /FRPLOT/ SAVCON(80,5),SAVTIM(80),NT,INOW                        AI     6
      COMMON /SPEC/ NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),              AI     7
     1              FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,       AI     8
     2              XNAL,NOZ,FENX(2),CR(61),NI,KOZ(5)                       AI     9
C                                                                            AI     9A
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                         AI     9B
      CHARACTER*4  HCSPEC, REACT, PLSP                                       AI     9C
C                                                                            AI    10
      DIMENSION C(80)                                                        AI    11
      DATA NFRST/1/                                                          AI    12
C                                                                            AI    13
      IF (NFRST.NE.1.AND.T.EQ.TOLD) RETURN                                   AI    14
      IF (NT.EQ.0) NT=1                                                      AI    15
      NFRST=2                                                                AI    16
      TOLD=T                                                                 AI    17
      IF (NT.GT.80) RETURN                                                   AI    18
      IF (T.LT.SAVTIM(NT)) RETURN                                            AI    19
      SAVTIM(NT)=T                                                           AI    20
C                                                                            AI    21
      DO 10 II=1,NOZ                                                         AI    22
      I=KOZ(II)                                                              AI    23
      SAVCON(NT,II)=C(I)                                                     AI    24
   10 CONTINUE                                                               AI    25
      NT=NT+1                                                                AI    26
      RETURN                                                                 AI    27
      END                                                                    AI    28-
```

```
      SUBROUTINE SORDER (N,IA,JA,P,Q,MAX,V,L,IER)                       AJ    1
C                                                                       AJ    2
C  PART OF THE GEAR ROUTINES                                           AJ    3
C                                                                       AJ    4
      SAVE                                                              AJ    5
      INTEGER IA(1),JA(1),P(1),Q(1),V(1),L(1)                           AJ    6
      INTEGER S,SFS,PI,PJ,VI,VJ,VK,QVK,DTHR,DMIN                        AJ    7
      IER=0                                                             AJ    8
      DO 10 S=1,MAX                                                     AJ    9
   10 L(S)=S+1                                                          AJ   10
      SFS=1                                                             AJ   11
      L(MAX)=0                                                          AJ   12
      DO 20 K=1,N                                                       AJ   13
      P(K)=K                                                            AJ   14
      Q(K)=K                                                            AJ   15
      V(K)=1                                                            AJ   16
   20 L(K)=0                                                            AJ   17
      SFS=SFS+N                                                         AJ   18
      DO 100 K=1,N                                                      AJ   19
      JMIN=IA(K)                                                        AJ   20
      JMAX=IA(K+1)-1                                                    AJ   21
      IF(JMIN.GT.JMAX+1) GO TO 290                                      AJ   22
      KDIAG=0                                                           AJ   23
      DO 90 J=JMIN,JMAX                                                 AJ   24
      VJ=JA(J)                                                          AJ   25
      IF (VJ.NE.K) GO TO 30                                             AJ   26
      KDIAG=1                                                           AJ   27
      GO TO 90                                                          AJ   28
   30 LLK=K                                                             AJ   29
   40 LK=LLK                                                            AJ   30
      LLK=L(LK)                                                         AJ   31
      IF (LLK.EQ.0) GO TO 50                                            AJ   32
      IF (V(LLK)-VJ) 40,60,50                                           AJ   33
   50 LLK=SFS                                                           AJ   34
      IF (LLK.EQ.0) GO TO 300                                           AJ   35
      SFS=L(SFS)                                                        AJ   36
      V(K)=V(K)+1                                                       AJ   37
      V(LLK)=VJ                                                         AJ   38
      L(LLK)=L(LK)                                                      AJ   39
      L(LK)=LLK                                                         AJ   40
   60 LLK=VJ                                                            AJ   41
   70 LK=LLK                                                            AJ   42
      LLK=L(LK)                                                         AJ   43
      IF (LLK.EQ.0) GO TO 80                                            AJ   44
      IF (V(LLK)-K) 70,90,80                                            AJ   45
   80 LLK=SFS                                                           AJ   46
      IF (LLK.EQ.0) GO TO 300                                           AJ   47
      SFS=L(SFS)                                                        AJ   48
      V(VJ)=V(VJ)+1                                                     AJ   49
      V(LLK)=K                                                          AJ   50
      L(LLK)=L(LK)                                                      AJ   51
      L(LK)=LLK                                                         AJ   52
   90 CONTINUE                                                          AJ   53
      IF (KDIAG.EQ.0) GO TO 320                                         AJ   54
  100 CONTINUE                                                          AJ   55
      J=0                                                               AJ   56
      DTHR=0                                                            AJ   57
      DMIN=N                                                            AJ   58
      I=0                                                               AJ   59
  110 I=I+1                                                             AJ   60
      IF (I.GT.N) GO TO 280                                             AJ   61
      JMIN=MAX0(J+1,I)                                                  AJ   62
      IF (JMIN.GT.N) GO TO 140                                          AJ   63
  120 DO 130 J=JMIN,N                                                   AJ   64
```

```
      VI=P(J)                                                          AJ   65
      IF (V(VI).LE.DTHR) GO TO 150                                     AJ   66
      IF (V(VI).LT.DMIN) DMIN=V(VI)                                    AJ   67
  130 CONTINUE                                                         AJ   68
  140 DTHR=DMIN                                                        AJ   69
      DMIN=N                                                           AJ   70
      JMIN=I                                                           AJ   71
      GO TO 120                                                        AJ   72
  150 PJ=P(I)                                                          AJ   73
      P(J)=PJ                                                          AJ   74
      Q(PJ)=J                                                          AJ   75
      PI=VI                                                            AJ   76
      P(I)=PI                                                          AJ   77
      Q(PI)=I                                                          AJ   78
      LI=VI                                                            AJ   79
  160 LI=L(LI)                                                         AJ   80
      IF (LI.EQ.0) GO TO 210                                           AJ   81
      VK=V(LI)                                                         AJ   82
      LLK=VK                                                           AJ   83
      LJ=VI                                                            AJ   84
  170 LJ=L(LJ)                                                         AJ   85
      IF (LJ.EQ.0) GO TO 200                                           AJ   86
      VJ=V(LJ)                                                         AJ   87
      IF (VJ.EQ.VK) GO TO 170                                          AJ   88
  180 LK=LLK                                                           AJ   89
      LLK=L(LK)                                                        AJ   90
      IF (LLK.EQ.0) GO TO 190                                          AJ   91
      IF (V(LLK)-VJ) 180,170,190                                       AJ   92
  190 LLK=SFS                                                          AJ   93
      IF (LLK.EQ.0) GO TO 310                                          AJ   94
      SFS=L(SFS)                                                       AJ   95
      V(VK)=V(VK)+1                                                    AJ   96
      V(LLK)=VJ                                                        AJ   97
      L(LLK)=L(LK)                                                     AJ   98
      L(LK)=LLK                                                        AJ   99
      GO TO 170                                                        AJ  100
  200 IF (V(VK).GT.V(VI)) GO TO 160                                    AJ  101
      I=I+1                                                            AJ  102
      QVK=Q(VK)                                                        AJ  103
      PI=P(I)                                                          AJ  104
      P(QVK)=PI                                                        AJ  105
      Q(PI)=QVK                                                        AJ  106
      P(I)=VK                                                          AJ  107
      Q(VK)=I                                                          AJ  108
      GO TO 160                                                        AJ  109
  210 LI=VI                                                            AJ  110
  220 IF (L(LI).EQ.0) GO TO 270                                        AJ  111
      LI=L(LI)                                                         AJ  112
      VK=V(LI)                                                         AJ  113
      LLK=VK                                                           AJ  114
      QVK=MIN0(Q(VK),I)                                                AJ  115
  230 LK=LLK                                                           AJ  116
      LLK=L(LK)                                                        AJ  117
      IF (LLK.EQ.0) GO TO 240                                          AJ  118
      VJ=V(LLK)                                                        AJ  119
      IF (Q(VJ).GT.QVK) GO TO 230                                      AJ  120
      V(VK)=V(VK)-1                                                    AJ  121
      L(LK)=L(LLK)                                                     AJ  122
      L(LLK)=SFS                                                       AJ  123
      SFS=LLK                                                          AJ  124
      LLK=LK                                                           AJ  125
      GO TO 230                                                        AJ  126
  240 IF (Q(VK).LE.I) GO TO 260                                        AJ  127
      IF (V(VK).LE.DTHR) GO TO 250                                     AJ  128
```

```
      IF ((DTHR.LT.V(VK)).AND.(V(VK).LT.DMIN)) DMIN=V(VK)          AJ  129
      GO TO 220                                                    AJ  130
  250 J=MIN0(Q(VK)-1,J)                                            AJ  131
      DTHR=V(VK)                                                   AJ  132
      GO TO 220                                                    AJ  133
  260 L(LK)=SFS                                                    AJ  134
      SFS=L(VK)                                                    AJ  135
      GO TO 220                                                    AJ  136
  270 L(LI)=SFS                                                    AJ  137
      SFS=L(VI)                                                    AJ  138
      GO TO 110                                                    AJ  139
  280 RETURN                                                       AJ  140
  290 CALL YSMER ('ROW',K,' OF A IS NULL')                         AJ  141
      GO TO 330                                                    AJ  142
  300 CALL YSMER ('ROW',K,' EXCEEDS STORAGE')                      AJ  143
      GO TO 330                                                    AJ  144
  310 CALL YSMER ('VERTEX',VI,' EXCEEDS STORAGE')                  AJ  145
      GO TO 330                                                    AJ  146
  320 CALL YSMER ('COLUMN',K,'.. DIAGONAL MISSING')                AJ  147
  330 IER=1                                                        AJ  148
      RETURN                                                       AJ  149
      END                                                          AJ  150-
```

```
      SUBROUTINE YSMER (A,K,A1)                                          AK     1
C                                                                        AK     2
C  WRITE ERROR MESSAGES                                                  AK     3
C                                                                        AK     4
      SAVE                                                               AK     5
C     INTEGER A,A1(5)                                                    AK     6
      CHARACTER*6 A                                                      AK     6A
      CHARACTER*4 A1(5)                                                  AK     6B
      COMMON /INOUT/ INP,LOUT,ITAPE,IALN,IALL,INHH,IOZC                  AK     7
      WRITE (LOUT,10) A,K,(A1(II),II=1,5)                                AK     8
      RETURN                                                             AK     9
C                                                                        AK    10
C                                                                        AK    11
   10 FORMAT (1X,A4,I6,5A4)                                              AK    12
      END                                                                AK    13-
```

```
      FUNCTION CIRC (TI,XI,YI)                                          AL     1
C                                                                       AL     2
C  PERFORM INTERPOLATION USING FOUR POINTS                              AL     3
C                                                                       AL     4
      SAVE                                                              AL     5
      DIMENSION XI(3), YI(3)                                            AL     6
      DX=XI(3)-XI(1)                                                    AL     7
      DY=YI(3)-YI(1)                                                    AL     8
      X=(XI(2)-XI(1))/DX                                                AL     9
      Y=(YI(2)-YI(1))/DY                                                AL    10
      T=(TI-XI(1))/DX                                                   AL    11
      IF (X.EQ.Y) GO TO 20                                              AL    12
      B=((X*X+Y*Y)*0.5-X)/(Y-X)                                         AL    13
      TT=SQRT(B*B+2.*T*(1.-B)-T*T)                                      AL    14
      CX=B+TT                                                           AL    15
      IF (X.GT.Y) CX=B-TT                                               AL    16
      IF (CX.LT.0..OR.CX.GT.1.) GO TO 20                                AL    17
   10 CIRC=CX*DY+YI(1)                                                  AL    18
      RETURN                                                            AL    19
   20 CX=T*Y/X                                                          AL    20
      IF (T.GT.X) CX=(T-X)*(1.-Y)/(1.-X)+Y                              AL    21
      GO TO 10                                                          AL    22
      END                                                               AL    23-
```

```
      SUBROUTINE SPLOT                                                  AM     1
C                                                                       AM     2
C  PLOTS SPECIES CONCENTRATIONS AS A FUNCTION OF TIME                   AM     3
C                                                                       AM     4
      SAVE                                                              AM     5
      COMMON /TITL/  ITTL(36)                                           AM     6
      COMMON /INOUT/ IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                  AM     7
      COMMON /CALC/  NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),     AM     8
     1               IA(60),JA(800),DILUT,TEMP,ERR,START,STOPP,TPRNT,   AM     9
     2               TSTEP,ZENI                                         AM     9A
      COMMON /SUNLIT/ Z(10),RTCON(10),LAM1,INC,SLA,SLO,TZ,IY,IM,ID,     AM    10
     1                ISTRT,ISTOP,IINC,IEND,SPECIE,MAXZ,ITIME(24),      AM    11
     2                XZ(24),KKK(24),JSTRT,JSTOP,PSPEC,MNLM,MXLM,MAXL,  AM    11A
     3                MAXJ                                              AM    12
      COMMON /SPEC/   NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),       AM    13
     1                FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN, AM    14
     2                XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                  AM    15
      COMMON /HOUR/   OZM(5),NGO,TM,DUMMM(5)                            AM    16
      COMMON /FRPLOT/ SAVCON(80,5),SAVTIM(80),NT1,INOW                  AM    17
      COMMON /PLTND/  JBAR,JSYMB,CVERT(9),TVERT(52,2)                   AM    18
      COMMON /NEED1/  JBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,     AM    19
     1                IIH2O,JPLUS                                       AM    20
      DIMENSION JGRID(101), JSAV(101)                                   AM    21
C                                                                       AM    21A
      COMMON /CALCHR/ SPECIS(61)                                        AM    21B
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                    AM    21C
      CHARACTER*1 JBAR, JSYMB                                           AM    21D
      CHARACTER*2 ITTL                                                  AM    21E
      CHARACTER*4 SPECIS, HCSPEC, REACT, PLSP                           AM    21F
      CHARACTER*4 JGRID, CVERT, TVERT                                   AM    21G
      CHARACTER*4 JBLANK,MBLANK,IIHC,IINX,IICO,IINO2,IINO,IIO3,         AM    21H
     1            IIH2O,JPLUS                                           AM    21I
C                                                                       AM    21J
      DIMENSION TPRINT(11),TV1(10)                                      AM    22
      DATA MAXHC/101/,MAXNOX/50/,TGRID/100./,CGRID/50./                 AM    23
C                                                                       AM    24
      NT=NT1-1                                                          AM    25
      TCI=FLOAT(JSTRT)                                                  AM    26
      DO 100 L=1,NOZ                                                    AM    27
      IF (OZM(L).LE.0.) GO TO 100                                       AM    28
C                                                                       AM    29
C SET NORMALIZATION FACTORS AND VERTICAL LABELS                         AM    30
C                                                                       AM    31
      CLOW=0.                                                           AM    32
      TLOW=0.                                                           AM    33
      CH=OZM(L)*1.1                                                     AM    34
      CH1=ALOG10(CH)                                                    AM    35
      IAMEG=IFIX(CH1)                                                   AM    36
      IF (CH1.LT.0.) IAMEG=IAMEG-1                                      AM    37
      CHIGH=CH/(10.**IAMEG)                                             AM    38
      REM=CHIGH-FLOAT(IFIX(CHIGH))                                      AM    39
      CHIGH=CH+(1.-REM)*(10.**IAMEG)                                    AM    40
      CSPAN=CGRID/CHIGH                                                 AM    41
      DO 10 I=1,10                                                      AM    42
      M=11-I                                                            AM    43
      TV1(I)=(FLOAT(M)*.1)*CHIGH                                        AM    44
   10 CONTINUE                                                          AM    45
C                                                                       AM    46
C SET HORIZONTAL LABELS                                                 AM    47
C                                                                       AM    48
   20 THIGH=STOPP                                                       AM    49
   30 TSPAN=TGRID/THIGH                                                 AM    50
      DO 40 J=1,11                                                      AM    51
      TPRINT(J)=(FLOAT(J-1)/10.)*THIGH+.5                               AM    52
```

```
      TPRINT(J)=CLOCK(TCI,IFIX(TPRINT(J)))                                  AM   53
   40 CONTINUE                                                              AM   54
C                                                                           AM   55
C CLEAR GRID                                                                AM   56
C                                                                           AM   57
      MAXHC1=MAXHC-1                                                        AM   58
      DO 50 J=1,MAXHC                                                       AM   59
      JSAV(J)=0                                                             AM   60
   50 CONTINUE                                                              AM   61
C                                                                           AM   62
      IF (NT.LT.1) NT=1                                                     AM   63
      DO 60 J=1,NT                                                          AM   64
      KHC=IFIX((SAVTIM(J)-TLOW)*TSPAN+1.5)                                  AM   65
      KNOX=IFIX((SAVCON(J,L)-CLOW)*CSPAN-0.5)                               AM   66
      KNOX=MAXNOX-KNOX                                                      AM   67
      IF (KNOX.LT.1) GO TO 60                                               AM   68
      IF (KNOX.GT.MAXNOX) GO TO 60                                          AM   69
      IF (KHC.LT.1) GO TO 60                                                AM   70
      IF (KHC.GT.MAXHC1) GO TO 60                                           AM   71
      IF (KHC.LT.2) GO TO 60                                                AM   72
      JSAV(KHC)=KNOX                                                        AM   73
   60 CONTINUE                                                              AM   74
C                                                                           AM   75
      WRITE (IOUT,110) TVERT(1,1),TV1(1)                                    AM   76
      DO 90 K=2,MAXNOX                                                      AM   77
      M=MOD((K-1),5)                                                        AM   78
      I=(K-1)/5+1                                                           AM   79
      DO 70 J=2,MAXHC1                                                      AM   80
      JGRID(J)=JBLANK                                                       AM   81
      IF (JSAV(J).EQ.K) JGRID(J)=JSYMB                                      AM   82
   70 CONTINUE                                                              AM   83
C                                                                           AM   84
      IF (M.NE.0) GO TO 80                                                  AM   85
      JGRID(1)=JPLUS                                                        AM   86
      JGRID(101)=JPLUS                                                      AM   87
      WRITE (IOUT,130) TVERT(K,1),TV1(I),(JGRID(J),J=1,MAXHC)               AM   88
      GO TO 90                                                              AM   89
   80 JGRID(1)=JBAR                                                         AM   90
      JGRID(101)=JBAR                                                       AM   91
      WRITE (IOUT,140) TVERT(K,1),(JGRID(J),J=1,MAXHC)                      AM   92
   90 CONTINUE                                                              AM   93
      WRITE (IOUT,150) CLOW                                                 AM   94
      WRITE (IOUT,170) TPRINT                                               AM   95
      WRITE (IOUT,160) (ITTL(I),I=1,36)                                     AM   96
      WRITE (IOUT,180) PLSP(L)                                              AM   97
  100 CONTINUE                                                              AM   98
C                                                                           AM   99
      RETURN                                                                AM  100
C                                                                           AM  101
C  FORMAT STATEMENTS                                                        AM  102
C                                                                           AM  103
  110 FORMAT (1H1////9X,A4,F5.3,1H+,10(10H---------+))                      AM  104
  120 FORMAT (1H1//////18X,1H+,10(10H---------+)/18X,101A1/18X,101A1)       AM  105
  130 FORMAT (9X,A4,F5.3,101A1)                                             AM  106
  140 FORMAT (9X,A4,5X,101A1)                                               AM  107
  150 FORMAT (13X,F5.3,1H+,10(10H---------+))                               AM  108
  160 FORMAT (46X,36A2)                                                     AM  109
  170 FORMAT (F21.0,10F10.0/63X,14H  TIME (LDT)  //)                        AM  110
  180 FORMAT (1H0/45X,A4,36H CONCENTRATION AS A FUNCTION OF TIME)           AM  111
      END                                                                   AM  112-
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```
      SUBROUTINE CURV1 (N,X,Y,SLP1,SLPN,YP,TEMP,SIGMA)                  AN     1
C                                                                       AN     2
C     THIS SUBROUTINE DETERMINES THE PARAMETERS NECESSARY TO            AN     3
C     COMPUTE AN INTERPOLATORY SPLINE UNDER TENSION THROUGH             AN     4
C     A SEQUENCE OF FUNCTIONAL VALUES.  THE SLOPES AT THE TWO           AN     5
C     ENDS OF THE CURVE MAY BE SPECIFIED OR OMITTED.  FOR ACTUAL        AN     6
C     COMPUTATION OF POINTS ON THE CURVE IT IS NECESSARY TO CALL        AN     7
C     THE FUNCTION CURV2.                                               AN     8
C                                                                       AN     9
C     ON INPUT --                                                       AN    10
C     N = THE NUMBER OF VALUES TO BE INTERPOLATED (N.GE.2),             AN    11
C     X = AN ARRAY OF THE N INCREASING ABCISSAE OF THE                  AN    12
C         FUNCTIONAL VALUES,                                            AN    13
C     Y = AN ARRAY OF THE N ORDINATES OF THE VALUES, (I.E.Y(K)          AN    14
C         IS THE FUNCTIONAL VALUE CORRESPONDING TO X(K)),               AN    15
C     SLP1,SLPN CONTAIN THE DESIRED VALUES FOR THE FIRST                AN    16
C         DERIVATIVE TO THE CURVE AT X(1) AND X(N), RESPECTIVELY,       AN    17
C         IF THE QUANTITY SIGMA IS NEGATIVE THESE VALUES WILL BE        AN    18
C         DETERMINED INTERNALLY AND THE USER NEED ONLY FURNISH          AN    19
C         PLACE-HOLDING PARAMETERS FOR SLP1 AND SLPN.  SUCH PLACE-      AN    20
C         HOLDING PARAMETERS WILL BE IGNORED BY NOT DESTROYED,          AN    21
C     YP = AN ARRAY OF LENGTH AT LEAST N                                AN    22
C     TEMP = AN ARRAY OF LENGTH AT LEAST N WHICH IS USED FOR            AN    23
C         SCRATCH STORAGE,                                              AN    24
C     SIGMA = THE TENSION FACTOR.  THIS IS NON-ZERO AND                 AN    25
C         INDICATES THE CURVINESS DESIRED. IF ABS(SIGMA) IS NEARLY      AN    26
C         ZERO (E.G. .001) THE RESULTING CURVE IS APPROXIMATELY A       AN    27
C         CUBIC SPLINE.  IF ABS(SIGMA) IS LARGE (E.G. 50.) THE          AN    28
C         RESULTING CURVE IS NEARLY A POLYGONAL LINE.  THE SIGN         AN    29
C         OF SIGMA INDICATES WHETHER THE DERIVATIVE INFORMATION         AN    30
C         HAS BEEN INPUT OR NOT.  IF SIGMA IS NEGATIVE THE ENDPOINT     AN    31
C         DERIVATIVES WILL BE DETERMINED INTERNALLY.  A STANDARD        AN    32
C         VALUE FOR SIGMA IS APPROXIMATELY 1. IN ABSOLUTE VALUE         AN    33
C                                                                       AN    34
C     ON OUTPUT --                                                      AN    35
C     YP = VALUES PROPORTIONAL TO THE SECOND DERIVATIVE                 AN    36
C        OF THE CURVE AT THE GIVEN NODES.                               AN    37
C     N,X,Y,SLP1 AND SIGMA ARE UNALTERED,                               AN    38
C                                                                       AN    39
C      *** AK CLINE/NCAR, COMM. ACM 17,4(APR.1974), 221.                AN    40
C                                                                       AN    41
      SAVE                                                              AN    42
      DIMENSION X(N), Y(N), YP(N), TEMP(N)                              AN    43
      COMMON /EXPVAL/ EXPMAX                                            AN    44
C                                                                       AN    45
      NCYC=0                                                            AN    46
      NCHG=0                                                            AN    47
      NM1=N-1                                                           AN    48
      NP1=N+1                                                           AN    49
      DELX1=X(2)-X(1)                                                   AN    50
      IF (ABS(DELX1/X(2)).LT.0.02) GO TO 110                            AN    51
      DX1=(Y(2)-Y(1))/DELX1                                             AN    52
C                                                                       AN    53
C     *** DETERMINE SLOPES IF NECESSARY                                 AN    54
      IF (SIGMA.LT.0.) GO TO 90                                         AN    55
      SLPP1=SLP1                                                        AN    56
      SLPPN=SLPN                                                        AN    57
C                                                                       AN    58
C     *** DENORMALIZE TENSION FACTOR                                    AN    59
   10 IF (ABS(X(N)-X(1))/X(N).LT.0.02) GO TO 110                        AN    60
      SIGMAP=ABS(SIGMA)*FLOAT(N-1)/(X(N)-X(1))                          AN    61
      DX1=(Y(2)-Y(1))/DELX1                                             AN    62
C                                                                       AN    63
C     *** SET UP RIGHT HAND SIDE OF TRIDIAGONAL SYSTEM                  AN    64
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C         FOR YP AND PERFORM FORWARD ELIMINATION                        AN   65
      DELS=SIGMAP*DELX1                                                 AN   66
      IF (ABS(DELS).GE.EXPMAX) GO TO 110                                AN   67
      EXPS=EXP(DELS)                                                    AN   68
      SINHS=0.5*(EXPS-1./EXPS)                                          AN   69
      SINHIN=1./(DELX1*SINHS)                                           AN   70
      DIAG1=SINHIN*(DELS*0.5*(EXPS+1./EXPS)-SINHS)                      AN   71
      DIAGIN=1./DIAG1                                                   AN   72
      YP(1)=DIAGIN*(DX1-SLPP1)                                          AN   73
      SPDIAG=SINHIN*(SINHS-DELS)                                        AN   74
      TEMP(1)=DIAGIN*SPDIAG                                             AN   75
      IF (N.EQ.2) GO TO 30                                              AN   76
      DO 20 I=2,NM1                                                     AN   77
      DELX2=X(I+1)-X(I)                                                 AN   78
      IF (ABS(DELX2)/X(I+1).LT.0.02) GO TO 110                          AN   79
      DX2=(Y(I+1)-Y(I))/DELX2                                           AN   80
      DELS=SIGMAP*DELX2                                                 AN   81
      IF (ABS(DELS).GE.EXPMAX) GO TO 110                                AN   82
      EXPS=EXP(DELS)                                                    AN   83
      SINHS=.5*(EXPS-1./EXPS)                                           AN   84
      SINHIN=1./(DELX2*SINHS)                                           AN   85
      DIAG2=SINHIN*(DELS*(.5*(EXPS+1./EXPS))-SINHS)                     AN   86
      DIAGIN=1./(DIAG1+DIAG2-SPDIAG*TEMP(I-1))                          AN   87
      YP(I)=DIAGIN*(DX2-DX1-SPDIAG*YP(I-1))                             AN   88
      SPDIAG=SINHIN*(SINHS-DELS)                                        AN   89
      TEMP(I)=DIAGIN*SPDIAG                                             AN   90
      DX1=DX2                                                           AN   91
      DIAG1=DIAG2                                                       AN   92
   20 CONTINUE                                                          AN   93
   30 DIAGIN=1./(DIAG1-SPDIAG*TEMP(NM1))                                AN   94
      YP(N)=DIAGIN*(SLPPN-DX2-SPDIAG*YP(NM1))                           AN   95
C                                                                       AN   96
C     ***  PERFORM BACK SUBSTITUTION                                    AN   97
      DO 40 I=2,N                                                       AN   98
      IBAK=NP1-I                                                        AN   99
      YP(IBAK)=YP(IBAK)-TEMP(IBAK)*YP(IBAK+1)                           AN  100
   40 CONTINUE                                                          AN  101
      IF (SIGMA.GT.0.) RETURN                                           AN  102
      IF (N.EQ.3) RETURN                                                AN  103
      IF (NCYC.GT.15) RETURN                                            AN  104
      IF (NCYC.GT.0) GO TO 50                                           AN  105
      XTEST=(X(3)+X(2))/2.                                              AN  106
      YCORD=(Y(3)+Y(2))/2.                                              AN  107
      FACT=SQRT(ABS(SIGMA))                                             AN  108
      YTEST=(YCORD*FACT+CIRC(XTEST,X(1),Y(1))+CIRC(XTEST,X(2),Y(2)))/(2.AN  109
     1+FACT)                                                            AN  110
      ITHH=1                                                            AN  111
      DY2=CURV2(XTEST,N,X,Y,YP,SIGMA,ITHH)-YTEST                        AN  112
      DSAV=DY2                                                          AN  113
      SN=-1.                                                            AN  114
      IF (DY2.GT.0.) SN=1.                                              AN  115
      FACT=0.3*(SN+2.)                                                  AN  116
      DY2=0.                                                            AN  117
      IT=1                                                              AN  118
   50 NCYC=NCYC+1                                                       AN  119
      DY1=DY2                                                           AN  120
      DY2=CURV2(XTEST,N,X,Y,YP,SIGMA,IT)-YTEST                          AN  121
      IF (NCYC.GT.15) RETURN                                            AN  122
      IF (NCYC.GT.13.AND.NCHG.LT.2) GO TO 80                            AN  123
      IF (SIGN(1.,DY1).NE.SIGN(1.,DY2)) GO TO 60                        AN  124
      IF (ABS(DY2).LT.ABS(DY1)) GO TO 70                                AN  125
   60 SN=-SN                                                            AN  126
      NCHG=NCHG+1                                                       AN  127
      FACT=SN*((1./(1.-SN*FACT))**(1./3.)-1.)                           AN  128
```

```
   70 SLPP1=SLPP1*(1.+SN*FACT)                                          AN  129
      GO TO 10                                                          AN  130
C                                                                       AN  131
   80 IF (DY2/DSAV.LT.0.2) GO TO 70                                     AN  132
      SLPP1=SLPPX                                                       AN  133
      NCYC=15                                                           AN  134
      GO TO 10                                                          AN  135
   90 IF (N.EQ.2) GO TO 100                                             AN  136
C                                                                       AN  137
C     *** IF NO DERIVATIVES ARE GIVEN USE SECOND ORDER POLYNOMIAL       AN  138
C         INTERPOLATION ON INPUT DATA FOR VALUES AT ENDPOINTS.          AN  139
      SLPP1=(Y(2)-Y(1))/(X(2)-X(1))                                     AN  140
      DELN=X(N)-X(NM1)                                                  AN  141
      DELNM1=X(NM1)-X(N-2)                                              AN  142
      DELNN=X(N)-X(N-2)                                                 AN  143
      IF (ABS(DELN)/X(N).LT.0.02) GO TO 110                             AN  144
      IF (ABS(DELN)/X(N).LT.0.02) GO TO 110                             AN  145
      IF (ABS(DELNM1)/X(NM1).LT.0.02) GO TO 110                         AN  146
      IF (ABS(DELNN)/X(N).LT.0.02) GO TO 110                            AN  147
      C1=(DELNN+DELN)/DELNN/DELN                                        AN  148
      C2=-DELNN/DELN/DELNM1                                             AN  149
      C3=DELN/DELNN/DELNM1                                              AN  150
      SLPPN=C3*Y(N-2)+C2*Y(NM1)+C1*Y(N)                                 AN  151
      DX2=X(3)-X(2)                                                     AN  152
      DX31=X(3)-X(1)                                                    AN  153
      IF (ABS(DX2)/X(3).LT.0.02) GO TO 110                              AN  154
      IF (ABS(DX31)/X(3).LT.0.02) GO TO 110                             AN  155
      C1=-(DX31+DELX1)/DX31/DELX1                                       AN  156
      C2=DX31/DELX1/DX2                                                 AN  157
      C3=-DELX1/DX31/DX2                                                AN  158
      SLPPX=C1*Y(1)+C2*Y(2)+C3*Y(3)                                     AN  159
      IF (Y(2).GT.Y(1)) SLPPX=AMAX1(0.,SLPPX)                           AN  160
      FACT2=SQRT(ABS(SIGMA))                                            AN  161
      SLPPX=(SLPPX+FACT2*SLPP1)/(1.+FACT2)                              AN  162
      SLPP1=SLPPX                                                       AN  163
      IF (Y(N).GT.Y(NM1)) SLPPN=AMAX1(0.,SLPPN)                         AN  164
      SLPNL=(Y(N)-Y(NM1))/DELN                                          AN  165
      SLPPN=(SLPPN+SLPNL*FACT2)/(1.+FACT2)                              AN  166
      SLPPN=(SLPPN-SLPNL*SIGMA)/(1.-SIGMA)                              AN  167
      GO TO 10                                                          AN  168
C                                                                       AN  169
C     *** IF ONLY TWO POINTS AND NO DERIVATIVES ARE GIVEN, USE          AN  170
C         STRAIGHT LINE FOR CURVE                                       AN  171
C                                                                       AN  172
  100 YP(1)=0.                                                          AN  173
      YP(2)=0.                                                          AN  174
      RETURN                                                            AN  175
  110 SIGMA=-50.                                                        AN  176
      RETURN                                                            AN  177
      END                                                               AN  178-
```

```
      FUNCTION CURV2 (T,N,X,Y,YP,SIGMA,IT)                              AO     1
C                                                                       AO     2
C     THIS FUNCTION INTERPOLATES A CURVE AT A GIVEN POINT               AO     3
C     USING A SPLINE UNDER TENSION.  THE SUBROUTINE CURV1 SHOULD        AO     4
C     BE CALLED EARLIER TO DETERMINE CERTAIN NECESSARY                  AO     5
C     PARAMETERS.                                                       AO     6
C                                                                       AO     7
C     ON INPUT--                                                        AO     8
C     T = A REAL VALUE TO BE MAPPED ONTO THE                            AO     9
C         INTERPOLATING CURVE.                                          AO    10
C     N = THE NUMBER OF POINTS WHICH WERE INTERPOLATED                  AO    11
C         TO DETERMINE THE CURVE,                                       AO    12
C     X,Y = ARRAYS CONTAINING THE ORDINATES AND ABCISSAS                AO    13
C         OF THE INTERPOLATED POINTS,                                   AO    14
C     YP = AN ARRAY WITH VALUES PROPORTIONAL TO THE SECOND              AO    15
C         DERIVATIVE OF THE CURVE AT THE NODES                          AO    16
C     SIGMA = THE TENSION FACTOR (ITS SIGN IS IGNORED)                  AO    17
C         IT IS AN INTEGER SWITCH.  IF IT IS NOT 1 THIS INDICATES       AO    18
C         THAT THE FUNCTION HAS BEEN CALLED PREVIOUSLY (WITH N,X,       AO    19
C         Y,YP, AND SIGMA UNALTERED) AND THAT THIS VALUE OF T           AO    20
C         EXCEEDS THE PREVIOUS VALUE.  WITH SUCH INFORMATION THE        AO    21
C         FUNCTION IS ABLE TO PERFORM THE INTERPOLATION MUCH MORE       AO    22
C         RAPIDLY.  IF A USER SEEKS TO INTERPOLATE AT A SEQUENCE        AO    23
C         OF POINTS, EFFICIENCY IS GAINED BY ORDERING THE VALUES        AO    24
C         INCREASING AND SETTING IT TO THE INDEX OF THE CALL.           AO    25
C         IF IT IS 1 THE SEARCH FOR THE INTERVAL (X(K),X(K+1))          AO    26
C         CONTAINING T STARTS WITH K=1.                                 AO    27
C         THE PARAMETERS N,X,Y,YP AND SIGMA SHOULD BE INPUT             AO    28
C         UNALTERED FROM THE OUTPUT OF CURV1.                           AO    29
C                                                                       AO    30
C     ON OUTPUT--                                                       AO    31
C     CURV2 = THE INTERPOLATED VALUE.  FOR T LESS THAN                  AO    32
C         X(1) CURV2 = Y(1).  FOR T GREATER THAN X(N) CURV2 = Y(N).     AO    33
C                                                                       AO    34
C     NONE OF THE INPUT PARAMETERS ARE ALTERED.                         AO    35
C                                                                       AO    36
C      *** AK CLINE/NCAR, COMM. ACM 17,4(APR.1974), 221                 AO    37
C                                                                       AO    38
      SAVE                                                              AO    39
      DIMENSION X(N), Y(N), YP(N)                                       AO    40
      COMMON /EXPVAL/ EXPMAX                                            AO    41
C                                                                       AO    42
      S=X(N)-X(1)                                                       AO    43
      IT=IABS(IT)                                                       AO    44
C                                                                       AO    45
C     *** DENORMALIZE SIGMA                                             AO    46
      SIGMAP=ABS(SIGMA)*FLOAT(N-1)/S                                    AO    47
C                                                                       AO    48
C     *** IF IT.NE. 1 START SEARCH WHERE PREVIOUSLY TERMINATED,         AO    49
C         OTHERWISE START SEARCH FROM BEGINNING                         AO    50
      IF (IT.EQ.1) I1=2                                                 AO    51
C                                                                       AO    52
C     *** SEARCH FOR INTERVAL                                           AO    53
   10 DO 20 I=I1,N                                                      AO    54
      IF (X(I)-T) 20,20,30                                              AO    55
   20 CONTINUE                                                          AO    56
      I=N                                                               AO    57
C                                                                       AO    58
C     *** CHECK TO INSURE CORRECT INTERVAL                              AO    59
   30 IF (X(I-1).LE.T.OR.T.LE.X(1)) GO TO 40                            AO    60
C                                                                       AO    61
C     *** RESTART SEARCH AND RESET I1                                   AO    62
C         (INPUT (IT( WAS INCORRECT)                                    AO    63
      I1=2                                                              AO    64
```

```
      GO TO 10                                                                  AO   65
C                                                                               AO   66
C     *** SET UP AND PERFORM INTERPOLATION                                      AO   67
   40 IF (SIGMA.LE.(-49.)) GO TO 50                                             AO   68
      DEL1=T-X(I-1)                                                             AO   69
      DEL2=X(I)-T                                                               AO   70
      DELS=X(I)-X(I-1)                                                          AO   71
      EXPTST=SIGMAP*DEL1                                                        AO   72
      IF (ABS(EXPTST).GT.EXPMAX.AND.EXPTST.LT.0.) EXPTST=-EXPMAX                AO   73
      IF (ABS(EXPTST).GT.EXPMAX.AND.EXPTST.GT.0.) EXPTST=EXPMAX                 AO   74
      EXPS1=EXP(EXPTST)                                                         AO   75
      SINHD1=.5*(EXPS1-1./EXPS1)                                                AO   76
      EXPTST=SIGMAP*DEL2                                                        AO   77
      IF (ABS(EXPTST).GT.EXPMAX.AND.EXPTST.LT.0.) EXPTST=-EXPMAX                AO   78
      IF (ABS(EXPTST).GT.EXPMAX.AND.EXPTST.GT.0.) EXPTST=EXPMAX                 AO   79
      EXPS=EXP(EXPTST)                                                          AO   80
      SINHD2=.5*(EXPS-1./EXPS)                                                  AO   81
      ALN1=ALOG(ABS(EXPS1))                                                     AO   82
      ALN2=ALOG(ABS(EXPS))                                                      AO   83
      IF (ABS(ALN1+ALN2).GT.EXPMAX.AND.EXPS.GT.1.E-10) EXPS=EXP(EXPMAX)         AO   84
      IF (ABS(ALN1+ALN2).GT.EXPMAX.AND.EXPS.LT.1.E-10)                          AO   85
     1       EXPS=EXP(-EXPMAX)                                                  AO   86
      IF (ABS(ALN1+ALN2).LT.EXPMAX) EXPS=EXPS1*EXPS                             AO   87
      SINHS=.5*(EXPS-1./EXPS)                                                   AO   88
      CURV2=(YP(I)*SINHD1+YP(I-1)*SINHD2)/SINHS+((Y(I)-YP(I))*DEL1+(Y(I-      AO   89
     11)-YP(I-1))*DEL2)/DELS                                                    AO   90
      IF ((ABS(Y(I)-CURV2)+ABS(Y(I-1)-CURV2)).GT.1.001*(ABS(Y(I)-Y(I-1))       AO   91
     1)) IT=-IT                                                                 AO   92
      I1=I                                                                      AO   93
      RETURN                                                                    AO   94
   50 IF (I.EQ.1) I=2                                                           AO   95
      IF (ABS(X(I)-X(I-1))/X(I).LT.0.02) I=I+1                                  AO   96
      IF (I.GT.N) I=N                                                           AO   97
      CURV2=((T-X(I-1))*(Y(I)-Y(I-1))/(X(I)-X(I-1)))+Y(I-1)                     AO   98
      IT=1                                                                      AO   99
      RETURN                                                                    AO  100
      END                                                                       AO  101-
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      SUBROUTINE RLINE (KS1,JS)                                          AP     1
C                                                                        AP     2
C  THIS ROUTINE CONTROLS THE ISOPLETH OPTION OF OZIPM                    AP     3
C                                                                        AP     4
      SAVE                                                               AP     5
      COMMON /NEED/  HC,XN,NL,OZP(20),OZN(11,11,5),MR,LS,HCS,XNS         AP     6
      COMMON /CNTRL/ SIG,SIGMA,INFO,NPTO,TSTRT,DTIM,Z1,Z2,DCON,EHC,EXN,  AP     7
     1               FLST,TLST                                           AP     8
      COMMON /HOUR/  OZM(5),NGO,TM,DUMMM(5)                              AP     9
      COMMON /SPEC/  NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),         AP    10
     1               FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN,   AP    11
     2               XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                    AP    12
      COMMON /INOUT/ IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                   AP    13
      COMMON /SPECHR/ HCSPEC(20), PLSP(5), REACT(61)                     AP   13A
      CHARACTER*4    HCSPEC,REACT,PLSP                                   AP    14
C                                                                        AP    15
      IF (KS1.GE.121) RETURN                                             AP    16
      IF (INFO.EQ.0) WRITE (IOUT,365) (PLSP(I),I=1,NOZ)                  AP    17
      IF (INFO.LT.0) WRITE (IOUT,370) (PLSP(I),I=1,NOZ)                  AP    18
      IF (KS1.GT.0) IBEG=KS1+1                                           AP    19
      IF (JS.LE.0) IBEG=1                                                AP    20
      INX=1                                                              AP    21
      DO 20 K=IBEG,121                                                   AP    22
      I=MOD(K,11)                                                        AP    23
      IF (I.EQ.0) I=11                                                   AP    24
      J=(K-I)/11+1                                                       AP    25
      HCC = FLOAT(J-1)*.1 * HC                                           AP    26
      XNN = FLOAT(I-1)*.1 * XN                                           AP    27
      CALL SIM (HCC,XNN,OZN(I,J,1),INX)                                  AP    28
      DO 10 L=2,5                                                        AP    29
      OZN(I,J,L)=OZM(L)                                                  AP    30
   10 CONTINUE                                                           AP    31
   20 CONTINUE                                                           AP    32
      RETURN                                                             AP    33
C                                                                        AP    34
  365 FORMAT (1H1,//,14X,36HTHE FOLLOWING SIMULATIONS WERE DONE./1H0/1H  AP    35
     1,6X,4HNMOC,11X,3HNOX,12X,5HRATIO,10X,5(A4,11X))                    AP    36
  370 FORMAT (1H1,//,14X,36HTHE FOLLOWING SIMULATIONS WERE DONE./1H0/1H  AP    37
     1,6X,4HNMOC,5X,3HNOX,7X,5HRATIO,5(6X,A4,6X,4HTIME))                 AP    38
  366 FORMAT (1H1,//,14X,36HTHE FOLLOWING SIMULATIONS WERE DONE./1H0/1H  AP    35
     1,6X,4HNMOC,11X,3HNOX,12X,5HRATIO,10X,5(A4,11X))                    AP    36
  371 FORMAT (1H1,//,14X,36HTHE FOLLOWING SIMULATIONS WERE DONE./1H0/1H  AP    37
     1,6X,4HNMOC,5X,3HNOX,7X,5HRATIO,5(6X,A4,6X,4HTIME))                 AP    38
      END                                                                AP    39-
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      SUBROUTINE LINER (KALCMP,OZN)                                          AQ     1
C                                                                            AQ     2
C  THIS SUBROUTINE PERFORMS THE ACTUAL PLOTTING OF THE ISOPLETHS             AQ     3
C                                                                            AQ     4
      SAVE                                                                   AQ     5
      COMMON /NEED/    HC,XN,NL,OZP(20),OZ1(11,11,5),MR,LS,HCS,XNS           AQ     6
      COMMON /VVLB1/   FACTOR,DISTNC,CHRSZ,NCHR,OZLBL                        AQ     7
      COMMON /PLTVEC/ HCT(20),OT(20),NT,OHC,HCG,PLTGRD,OXN,XNG,HC1,XN1,      AQ     8
     1                TICZ,DIGZ,CHRZ,IPLDEV                                 AQ     9
      COMMON /CNTRL/   SGG,SIGMA,INFO,NPTO,TSTRT,DTIM,Z1,Z2,DCON,EHC,EXN,    AQ    10
     1                FLST,TLST                                             AQ    11
      COMMON /INOUT/   IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC                     AQ    12
      COMMON /TITL/    ITTL(36)                                              AQ    13
      COMMON /GEAR6/   SCR(11,11),RXX(9,11),RPLV(20,11),RPLD(20,21),         AQ    14
     1                 NRL(20),NSL(20),NBL(20),NTL(20),NSLV(20),NRLV(20),    AQ    15
     2                 NBLV(20),NTLV(20),NSLD(20),NRLD(20),NBLD(20),         AQ    16
     3                 NTLD(20),XNOX(11),XHC(11),W(22),WW(22),OE(22),        AQ    16A
     3                 HCTP(20),XNE(22),XNEP(20),YP(20),TM(20),XNAP(20),     AQ    17
     4                 HCAP(20),HCLP(20),ITTL2(36),U(88),V(88),HCBP(20),     AQ    18
     5                 DUM1(378),NDM1(20),NDM2(20),NDM3(400)                 AQ    19
      COMMON /SCRAT3/ WY(20)                                                 AQ    20
      DIMENSION       ITTL1(36),OZN(11,11)                                   AQ    21
      DIMENSION       LBLTOP(6),LBLRGT(6)                                    AQ    22
C                                                                            AQ    23
      CHARACTER*1 LBLRGT, LBLTOP                                             AQ    23A
      CHARACTER*2 JBL, ITTL, ITTL1                                           AQ    23B
      CHARACTER*12 LBLLFT, LBLBOT                                            AQ    23C
C                                                                            AQ    23D
      DATA LBLTOP,LBLRGT/12*' '/                                             AQ    24
      DATA LBLLFT/'NOX (PPM)   '/                                            AQ    25
      DATA LBLBOT/'NMOC(PPM)   '/,JBL                                        AQ    26
C                                                                            AQ    27
C  FIRST SET CALCOMP OPTION                                                  AQ    28
C                                                                            AQ    29
      LS=1                                                                   AQ    30
      CHRSZ=TICZ                                                             AQ    31
      IDIG1=1                                                                AQ    32
      IDIG2=2                                                                AQ    33
      IHY=IFIX(HC*10.+0.5)                                                   AQ    34
      IHZ=IFIX(XN*1000.+0.5)                                                 AQ    35
      IF (MOD(IHY,10).NE.0) IDIG1=2                                          AQ    36
      IF (MOD(IHZ,7).NE.0.OR.IHZ.LT.10) IDIG2=3                              AQ    37
      HCC=HC1/HC                                                             AQ    38
      HCX=0.                                                                 AQ    39
      HCM=HC/10.                                                             AQ    40
      XNC=XN1/XN                                                             AQ    41
      XNX=0.                                                                 AQ    42
      XNM=XN/7.                                                              AQ    43
      XSIZE=HC1*.1                                                           AQ    44
      YSIZE=XN1*.1                                                           AQ    45
      XX=((10.24-(HCC*HC))/2.0)+0.3                                          AQ    46
      YY=((8.0-(XNC*XN))/2.0)+0.3                                            AQ    47
      ORGY=-.75                                                              AQ    48
      NLL = 0                                                                AQ    48A
      IF (KALCMP.LE.0) GO TO 10                                              AQ    49
      CALL PLOTS (I1,I2,14)                                                  AQ    50
      CALL PLOT (XX-0.5*XSIZE,YY-0.5*YSIZE,-3)                               AQ    51
   10 CONTINUE                                                               AQ    52
      DO 30 J=1,11                                                           AQ    53
      DO 20 I=1,11                                                           AQ    54
      SCR(I,J)=OZN(J,I)                                                      AQ    55
   20 CONTINUE                                                               AQ    56
   30 CONTINUE                                                               AQ    57
      CALL ISOPLT (HCTP,XN,1)                                                AQ    58
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C                                                                               AQ   59
C     DRAW THE ISOLINES                                                         AQ   60
C                                                                               AQ   61
      CALL VVMNMX (SCR,11,11,11,OMIN,OMAX)                                      AQ   62
      NW=0                                                                      AQ   63
      DO 40 I=1,NL                                                              AQ   64
      WY(I)=9.                                                                  AQ  64A
      IF (OZP(I).LT.OMIN.OR.OZP(I).GT.OMAX) GO TO 40                            AQ   65
      NW=NW+1                                                                   AQ   66
      WY(NW)=OZP(I)                                                             AQ   67
   40 CONTINUE                                                                  AQ   68
      NCHR=4                                                                    AQ   69
      NCNT=0                                                                    AQ   70
   50 VAL=WY(1)*(10.**NCNT)                                                     AQ   71
      IF (VAL.GT.0.01) GO TO 60                                                 AQ   72
      NCNT=NCNT+1                                                               AQ   73
      GO TO 50                                                                  AQ   74
   60 NCHR=NCHR+NCNT                                                            AQ   75
      REMB=WY(1)-FLOAT(IFIX(WY(1)*(10.**(NCNT+2))+0.1))/(10.**(NCNT+2))         AQ   76
      IF (REMB.GE.(0.001/(10.**NCNT))) NCHR=NCHR+1                              AQ   77
      IDG1=-(1000*NCHR+NW)                                                      AQ   78
      CALL CONMAP(SCR,11,11,11,XSIZE,YSIZE,WY,IDG1,KALCMP)                      AQ   79
C                                                                               AQ   80
      IF (KALCMP.LE.0) GO TO 130                                                AQ   81
      CALL PLOT (0.5*XSIZE,0.5*YSIZE,-3)                                        AQ   82
      CALL FRAME (0.,0.,0.,HC,HCC,HCX,HCM,IDIG1,0.,XN,XNC,XNX,XNM,IDIG2,        AQ   83
     1LBLBOT,12,LBLLFT,12,LBLTOP,1,LBLRGT,1)                                    AQ   84
      NCNT=0                                                                    AQ   85
      DO 70 I=1,36                                                              AQ   86
      IF (ITTL(I).NE.JBL) GO TO 80                                              AQ   87
      NCNT=NCNT+1                                                               AQ   88
   70 CONTINUE                                                                  AQ   89
   80 NLST=36-NCNT                                                              AQ   90
      DO 90 I=1,NLST                                                            AQ   91
   90 ITTL1(I)=ITTL(I+NCNT)                                                     AQ   92
      NCNT1=36                                                                  AQ   93
      DO 100 I=1,36                                                             AQ   94
      II = 37 - I                                                               AQ   95
      IF (ITTL1(II).NE.JBL) GO TO 110                                           AQ   96
      NCNT1=NCNT1-1                                                             AQ   97
  100 CONTINUE                                                                  AQ   98
  110 NCNT1=NCNT1-NCNT                                                          AQ   99
      ORGX=((HCC*HC)-(FLOAT(NCNT1)*4.*CHRZ))/2.0                                AQ  100
      DO 120 I=1,NCNT1                                                          AQ  101
      CALL SYMBOL (ORGX,ORGY,CHRZ,ITTL1(I),IDUM,0.,2)                           AQ  102
      ORGX=ORGX+2.0*CHRZ                                                        AQ  103
  120 CONTINUE                                                                  AQ  104
      CALL PLOT (10.,2.,999)                                                    AQ  105
  130 HCS=FLOAT(NW)                                                             AQ  106
      XNS=FLOAT(NLL)                                                            AQ  107
      CALL ISOPLT (HC,XN,3)                                                     AQ  108
      RETURN                                                                    AQ  109
      END                                                                       AQ  110-
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      SUBROUTINE EDGMX (X,Y,N,XMX,YMX,L)                                  AR     1
C                                                                         AR     2
C  CALCULATE THE MAXIMUM POINT ALONG A LINE                               AR     3
C                                                                         AR     4
      SAVE                                                                AR     5
      DIMENSION X(N), Y(N)                                                AR     6
      LL=N                                                                AR     7
      I=N                                                                 AR     8
      IF (N.LE.2) GO TO 30                                                AR     9
      NGO=0                                                               AR    10
      DO 10 I=2,LL                                                        AR    11
      IF (Y(I).GT.Y(I-1)) GO TO 10                                        AR    12
      IF (I.EQ.LL) L=I                                                    AR    13
      IF (I.EQ.LL) NGO=1                                                  AR    14
      IF (I.EQ.LL) GO TO 20                                               AR    15
      IF (Y(I).GT.Y(I+1)) L=I+1                                           AR    16
      IF (Y(I).GT.Y(I+1)) NGO=1                                           AR    17
      GO TO 20                                                            AR    18
   10 CONTINUE                                                            AR    19
   20 CONTINUE                                                            AR    20
      IF (NGO.EQ.1) GO TO 40                                              AR    21
   30 L=LL-1                                                              AR    22
      XMX=X(L+1)                                                          AR    23
      YMX=Y(L+1)                                                          AR    24
      RETURN                                                              AR    25
   40 L=MAX0(L-1,3)                                                       AR    26
      X21=X(L-1)-X(L-2)                                                   AR    27
      X221=X(L-1)*X(L-1)-X(L-2)*X(L-2)                                    AR    28
      X32=X(L)-X(L-1)                                                     AR    29
      XL2=X(L)*X(L)                                                       AR    30
      Y21=Y(L-1)-Y(L-2)                                                   AR    31
      C=(Y21/X21-(Y(L)-Y(L-1))/X32)/(X221/X21-(XL2-X(L-1)*X(L-1))/X32)    AR    32
      B=(Y21-C*X221)/X21                                                  AR    33
      A=Y(L)-B*X(L)-C*XL2                                                 AR    34
      XMX=-B*0.5/C                                                        AR    35
      YMX=A+B*XMX+C*XMX*XMX                                               AR    36
      IF (XMX.GE.0.999*X(L)) YMX=Y(L)                                     AR    37
      IF (YMX.EQ.Y(L)) XMX=X(L)                                           AR    38
      IF (XMX.LT.1.001*X(L-2).AND.L.GT.3) GO TO 40                        AR    39
      L=L-1                                                               AR    40
      IF (XMX.LE.X(L)) L=L-1                                              AR    41
      RETURN                                                              AR    42
      END                                                                 AR    43-
```

```
      SUBROUTINE ISOPLT (SAVHC,SAVNOX,IENTRY)                          AS    1
C                                                                      AS    2
C  DRAWS A LINE PRINTER PLOT OF THE ISOPLETH                           AS    3
C                                                                      AS    4
      SAVE                                                             AS    5
      COMMON /NEED/    HC,XN,NL,OZ1(20),OZN(11,11,5),MR,LS,HCS,XNS     AS    6
      COMMON /TITL/    ITTL(36)                                        AS    7
      COMMON /INOUT/   IN,IOUT,ITAPE,IALN,IALL,INHH,IOZC               AS    8
      COMMON /CALC/    NR,KR(200,12),A(200),S(200),R(200),ITYPE(200),  AS    9
     1                 IA(60),JA(800),DILUT,TEMP,ERR,START,STOPP,      AS    9A
     2                 TPRNT,TSTEP,ZENI                                AS   10
C     COMMON /PHOTON/  JGRID(101,42),SPRSE(13)                         AS   11
      COMMON /CNTRL/   SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN, AS   12
     1                 FLST,TLST                                       AS   13
      COMMON /SPEC/    NS,CARB(20),RCTY(20),XNF(2),IH(20),INOX(2),     AS   14
     1                 FINHC(20),FALHC(20),NHC,OZIN,OZAL,HCIN,HCAL,XNIN, AS  15
     2                 XNAL,NOZ,FENX(2),C(61),NI,KOZ(5)                AS   16
C     COMMON /GEAR6/   DUM1(880),XZP(20),DUM2(326),DUM3(972)           AS   17
C     COMMON /GEAR6C/  NGRID(101,2)                                    AS   17A
      COMMON /HOUR/    OZM(5),NGO,TM,DUMMM(5)                          AS   18
      COMMON /SCRAT3/  OZP(20)                                         AS   18A
      COMMON /SCRATC/  ISPN                                            AS   19
      COMMON /CALCHR/  SPECIS(61)                                      AS   19A
      COMMON /SPECHR/  HCSPEC(20), PLSP(5), REACT(61)                  AS   19B
C                                                                      AS   19C
      DIMENSION      TVERT(52,2), TPRINT(11), NLINE(3)                 AS   20
      DIMENSION      TV(7), SAVDAT(101), TV1(7)                        AS   21
      DIMENSION      JGRID(101,42), NGRID(101,2), DUM3(101)            AS   21A
C                                                                      AS   21B
      CHARACTER*1 JPLUS, JBAR, JSYMB, JBL                              AS   21C
      CHARACTER*1 JGRID, NGRID, NLINE                                  AS   21D
      CHARACTER*2 ITTL                                                 AS   21E
      CHARACTER*4 JBLANK, TV, TVERT, ISPN                              AS   21F
      CHARACTER*4 SPECIS, HCSPEC, REACT, PLSP                          AS   21G
C                                                                      AS   22
      DATA JBLANK/'    '/,MAXHC/101/,MAXNOX/42/,TGRID/100./,           AS   23
     1CGRID/42./,JPLUS/'+'/,JBAR/'I'/,JSYMB/'+'/,JBL/' '/             AS   24
      DATA TV/' N  ',' O  ',' X  ','    ',' P  ',' P  ',' M  '/       AS   25
      DATA TVERT/104*'    '/                                           AS   26
C                                                                      AS   27
C     EMULATE MULTIPLE ENTRY POINTS WITH COMPUTED GO TO                AS   28
      GO TO (10,90,120),IENTRY                                         AS   29
      STOP                                                             AS   30
   10 CONTINUE                                                         AS   31
      NR1=1                                                            AS   32
      DO 20 J=1,42                                                     AS   33
      IF (J.LE.2) NGRID(1,J)=JBAR                                      AS   34
      IF (J.LE.2) NGRID(101,J)=JBAR                                    AS   35
      JGRID(1,J)=JBAR                                                  AS   36
      JGRID(101,J)=JBAR                                                AS   37
   20 CONTINUE                                                         AS   38
      DO 30 I=1,52                                                     AS   39
      TVERT(I,1)=JBLANK                                                AS   40
      IF (I.LT.17.OR.I.GT.23) GO TO 30                                 AS   41
      K=I-16                                                           AS   42
      TVERT(I,1)=TV(K)                                                 AS   43
   30 CONTINUE                                                         AS   44
      DO 40 I=1,101                                                    AS   45
   40 SAVDAT(I)=0.                                                     AS   46
      DO 50 J=1,42,3                                                   AS   47
      JGRID(1,J)=JPLUS                                                 AS   48
      JGRID(101,J)=JPLUS                                               AS   49
   50 CONTINUE                                                         AS   50
C                                                                      AS   51
```

```
C SET NORMALIZATION FACTORS AND VERTICAL LABELS                          AS   52
C                                                                       AS   53
      CLOW=0.                                                           AS   54
      TLOW=0.                                                           AS   55
      CHIGH=XN                                                          AS   56
      CSPAN=CGRID/CHIGH                                                 AS   57
      THIGH=HC                                                          AS   58
      DO 60 I=1,7                                                       AS   59
      M=8-I                                                             AS   60
      TV1(I)=(FLOAT(M)/7.)*CHIGH                                        AS   61
   60 CONTINUE                                                          AS   62
C                                                                       AS   63
C SET HORIZONTAL LABELS                                                 AS   64
C                                                                       AS   65
      TSPAN=TGRID/THIGH                                                 AS   66
      DO 70 J=1,11                                                      AS   67
      TPRINT(J)=(FLOAT(J-1)/10.)*THIGH                                  AS   68
   70 CONTINUE                                                          AS   69
C                                                                       AS   70
C CLEAR GRID                                                            AS   71
C                                                                       AS   72
      MAXHC1=MAXHC-1                                                    AS   73
      DO 80 K=1,MAXNOX                                                  AS   74
      DO 80 J=2,MAXHC1                                                  AS   75
      JGRID(J,K)=JBLANK                                                 AS   76
      IF (K.LE.2) NGRID(J,K)=JBLANK                                     AS   77
   80 CONTINUE                                                          AS   78
      RETURN                                                            AS   79
C                                                                       AS   80
C ENTRY FOR SAVING INTERPOLATED POINTS                                  AS   81
C                                                                       AS   82
C     ENTRY SAVLIN                                                      AS   83
   90 CONTINUE                                                          AS   84
      KHC=IFIX((SAVHC-TLOW)*TSPAN+1.5)                                  AS   85
      KNOX=IFIX((SAVNOX-CLOW)*CSPAN-0.5)                                AS   86
      KNOX=MAXNOX-KNOX                                                  AS   87
      IF (KNOX.LT.1) GO TO 110                                          AS   88
      IF (KNOX.GT.MAXNOX) GO TO 110                                     AS   89
      IF (KHC.LT.1) GO TO 110                                           AS   90
      IF (KHC.GT.MAXHC1) GO TO 110                                      AS   91
      JGRID(KHC,KNOX)=JSYMB                                             AS   92
      IF (TM.EQ.1..AND.NPTO.EQ.0) DUM3(NR1)=FLOAT(KHC)                  AS   93
      IF (TM.EQ.1.) NR1=NR1+1                                           AS   94
      IF (KHC.LT.2) GO TO 110                                           AS   95
  100 CONTINUE                                                          AS   96
  110 RETURN                                                            AS   97
C                                                                       AS   98
C ENTRY FOR PLOTTING GRID                                               AS   99
C                                                                       AS  100
C     ENTRY LINPRT                                                      AS  101
  120 CONTINUE                                                          AS  102
      NPL=IFIX(HCS+0.1)                                                 AS  103
      NLL=IFIX(XNS+0.5)                                                 AS  104
      KOUNT=0                                                           AS  105
      IF (NLL.EQ.0) GO TO 160                                           AS  106
      NJ=1                                                              AS  107
  130 NJ=NJ+1                                                           AS  108
      J=MAXNOX-NJ                                                       AS  109
      IF (JGRID(3,J).EQ.JBLANK) GO TO 130                               AS  110
      KOUNT=KOUNT+1                                                     AS  111
      IF (KOUNT.GT.NLL) GO TO 150                                       AS  112
      IF (NJ.GT.MAXNOX-1) GO TO 150                                     AS  113
      NVAR=IFIX(OZP(KOUNT)*100.+0.5)                                    AS  114
      CALL CONVT (NVAR,NLINE,3)                                         AS  115
```

```
      DO 140 II=1,3                                                          AS  116
         II2=II+2                                                            AS  117
  140 IF (NLINE(II).NE.JBL) JGRID(II2,J)=NLINE(II)                           AS  118
      NJ=NJ+1                                                                AS  119
      GO TO 130                                                              AS  120
  150 KOUNT=KOUNT-1                                                          AS  121
  160 KOUNT=KOUNT+1                                                          AS  122
      NR1=NR1-1                                                              AS  123
      DO 180 I=KOUNT,NR1                                                     AS  124
      NVAR=IFIX(OZP(I)*100.+0.5)                                             AS  125
      CALL CONVT (NVAR,NLINE,3)                                              AS  126
      KHC=IFIX(DUM3(I)+0.1)                                                  AS  127
      DO 170 II=2,3                                                          AS  128
  170 IF (NLINE(II).NE.JBL) NGRID(KHC,II-1)=NLINE(II)                        AS  129
  180 CONTINUE                                                               AS  130
      WRITE (IOUT,220) ((NGRID(I,J),I=1,101),J=1,2)                          AS  131
      KFRST=1                                                                AS  132
      DO 190 K=KFRST,MAXNOX                                                  AS  133
      L=MOD((K-1),6)                                                         AS  134
      I=(K-1)/6+1                                                            AS  135
      IF (L.EQ.0) WRITE (IOUT,230) TVERT(K,1),TV1(I),(JGRID(J,K),J=1,MAXAS  136
     1HC)                                                                    AS  137
      IF (L.NE.0) WRITE (IOUT,240) TVERT(K,1),(JGRID(J,K),J=1,MAXHC)         AS  138
  190 CONTINUE                                                               AS  139
      WRITE (IOUT,250) CLOW                                                  AS  140
      WRITE (IOUT,260) TPRINT                                                AS  141
      WRITE (IOUT,270) (ITTL(I),I=1,36)                                      AS  142
      IF (NPTO.EQ.0) WRITE (IOUT,280) ISPN,(OZP(I),I=1,NPL)                  AS  143
  200 RETURN                                                                 AS  144
C                                                                            AS  145
C                                                                            AS  146
  210 FORMAT (1H1/////////9X,A4,F5.3,1H+,10(10H---------+))                  AS  147
  220 FORMAT (1H1//////18X,1H+,10(10H---------+)/18X,101A1/18X,101A1)        AS  148
  230 FORMAT (9X,A4,F5.3,101A1)                                              AS  149
  240 FORMAT (9X,A4,5X,101A1)                                                AS  150
  250 FORMAT (13X,F5.3,1H+,10(10H---------+))                                AS  151
  260 FORMAT (F21.3,10F10.2/64X,11HNMOC (PPMC)//)                            AS  152
  270 FORMAT (46X,36A2)                                                      AS  153
  280 FORMAT (1H0/20X,4HTHE ,A4,12H LINES ARE  ,10F8.5/40X,10F8.5)           AS  154
      END                                                                    AS  155-
```

```
      SUBROUTINE VVMNMX (Z,ND1,NX,NY,ZMIN,ZMAX)                          AT     1
C                                                                        AT     2
C     *** RETURNS THE MINIMUM AND MAXIMUM VALUES OF AN ARRAY             AT     3
C           GWL/SAI  DEC 77                                              AT     4
C                                                                        AT     5
      SAVE                                                               AT     6
      DIMENSION Z(ND1,1)                                                 AT     7
C                                                                        AT     8
      ZMIN = +1.E20                                                      AT     9
      ZMAX = -1.E20                                                      AT    10
C                                                                        AT    11
      DO 20 J=1,NY                                                       AT    12
          DO 10 I=1,NX                                                   AT    13
              ZIJ = Z(I,J)                                               AT    14
C                                                                        AT    15
              IF (ZIJ .LT. ZMIN) ZMIN = ZIJ                              AT    16
              IF (ZIJ .GT. ZMAX) ZMAX = ZIJ                              AT    17
   10     CONTINUE                                                       AT    18
   20 CONTINUE                                                           AT    19
C                                                                        AT    20
      RETURN                                                             AT    21
      END                                                                AT    22-
```

```
      SUBROUTINE CONMAP (Z,ND1,NOX,NOY,SIZX,SIZY,C,NLEV,KALCM1)          AU     1
      SAVE                                                               AU     2
C                                                                        AU     3
C     *** PURPOSE -- DRAWS A CONTOUR MAP                                 AU     4
C             GW LUNDBERG/SAI  JULY 87                                   AU     5
C                                                                        AU     6
C     Z     THE (ORIGIN OF THE) ARRAY TO BE CONTOURED                    AU     7
C     ND1   THE FIRST DIMENSION OF Z                                     AU     8
C     NOX   THE NUMBER OF ELEMENTS OF Z TO USE IN X-DIRECTION            AU     9
C     NOY   THE NUMBER IN THE Y-DIRECTION                                AU    10
C     SIZX INCHES/CELL IN THE X-DIRECTION                                AU    11
C     SIZY INCHES/CELL IN THE Y-DIRECTION                                AU    12
C     C     THE CONTOUR LEVELS TO DRAW                                   AU    13
C     NLEV MOD(IABS(NLEV),1000) IS THE NUMBER OF LEVELS                  AU    14
C          IF NLEV<0, THE CONTOURS ARE LABELED WITH                      AU    15
C             -NLEV/1000 DECIMAL DIGITS OF PRECISION                     AU    16
C          IF NLEV>=1000, THE CONTOURS ARE LABELED                       AU    17
C             NLEV/1000, NLEV/1000+1,.....,NLEV/1000+NL-1                AU    18
C             AS INTEGERS WHERE NL=MOD(NLEV,1000)                        AU    19
C                                                                        AU    20
C     *** NOTE -- MISSING DATA CELLS ARE NOT MAPPED                      AU    21
C                                                                        AU    22
      DIMENSION Z(11,1),C(1)                                             AU    23
      LOGICAL NOLBL                                                      AU    24
      COMMON /VVCONM/ IX,JY,IDX,JDY,NBR,LOOP,NP,NTBL(1000),NR,           AU    25
     1                NX,NY,XSIZ,YSIZ,XXFLG,KALCMP                       AU    26
      COMMON /VVLB1/  FACT,DIST,CHRSZ,NCHR,OZL                           AU    27
      DATA NR1/1000/                                                     AU    28
      NR=NR1                                                             AU    29
      KALCMP=KALCM1                                                      AU    30
C                                                                        AU    31
C     *** MOVE ARGUMENTS TO COMMON                                       AU    32
      NX = NOX                                                           AU    33
      NY = NOY                                                           AU    34
      XSIZ = SIZX                                                        AU    35
      YSIZ = SIZY                                                        AU    36
C                                                                        AU    37
C     *** SET THE NUMBER OF LEVELS REQUESTED                             AU    38
      NC = MOD(IABS(NLEV),1000)                                          AU    39
C                                                                        AU    40
C     *** ASSUME NO LABELS                                               AU    41
      NOLBL = .TRUE.                                                     AU    42
C                                                                        AU    43
C     *** SET LABEL SIZE JUST IN CASE                                    AU    44
      SIZLBL = 0.07                                                      AU    45
C     *** SET UP LABELING PARAMETERS AS REQUESTED                        AU    46
      IF (NLEV .GT. 0) GO TO 10                                          AU    47
C                                                                        AU    48
      NDEC = -NLEV/1000                                                  AU    49
      IF (NDEC .EQ. 0) NDEC = -1                                         AU    50
      NOLBL = .FALSE.                                                    AU    51
      GO TO 20                                                           AU    52
C                                                                        AU    53
   10 IF (NLEV .LT. 1000) GO TO 20                                       AU    54
      LOW = NLEV/1000 - 1                                                AU    55
      NDEC = -1                                                          AU    56
      NOLBL = .FALSE.                                                    AU    57
C                                                                        AU    58
C                                                                        AU    59
C     *** FOR EACH LEVEL, LOCATE THE STARTING POINT OF EACH              AU    60
C         CONTOUR, THEN CALL VVCMAP TO DRAW THE LINE                     AU    61
   20 DO 120 L=1,NC                                                      AU    62
C                                                                        AU    63
C         NORMALIZE THE CONTOUR LEVEL                                    AU    64
```

```
C
      CV = C(L)/2.0                                                      AU   65
      CV = CV*2.0                                                        AU   66
C                                                                        AU   67
C     *** SET UP LABELS IF REQUESTED                                     AU   68
      IF (NOLBL) GO TO 30                                                AU   69
      OZL = CV                                                           AU   70
C                                                                        AU   71
   30 NP = 0                                                             AU   72
C                                                                        AU   73
C     *** IN THE FOLLOWING, (IX,JY) IS THE GRID POINT (NODE)             AU   74
C         JUST HIGHER THAN CV.  NBR IS ONE OF FOUR NEIGHBORING           AU   75
C         NODES (1=WEST, 3=N, 5=E, 7=S) TO BE USED WITH (IX,JY) TO       AU   76
C         INTERPOLATE THE COORDINATES OF THE CONTOUR.  IDX AND JDY       AU   77
C         INDICATE THE DIRECTION OF THIS NEIGHBOR.                       AU   78
C                                                                        AU   79
C     *** SCAN THE FOUR EDGES FOR OPEN CONTOURS.  THIS SCAN CLEVERLY     AU   80
C         CAPTURES EVERY OPEN CONTOUR EXACTLY ONCE                       AU   81
      LOOP = 0                                                           AU   82
C                                                                        AU   83
C     *** SCAN BOTTOM AND TOP EDGE                                       AU   84
      DO 50 I=2,NX                                                       AU   85
         IM1 = I-1                                                       AU   86
         IF (Z(IM1,1) .GE. CV .OR. Z(I,1) .LT. CV) GO TO 40              AU   87
         IX = I                                                          AU   88
         JY = 1                                                          AU   89
         IDX = -1                                                        AU   90
         JDY = 0                                                         AU   91
         NBR = 1                                                         AU   92
         CALL VVCMAP (Z,ND1,CV)                                          AU   93
C                                                                        AU   94
   40    IF (Z(I,NY) .GE. CV .OR. Z(IM1,NY) .LT. CV) GO TO 50            AU   95
         IX = IM1                                                        AU   96
         JY = NY                                                         AU   97
         IDX = 1                                                         AU   98
         JDY = 0                                                         AU   99
         NBR = 5                                                         AU  100
         CALL VVCMAP (Z,ND1,CV)                                          AU  101
   50 CONTINUE                                                           AU  102
C                                                                        AU  103
C     *** SCAN RIGHT AND LEFT EDGE                                       AU  104
      DO 70 J=2,NY                                                       AU  105
         JM1 = J-1                                                       AU  106
         IF (Z(NX,JM1) .GE. CV .OR. Z(NX,J) .LT. CV) GO TO 60            AU  107
         IX = NX                                                         AU  108
         JY = J                                                          AU  109
         IDX = 0                                                         AU  110
         JDY = -1                                                        AU  111
         NBR = 7                                                         AU  112
         CALL VVCMAP (Z,ND1,CV)                                          AU  113
C                                                                        AU  114
   60    IF (Z(1,J) .GE. CV .OR. Z(1,JM1) .LT. CV) GO TO 70              AU  115
         IX = 1                                                          AU  116
         JY = JM1                                                        AU  117
         IDX = 0                                                         AU  118
         JDY = 1                                                         AU  119
         NBR = 3                                                         AU  120
         CALL VVCMAP (Z,ND1,CV)                                          AU  121
   70 CONTINUE                                                           AU  122
C                                                                        AU  123
C     *** SCAN CENTER REGION FOR CLOSED LOOPS -- IT IS SUFFICIENT        AU  124
C         TO CHECK ONLY THE WEST NEIGHBOR AT EACH NODE                   AU  125
      LOOP = -1                                                          AU  126
      NYM1 = NY-1                                                        AU  127
                                                                         AU  128
```

```
      DO 110 J=2,NYM1                                                    AU  129
          DO 100 I=2,NX                                                  AU  130
              IM1 = I-1                                                  AU  131
              IF (Z(IM1,J) .GE. CV .OR. Z(I,J) .LT. CV) GO TO 100        AU  132
C                                                                        AU  133
C             *** CHECK IF NODE ALREADY USED                             AU  134
              NODE = 1000*I + J                                          AU  135
              IF (NP .EQ. 0) GO TO 90                                    AU  136
              DO 80 K=1,NP                                               AU  137
                  IF (NODE .EQ. NTBL(K)) GO TO 100                       AU  138
   80         CONTINUE                                                   AU  139
C                                                                        AU  140
C             *** TAG THIS NODE TO PREVENT RETRACE                       AU  141
   90         NP = NP+1                                                  AU  142
              IF (NP .GT. NR) GO TO 120                                  AU  143
              NTBL(NP) = NODE                                            AU  144
C                                                                        AU  145
C             *** SET PARAMETERS AND DRAW LOOP                           AU  146
              IX = I                                                     AU  147
              JY = J                                                     AU  148
              IDX = -1                                                   AU  149
              JDY = 0                                                    AU  150
              NBR = 1                                                    AU  151
              CALL VVCMAP (Z,ND1,CV)                                     AU  152
  100         CONTINUE                                                   AU  153
  110     CONTINUE                                                       AU  154
  120 CONTINUE                                                           AU  155
C                                                                        AU  156
      RETURN                                                             AU  157
      END                                                                AU  158-
```

```
      SUBROUTINE VVCMAP (Z,ND1,C)                                          AV     1
      SAVE                                                                 AV     2
C                                                                          AV     3
C     *** PURPOSE -- TRACES AND DRAWS A CONTOUR GIVEN THE BEGINNING        AV     4
C         BY CONMAP                                                        AV     5
C             GW LUNDBERG/SAI  JULY 87                                     AV     6
C                                                                          AV     7
C     Z     THE (ORIGIN OF THE) ARRAY TO BE CONTOURED                      AV     8
C     ND1   THE FIRST DIMENSION OF Z                                       AV     9
C     C     THE CONTOUR LEVEL TO DRAW                                      AV    10
C                                                                          AV    11
      DIMENSION Z(ND1,1),INX(8),JNY(8),UT(11),VT(11),TM(20),YP(20)         AV    12
      COMMON /VVCONM/ IX,JY,IDX,JDY,NBR,LOOP,NP,NTBL(1000),NR,             AV    13
     1                NX,NY,XSIZ,YSIZ,XXFLG,KALCMP                         AV    14
      COMMON /CNTRL/  SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN,    AV    15
     1                FLST,TLST                                            AV    16
      DATA INX /-1,-1,0,1,1,1,0,-1/                                        AV    17
      DATA JNY /0,1,1,1,0,-1,-1,-1/                                        AV    18
C     DATA FUZZ/0.003/                                                     AV    19
C                                                                          AV    20
      CV = C                                                               AV    21
C                                                                          AV    22
C     *** SAVE STARTING NODE AND CURRENT NEIGHBOR                          AV    23
      IX0 = IX                                                             AV    24
      JY0 = JY                                                             AV    25
      NBR0 = NBR                                                           AV    26
C                                                                          AV    27
C     *** SET THE SECOND POINT FOR INTERPOLATION                           AV    28
      IX1 = IX + IDX                                                       AV    29
      JY1 = JY + JDY                                                       AV    30
C                                                                          AV    31
C     *** IF EITHER POINT MISSING -- IGNORE WITH VVKURV MODE RESET         AV    32
      MODE = -1                                                            AV    33
      IF (Z(IX,JY) .EQ. XXFLG .OR. Z(IX1,JY1) .EQ. XXFLG)                  AV    34
     1     GO TO 30                                                        AV    35
C                                                                          AV    36
C     *** INTERPOLATE FOR THE FIRST POINT AND SAVE                         AV    37
      IF (IDX .EQ. 0) GO TO 10                                             AV    38
      Y = JY                                                               AV    39
      X = (Z(IX,JY)-CV)/(Z(IX,JY)-Z(IX1,JY))*IDX + IX                      AV    40
      GO TO 20                                                             AV    41
C                                                                          AV    42
   10 X = IX                                                               AV    43
      Y = (Z(IX,JY)-CV)/(Z(IX,JY)-Z(IX,JY1))*JDY + JY                      AV    44
C                                                                          AV    45
C     *** SCALE AND SEND TO SPLINE ROUTINE                                 AV    46
   20 X = (X-0.5)*XSIZ                                                     AV    47
      Y = (Y-0.5)*YSIZ                                                     AV    48
      CALL VVKURV (X,Y,-1)                                                 AV    49
C                                                                          AV    50
      MODE = 0                                                             AV    51
C                                                                          AV    52
C                                                                          AV    53
C     *** MAIN LOOP -- STARTING AT (IX,JY) AND KNOWING THAT THIS           AV    54
C         NODE IS JUST ON THE HIGH SIDE OF THE CONTOUR, CHECK EACH         AV    55
C         NEIGHBORING POINT IN THE ORDER W,NW,N,NE,E,SE,S,SW, IF           AV    56
C         NEIGHBOR IS LOWER THAN CV AND NOT A DIAGONAL -- NW,NE,SE,        AV    57
C         SW -- INTERPOLATE AND PASS (X,Y) TO THE SPLINE ROUTINE.          AV    58
C         IF NEIGHBOR IS A DIAGONAL, SIMPLY MOVE ON TO NEXT NEIGHBOR. IF   AV    59
C         THE NEIGHBOR IS ON HIGH SIDE OF CONTOUR, MOVE (IX,JY)            AV    60
C         TO THAT POINT AND AGAIN SCAN THE NEIGHBORS STARTING FROM         AV    61
C         WHERE (IX,JY) WAS (PLUS ONE).                                    AV    62
C                                                                          AV    63
C         NOTE -- IF EITHER NODE HAS A Z MISSING VALUE, THE CONTOUR        AV    64
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```
C          IS TERMINATED ALTHOUGH THE SCAN CONTINUES.  THE CONTOUR      AV   65
C          REAPPEARS WHEN BOTH NODES ARE AGAIN KNOWN.                   AV   66
   30 NBR = NBR + 1                                                     AV   67
      IF (NBR .GT. 8) NBR = NBR - 8                                     AV   68
      IDX = INX(NBR)                                                    AV   69
      JDY = JNY(NBR)                                                    AV   70
      IX1 = IX + IDX                                                    AV   71
      JY1 = JY + JDY                                                    AV   72
      IF (LOOP .NE. 0) GO TO 40                                         AV   73
C                                                                       AV   74
C     *** CHECK FOR END OF OPEN CONTOUR                                 AV   75
      IF (IX1 .GT. NX  .OR.  IX1 .LT. 1  .OR.                           AV   76
     1    JY1 .GT. NY  .OR.  JY1 .LT. 1) GO TO 200                     AV   77
C                                                                       AV   78
C     *** CHECK IF POINT BELOW LEVEL                                    AV   79
   40 IF (CV .GT. Z(IX1,JY1)) GO TO 60                                  AV   80
C                                                                       AV   81
C     *** REVERSE NODES AND GO ON (UNLESS CELL IS DEGENERATE)           AV   82
C     IF (MOD(NBR,2) .NE. 0) GO TO 120                                  AV   83
C                                                                       AV   84
      NNBR = NBR+1                                                      AV   85
      IF (NNBR .GT. 8) NNBR = NNBR-8                                    AV   86
      NX1 = IX + INX(NNBR)                                              AV   87
      NY1 = JY + JNY(NNBR)                                              AV   88
C                                                                       AV   89
C     *** BE CAREFUL OF EDGE                                            AV   90
      IF (NX1 .GT. NX  .OR.  NX1 .LT. 1  .OR.                           AV   91
     1    NY1 .GT. NY ..OR.  NY1 .LT. 1) GO TO 50                      AV   92
C                                                                       AV   93
C     *** TEST FOR DEGENERACY                                           AV   94
      IF (CV .LE. Z(NX1,NY1)) GO TO 50                                  AV   95
C                                                                       AV   96
C     *** CELL IS DEGENERATE -- ESTIMATE CENTER HEIGHT                  AV   97
      ZCEN = 0.25 * (Z(IX,JY)+Z(IX,JY1)+Z(IX1,JY1)+Z(IX1,JY))           AV   98
C                                                                       AV   99
C     *** PUNT IF CENTER LOW                                            AV  100
      IF (CV .GT. ZCEN) GO TO 30                                        AV  101
C                                                                       AV  102
   50 NBR = NBR + 4                                                     AV  103
      IX = IX1                                                          AV  104
      JY = JY1                                                          AV  105
      GO TO 30                                                          AV  106
C                                                                       AV  107
C     *** MAY BE OK -- BUT CHECK FOR MISSING POINT                      AV  108
   60 IF (Z(IX,JY) .NE. XXFLG  .AND.  Z(IX1,JY1) .NE. XXFLG)            AV  109
     1     GO TO 70                                                     AV  110
C                                                                       AV  111
C     *** ONE POINT MISSING -- FLUSH SPLINE BUFFER TO SET               AV  112
C         FOR A BROKEN LINE SEGMENT IF NECESSARY                        AV  113
      IF (MODE .EQ. -1) GO TO 180                                       AV  114
      CALL VVKURV (DUM,DUM,2)                                           AV  115
      GO TO 180                                                         AV  116
C                                                                       AV  117
C     *** LOOKS OK -- INTERPOLATE FOR X AND Y                           AV  118
C                                                                       AV  119
C     *** BUT MAY BE A DIAGONAL NODE                                    AV  120
   70 IF (MOD(NBR,2) .EQ. 0) GO TO 30                                   AV  121
      IF (IDX .EQ. 0) GO TO 120                                         AV  122
      Y = JY                                                            AV  123
C     X = (Z(IX,JY)-CV)/(Z(IX,JY)-Z(IX1,JY))*IDX + IX                   AV  124
C                                                                       AV  125
C  USE SPLINE FIT OF DATA                                               AV  126
C                                                                       AV  127
      IF (IDX.GT.0) GO TO 90                                            AV  128
```

```
      IPTS=IX                                                          AV  129
      DO 80 JJ=1,IX                                                    AV  130
      UT(JJ)=Z(JJ,JY)                                                  AV  131
      VT(JJ)=FLOAT(JJ)                                                 AV  132
   80 CONTINUE                                                         AV  133
      GO TO 110                                                        AV  134
   90 IPTS=12-IX                                                       AV  135
      DO 100 JJ=1,IPTS                                                 AV  136
      UT(JJ)=Z(12-JJ,JY)                                               AV  137
      VT(JJ)=FLOAT(12-JJ)                                              AV  138
  100 CONTINUE                                                         AV  139
C                                                                      AV  140
  110 SX=-SIG*30.                                                      AV  141
      IF (IPTS.GT.2) SX=-SIG*20./(FLOAT(IPTS-2)**2)                    AV  142
      CALL CURV1(IPTS,UT,VT,SP1,SP2,YP,TM,SX)                          AV  143
      IT=1                                                             AV  144
      X=CURV2(CV,IPTS,UT,VT,YP,SX,IT)                                  AV  145
C                                                                      AV  146
      GO TO 170                                                        AV  147
C                                                                      AV  148
  120 X = IX                                                           AV  149
C     Y = (Z(IX,JY)-CV)/(Z(IX,JY)-Z(IX,JY1))*JDY + JY                  AV  150
C                                                                      AV  151
C  USE SPLINE FIT OF DATA                                              AV  152
C                                                                      AV  153
      IF (JDY.GT.0) GO TO 140                                          AV  154
      IPTS=JY                                                          AV  155
      DO 130 JJ=1,JY                                                   AV  156
      UT(JJ)=Z(IX,JJ)                                                  AV  157
      VT(JJ)=FLOAT(JJ)                                                 AV  158
  130 CONTINUE                                                         AV  159
      GO TO 160                                                        AV  160
  140 IPTS=12-JY                                                       AV  161
      DO 150 JJ=1,IPTS                                                 AV  162
      UT(JJ)=Z(IX,12-JJ)                                               AV  163
      VT(JJ)=FLOAT(12-JJ)                                              AV  164
  150 CONTINUE                                                         AV  165
C                                                                      AV  166
  160 SX=-SIG*30.                                                      AV  167
      IF (IPTS.GT.2) SX=-SIG*20./(FLOAT(IPTS-2)**2)                    AV  168
      CALL CURV1(IPTS,UT,VT,SP1,SP2,YP,TM,SX)                          AV  169
      IT=1                                                             AV  170
      Y=CURV2(CV,IPTS,UT,VT,YP,SX,IT)                                  AV  171
C                                                                      AV  172
C     *** SCALE AND SEND                                               AV  173
  170 XHH=X                                                            AV  173A
      YHH=Y                                                            AV  173B
      X = (X-0.5)*XSIZ                                                 AV  174
      Y = (Y-0.5)*YSIZ                                                 AV  175
      WRITE (9,1111) XHH,YHH,CV                                        AV  175A
 1111 FORMAT (1P,3E13.4)                                               AV  175B
      CALL VVKURV (X,Y,MODE)                                           AV  176
C                                                                      AV  177
C     *** RESET MODE                                                   AV  178
      MODE = 0                                                         AV  179
C                                                                      AV  180
C     *** SET NODE IN NTBL SO ITS NOT RETRACED                         AV  181
  180 IF (NBR .NE. 1) GO TO 190                                        AV  182
      NP = NP + 1                                                      AV  183
      IF (NP .GT. NR) GO TO 200                                        AV  184
      NTBL(NP) = 1000*IX + JY                                          AV  185
C                                                                      AV  186
C     *** CHECK IF LOOP COMPLETE                                       AV  187
  190 IF (LOOP .EQ. 0) GO TO 30                                        AV  188
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      IF (IX .NE. IX0) GO TO 30                                          AV  189
      IF (JY .NE. JY0) GO TO 30                                          AV  190
      IF (NBR .NE. NBR0) GO TO 30                                        AV  191
C                                                                        AV  192
C     *** ALL DONE -- FINISHED OFF THIS LINE AND RETURN                  AV  193
  200 CALL VVKURV (X,Y,1)                                                AV  194
      RETURN                                                             AV  195
      END                                                                AV  196-
```

```
      SUBROUTINE VVKURV (XPT,YPT,MODE)                                  AW     1
      SAVE                                                              AW     2
C                                                                       AW     3
C     *** PLOTS COMPLICATED SPLINE FITTED LINE BY SECTIONS              AW     4
C           GW LUNDBERG/SAI  APR 79                                     AW     5
C                                                                       AW     6
C     *** NOTE -- THE POINTS ARE RECEIVED ONE AT A TIME                 AW     7
C                                                                       AW     8
C         XPT    NODE X COORDINATE IN INCHES FROM CURRENT PLOT ORIGIN   AW     9
C         YPT    NODE Y COORDINATE IN INCHES FROM CURRENT PLOT ORIGIN   AW    10
C         MODE   <0, INITIAL POINT OF FIRST SECTION                     AW    11
C                =0, ADDITIONAL POINT                                   AW    12
C                =1, FLUSH THE BUFFER -- XPT,YPT FORCED                 AW    13
C                =2, FLUSH THE BUFFER -- XPT,YPT IGNORED                AW    14
C                                                                       AW    15
C     *** NOTE -- THIS CODE PROVIDES FOR BROKEN SPLINED LINES.          AW    16
C         USE MODE=1 TO TERMINATE THE SUBLINE. A NEW LINE IS            AW    17
C         STARTED WITH MODE=-1, OR A NEW SUBLINE WITH MODE=0.           AW    18
C         THIS FEATURE IS USED BY CONMAP FOR MISSING DATA.              AW    19
C     LOG                                                               AW    20
C                                                                       AW    21
C     7/17/85 RGJ CHANGED CODE TO SET NPTS TO ZERO IF THERE IS          AW    22
C     A BROKEN LINE AND NPTS WAS 1.                                     AW    23
C                                                                       AW    24
C         .                                                             AW    25
C     *** SEE VVKRV1 FOR A DESCRIPTION OF THESE VARIABLES               AW    26
      COMMON /VVCONM/ IDUM(1010),XSIZ,YSIZ,XXFLG,KALCMP                 AW    27
      COMMON /VVKRV/  NPTS,NSLP,SLP1,SLPN,LSLP,TANGNT,S,                AW    28
     1                X(32),Y(32),XP(32),YP(32)                        AW    29
      COMMON /VVLB1/  FCTR,DIST,CHRSZ,NCHR,OZLBL                        AW    30
      COMMON /HOUR/   OZR(5),NGG,TM,DUM(5)                              AW    31
      COMMON /NEED/   HC,XN,NL,OZP(20),OZN(11,11,5),MR,LS,HCS,XNS       AW    32
C                                                                       AW    33
      DATA STEP/0.04/, MXPT/31/, FUZZ/0.05/,NPTS1/0/                    AW    34
      DATA TANN/0./,LSLP1/0/,IFRST/1/                                   AW    35
      IF (IFRST.EQ.1) NPTS=NPTS1                                        AW    36
      IF (IFRST.EQ.1) LSLP=LSLP1                                        AW    37
      IFRST=2                                                           AW    38
C                                                                       AW    39
C     *** JUMP TO APPROPRIATE CODE                                      AW    40
      IF (MODE) 10,20,60                                                AW    41
C                                                                       AW    42
C*****************************************                              AW    43
C         ENTRY FOR MODE LESS THAN ZERO                                 AW    44
C*****************************************                              AW    45
C                                                                       AW    46
C     *** INITIAL POINT RECEIVED -- SET SECTION COUNT, INITIALIZE       AW    47
C         VVLABL AND SAVE THE POINT                                     AW    48
   10 NSECTN = 1                                                        AW    49
      USX=(XPT-0.5)*HC*.1/XSIZ                                          AW    50
      USY=(YPT-0.5)*XN*.1/YSIZ                                          AW    51
      TM=1.                                                             AW    52
      CALL ISOPLT(USX,USY,2)                                            AW    53
      TM=2.                                                             AW    54
      IF (KALCMP.GT.0) CALL VVLABL (XPT,YPT,3)                          AW    55
      XSTRT = XPT                                                       AW    56
      YSTRT = YPT                                                       AW    57
      X(1) = XPT                                                        AW    58
      Y(1) = YPT                                                        AW    59
      NPTS = 1                                                          AW    60
C         .                                                             AW    61
C     *** ZERO KNOWN SLOPE FLAG                                         AW    62
      KSLP = 0                                                          AW    63
      RETURN                                                            AW    64
```

```
C                                                                       AW   65
C*****************************************                              AW   66
C         ENTRY FOR MODE EQUAL ZERO                                     AW   67
C*****************************************                              AW   68
C                                                                       AW   69
   20 IF (NPTS .GT. 0) GO TO 30                                         AW   70
C                                                                       AW   71
C     *** THIS IS THE CONTINUATION OF A BROKEN LINE (SEE                AW   72
C         CONMAP) -- SET PEN                                            AW   73
      IF (KALCMP.GT.0) CALL VVLABL (XPT,YPT,3)                          AW   74
      GO TO 40                                                          AW   75
C                                                                       AW   76
C     *** SAVE POINT (IF NOT TOO CLOSE TO LAST POINT)                   AW   77
C         IN BUFFER -- FLUSH WHEN FULL                                  AW   78
   30 IF (ABS(X(NPTS)-XPT) .LT. FUZZ  .AND.                             AW   79
     1    ABS(Y(NPTS)-YPT) .LT. FUZZ) RETURN                           AW   80
   40 NPTS = NPTS+1                                                     AW   81
      X(NPTS) = XPT                                                     AW   82
      Y(NPTS) = YPT                                                     AW   83
      IF (NPTS .LT. MXPT) RETURN                                        AW   84
C                                                                       AW   85
C     *** FLUSH THE BUFFER -- SUPPLY STARTING SLOPE IF AVAILABLE        AW   86
      NSLP = KSLP                                                       AW   87
      SLP1 = TANN                                                       AW   88
C                                                                       AW   89
      CALL VVKRV1                                                       AW   90
C                                                                       AW   91
C     *** SET NUMBER OF POINTS TO INTERPOLATE AND NORMALIZED STEP SIZE  AW   92
      N = S/STEP - 1                                                    AW   93
      FACT = STEP/S                                                     AW   94
      DIST=S                                                            AW   95
C                                                                       AW   96
C     *** SAVE THE SLOPE FOR FIRST SECTION ONLY                         AW   97
      IF (NSECTN .EQ. 1) TAN1 = SLP1                                    AW   98
C                                                                       AW   99
C     *** INITIALIZE VVKRV2 (PEN ALREADY THERE)                         AW  100
      CALL VVKRV2( 0.,XX,YY)                                            AW  101
C                                                                       AW  102
C     *** PLOT THE MIDDLE INTERPOLATED POINTS                           AW  103
      DO 50 I=1,N                                                       AW  104
          T = -FLOAT(I)*FACT                                            AW  105
          CALL VVKRV2 (T,XX,YY)                                         AW  106
          USX=(XX-0.5)*HC*.1/XSIZ                                       AW  107
          USY=(YY-0.5)*XN*.1/YSIZ                                       AW  108
          CALL ISOPLT(USX,USY,2)                                        AW  109
          IF (KALCMP.LE.0) GO TO 50                                     AW  110
          CALL VVLABL (XX,YY,2)                                         AW  111
   50 CONTINUE                                                          AW  112
C                                                                       AW  113
C     *** GET SLOPE AT LAST POINT, SAVE, AND PLOT LAST SEGMENT          AW  114
      CALL VVKRV2 (-1.,XX,YY)                                           AW  115
      TANN = SLPN                                                       AW  116
      USX=(XX-0.5)*HC*.1/XSIZ                                           AW  117
      USY=(YY-0.5)*XN*.1/YSIZ                                           AW  118
      CALL ISOPLT(USX,USY,2)                                            AW  119
      IF (KALCMP.GT.0) CALL VVLABL (XX,YY,2)                            AW  120
C                                                                       AW  121
C     *** BUMP SECTION COUNT                                            AW  122
      NSECTN = NSECTN + 1                                               AW  123
C                                                                       AW  124
C     *** MAKE THE LAST POINT THE FIRST FOR THE NEXT SECTION            AW  125
      X(1) = X(NPTS)                                                    AW  126
      Y(1) = Y(NPTS)                                                    AW  127
      NPTS = 1                                                          AW  128
```

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C
C     *** FLAG FIRST SLOPE AS KNOWN                                          AW  129
      KSLP = 1                                                               AW  130
      RETURN                                                                 AW  131
C                                                                            AW  132
C*******************************************                                 AW  133
C         ENTRY FOR MODE GREATER THAN ZERO                                   AW  134
C*******************************************                                 AW  135
C                                                                            AW  136
C     *** FLUSH THE BUFFER                                                   AW  137
C                                                                            AW  138
C     *** PUNT IF ONLY FLUSHING                                              AW  139
   60 IF (MODE .EQ. 2) GO TO 70                                              AW  140
C                                                                            AW  141
C     *** FORCE FINAL POINT IF NOT ALREADY ENTERED                           AW  142
      IF (X(NPTS) .EQ. XPT  .AND.  Y(NPTS) .EQ. YPT) GO TO 70                AW  143
C                                                                            AW  144
C     *** THERE IS ALWAYS AN EXTRA POSITION IN X AND Y                       AW  145
      NPTS = NPTS+1                                                          AW  146
      X(NPTS) = XPT                                                          AW  147
      Y(NPTS) = YPT                                                          AW  148
C                                                                            AW  149
C     *** IGNORE SINGLE OR NULL POINT                                        AW  150
C                                                                            AW  151
C---  START OF FIX 7/17/87                                                   AW  152
C                                                                            AW  153
   70 IF (MODE .NE. 2) GO TO 80                                              AW  154
      IF (NPTS .EQ. 1) KSPL = 0                                              AW  155
      IF (NPTS .LE. 1) NPTS = 0                                              AW  156
   80 IF (NPTS .LE. 1) RETURN                                                AW  157
C                                                                            AW  158
C---  END OF FIX 7/17/87                                                     AW  159
C                                                                            AW  160
C     *** CHECK FOR SIMPLE LINE -- ONLY ONE SECTION                          AW  161
      IF (NSECTN .GT. 1) GO TO 110                                           AW  162
C                                                                            AW  163
C     ***  TWO POINT LINES TAKE SPECIAL TREATMENT                            AW  164
      IF (NPTS .GT. 2) GO TO 90                                              AW  165
C                                                                            AW  166
C     *** TWO POINTS -- DRAW SEGMENT AND RETURN                              AW  167
      USX=(X(1)-0.5)*HC*.1/XSIZ                                              AW  168
      USY=(Y(1)-0.5)*XN*.1/YSIZ                                              AW  169
      CALL ISOPLT(USX,USY,2)                                                 AW  170
      USX=(X(2)-0.5)*HC*.1/XSIZ                                              AW  171
      USY=(Y(2)-0.5)*XN*.1/YSIZ                                              AW  172
      CALL ISOPLT(USX,USY,2)                                                 AW  173
      IF (KALCMP.LE.0) GO TO 160                                             AW  174
      CALL VVLABL (X(1),Y(1),3)                                              AW  175
      CALL VVLABL (X(2),Y(2),2)                                              AW  176
      CALL VVLABL (DUM,DUM,1)                                                AW  177
      GO TO 160                                                              AW  178
C                                                                            AW  179
C     *** SIMPLE BUT MAY BE A LOOP                                           AW  180
   90 IF (X(NPTS) .EQ. XSTRT  .AND.  Y(NPTS) .EQ. YSTRT) GO TO 100           AW  181
C                                                                            AW  182
C     *** A SIMPLE SIMPLE LINE                                               AW  183
      NSLP = 0                                                               AW  184
      CALL VVKRV1                                                            AW  185
      GO TO 130                                                              AW  186
C                                                                            AW  187
C     *** SIMPLE LOOP                                                        AW  188
  100 NSLP = -1                                                              AW  189
      CALL VVKRV1                                                            AW  190
      GO TO 130                                                              AW  191
                                                                             AW  192
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C                                                                       AW  193
C     *** COMPLEX LINE AND MAY BE LOOP                                  AW  194
  110 IF (X(NPTS) .EQ. XSTRT  .AND.  Y(NPTS) .EQ. YSTRT) GO TO 120      AW  195
C                                                                       AW  196
C     *** COMPLEX OPEN LINE                                             AW  197
      NSLP = 1                                                          AW  198
      SLP1 = TANN                                                       AW  199
      CALL VVKRV1                                                       AW  200
      GO TO 130                                                         AW  201
C                                                                       AW  202
C     *** COMPLEX LOOP                                                  AW  203
  120 NSLP = 3                                                          AW  204
      SLP1 = TANN                                                       AW  205
      SLPN = TAN1                                                       AW  206
      CALL VVKRV1                                                       AW  207
C                                                                       AW  208
C     *** JUST MARK THE POINT IF ARC LENGTH SMALL                       AW  209
  130 IF (S .GT. 0.01) GO TO 140                                        AW  210
      IF (KALCMP.LE.0) GO TO 160                                        AW  211
      CALL PLOT (XSTRT,YSTRT,3)                                         AW  212
      CALL PLOT (XSTRT,YSTRT,2)                                         AW  213
      GO TO 160                                                         AW  214
C                                                                       AW  215
C     *** PLOT THE FINAL SECTION                                        AW  216
  140 N = S/STEP - 1.                                                   AW  217
      FACT = STEP/S                                                     AW  218
      DIST = S                                                          AW  219
      CALL VVKRV2 (0.,XX,YY)                                            AW  220
      DO 150 I=1,N                                                      AW  221
          T = -I*FACT                                                   AW  222
          CALL VVKRV2 (T,XX,YY)                                         AW  223
          USX=(XX-0.5)*HC*.1/XSIZ                                       AW  224
          USY=(YY-0.5)*XN*.1/YSIZ                                       AW  225
          CALL ISOPLT(USX,USY,2)                                        AW  226
          IF (KALCMP.LE.0) GO TO 150                                    AW  227
          CALL VVLABL (XX,YY,2)                                         AW  228
  150 CONTINUE                                                          AW  229
C                                                                       AW  230
      CALL VVKRV2 (-1.,XX,YY)                                           AW  231
      USX=(XX-0.5)*HC*.1/XSIZ                                           AW  232
      USY=(YY-0.5)*XN*.1/YSIZ                                           AW  233
      CALL ISOPLT(USX,USY,2)                                            AW  234
      IF (KALCMP.LE.0) GO TO 160                                        AW  235
      CALL VVLABL (XX,YY,2)                                             AW  236
      CALL VVLABL (DUM,DUM,1)                                           AW  237
C                                                                       AW  238
  160 NPTS = 0                                                          AW  239
      KSLP = 0                                                          AW  240
      RETURN                                                            AW  241
      END                                                               AW  242-
```

```
      SUBROUTINE VVLABL (X2,Y2,IPEN)                                    AX    1
      SAVE                                                              AX    2
C                                                                       AX    3
C     *** SETS A LINE LABEL INTO A VECTOR PLOT PROVIDING THAT           AX    4
C         PARAMETERS IN /VVLBL/                                         AX    5
C             GW LUNDBERG/SAI  AUG 87                                   AX    6
C                                                                       AX    7
C     X2,Y2     THE TERMINAL POINT OF THE CURRENT VECTOR                AX    8
C               IN INCHES FROM PRESENT PLOT ORIGIN                      AX    9
C     IPEN      =3, INITIALIZE -- SET PEN TO X2,Y2                      AX   10
C               =2, CONTINUE -- DRAW LINE WITH LABEL TO X2,Y2           AX   11
C               =1, FINISH -- COMPLETE LINE                             AX   12
C                                                                       AX   13
C     *** NOTES --                                                      AX   14
C         (1) THE VALUES FOR IPEN MAY APPEAR WHIMSICAL, BUT THEY        AX   15
C             FOLLOW THE PRECEDENT SET BY SUBROUTINE PLOT.              AX   16
C         (2) THE LABELS ARE SEPERATED BY DIST INCHES EXCEPT FOR        AX   17
C             THE FIRST LABEL WHICH STARTS FRST INCHES FROM             AX   18
C             THE BEGINNING OF THE VECTOR PLOT -- THIS PROVIDES FOR     AX   19
C             STAGGERED LABELS.                                         AX   20
C                                                                       AX   21
      DIMENSION XSV(100),YSV(100)                                       AX   22
C                                                                       AX   23
C     *** DIST IS THE DISTANCE IN INCHES BETWEEN LABELS FROM BEGINNING  AX   24
C         TO BEGINNING.  FRST IS THE DISTANCE TO THE FIRST LABEL.       AX   25
C         CHRSZ IS THE SIZE OF THE LABEL CHARACTERS IN INCHES.          AX   26
C         NCHR IS THE NUMBER OF CHARACTERS (0-10), AND LABEL            AX   27
C         IS THE A-FORMATED TEXT OF THE LABEL                           AX   28
C                                                                       AX   28A
      COMMON /VVLB1/ FACT,DIST,CHRSZ,NCHR,OZL                           AX   29
C                                                                       AX   29A
      DATA MXSV/100/                                                    AX   30
C                                                                       AX   31
C     *** BRANCH ACCORDING TO IPEN                                      AX   32
      GO TO (100,20,10), IPEN                                           AX   33
C                                                                       AX   34
C     *** MOVE THE PEN TO THE FIRST POINT                               AX   35
   10 CALL PLOT (X2,Y2,3)                                               AX   36
C                                                                       AX   37
C     *** SET NUMBER OF SAVED SEGMENTS TO ZERO                          AX   38
      NSV = 0                                                           AX   39
C                                                                       AX   40
C     *** IF THERE ARE TO BE NO LABELS -- JUST RETURN                   AX   41
      IF (NCHR .EQ. 0) RETURN                                           AX   42
C                                                                       AX   43
C     *** SET UP THE OFFSET NECESSARY TO CENTER THE LABEL AND           AX   44
C         THE DISTANCE REQUIRED BY THE LABEL                            AX   45
      OFF = CHRSZ/2.                                                    AX   46
      SZLBL = NCHR*CHRSZ + 2.*OFF - 0.4286*CHRSZ                        AX   47
C                                                                       AX   48
C     *** INITIALIZE THE ACCUMLATED LENGTH OF THE VECTORS AND THE       AX   49
C         LENGTH REQUIRED BEFORE THE FIRST LABEL.                       AX   50
      TOTSZ = 0.                                                        AX   51
      SKPSZ = FACT*DIST                                                 AX   52
C                                                                       AX   53
C     *** REMEMBER THE STARTING LOCATION OF FIRST VECTOR                AX   54
      X1 = X2                                                           AX   55
      Y1 = Y2                                                           AX   56
C                                                                       AX   57
      RETURN                                                            AX   58
C                                                                       AX   59
C*****************************************************************    AX   60
C                   ENTRY FOR IPEN = 2                                  AX   61
C*****************************************************************    AX   62
```

```
C                                                                       AX   63
C     *** IF THERE ARE TO BE NO LABELS -- PLOT THE VECTOR AND RETURN     AX   64
   20 IF (NCHR .GT. 0) GO TO 30                                         AX   65
      CALL PLOT (X2,Y2,2)                                               AX   66
      RETURN                                                            AX   67
C                                                                       AX   68
C     *** IF SEEKING ROOM FOR THE LABEL -- SKIP FOLLOWING               AX   69
   30 IF (NSV .GT. 0) GO TO 50                                          AX   70
C                                                                       AX   71
C     *** CALCULATE THIS VECTOR LENGTH AND ADD TO THE ACCUMULATED       AX   72
C         LENGTH.  IF A LABEL IS TO START IN THIS VECTOR, SKIP TO       AX   73
C         120, ELSE PLOT THE VECTOR AND RETURN                          AX   74
      VECSZ = SQRT ((X2-X1)**2 + (Y2-Y1)**2)                            AX   75
      TOTSZ = TOTSZ + VECSZ                                             AX   76
      IF (TOTSZ .GT. SKPSZ) GO TO 40                                    AX   77
      CALL PLOT (X2,Y2,2)                                               AX   78
      X1 = X2                                                           AX   79
      Y1 = Y2                                                           AX   80
      RETURN                                                            AX   81
C                                                                       AX   82
C     *** ITS TIME FOR A LABEL -- LOCATE START                          AX   83
   40 RATIO = (VECSZ - TOTSZ + SKPSZ)/VECSZ                             AX   84
      X1L = X1 + RATIO*(X2-X1)                                          AX   85
      Y1L = Y1 + RATIO*(Y2-Y1)                                          AX   86
C                                                                       AX   87
C     *** PLOT SUBVECTOR AND REMEMBER THE END POINT                     AX   88
      CALL PLOT (X1L,Y1L,2)                                             AX   89
      X1 = X1L                                                          AX   90
      Y1 = Y1L                                                          AX   91
C                                                                       AX   92
C     *** RESET ARCLENGTH OF PREEMPTED SEGMENTS                         AX   93
      ARCL = 0.                                                         AX   94
C                                                                       AX   95
C     *** FIND OUT IF THERE IS ENOUGH ROOM LEFT IN THIS VECTOR          AX   96
C         FOR THE LABEL                                                 AX   97
   50 HAVSZ = SQRT ((X2-X1L)**2 + (Y2-Y1L)**2)                          AX   98
      IF (HAVSZ .GE. SZLBL) GO TO 80                                    AX   99
C                                                                       AX  100
C     *** NOT ENOUGH ROOM -- ACCUMULATE ARCLENGTH                       AX  101
      ARCL = ARCL + SQRT ((X2-X1)**2 + (Y2-Y1)**2)                      AX  102
C                                                                       AX  103
C     *** CHECK FOR OVERFLOW OR TOO WIGGLY                              AX  104
      IF (NSV .LT. MXSV  .AND.  ARCL .LT. 1.1*SZLBL) GO TO 70           AX  105
C                                                                       AX  106
C     *** LINE MUST BE TOO WIGGLY FOR LABEL -- FLUSH IT                 AX  107
      DO 60 I=1,NSV                                                     AX  108
         CALL PLOT (XSV(I),YSV(I),2)                                    AX  109
   60 CONTINUE                                                          AX  110
C                                                                       AX  111
C     *** RESET FOR LABEL AND START OVER                                AX  112
      NSV = 0                                                           AX  113
      TOTSZ = SKPSZ                                                     AX  114
      GO TO 20                                                          AX  115
C                                                                       AX  116
C     *** SAVE THIS NODE AND RETURN                                     AX  117
   70 NSV = NSV+1                                                       AX  118
      XSV(NSV) = X2                                                     AX  119
      YSV(NSV) = Y2                                                     AX  120
      X1 = X2                                                           AX  121
      Y1 = Y2                                                           AX  122
      RETURN                                                            AX  123
C                                                                       AX  124
C     *** CALCULATE THE END OF THE LABEL                                AX  125
C         IM SURE THERE IS AN EASIER WAY TO DO THIS, BUT IT             AX  126
```

```
C          ESCAPES ME                                                    AX  127
   80 A = (X2-X1)**2 + (Y2-Y1)**2                                        AX  128
      B = -2*((X1L-X1)*(X2-X1) + (Y1L-Y1)*(Y2-Y1))                       AX  129
      C = (X1L-X1)**2 + (Y1L-Y1)**2 - SZLBL*SZLBL                        AX  130
C                                                                        AX  131
      SQRTD = SQRT(B*B - 4*A*C)                                          AX  132
      T1 = (-B + SQRTD)/(2*A)                                            AX  133
      T2 = (-B - SQRTD)/(2*A)                                            AX  134
C                                                                        AX  135
C     *** PICK THE MINIMUM T BETWEEN 0-1 (MUST BE ONE)                   AX  136
      IF (T1 .LT. 0.) T1 = 1.                                            AX  137
      IF (T2 .LT. 0.) T2 = 1.                                            AX  138
      RATIO = T1                                                         AX  139
      IF (T2 .LT. T1) RATIO = T2                                         AX  140
C                                                                        AX  141
C     *** SET LABEL END POINT                                            AX  142
      X2L = X1 + RATIO*(X2-X1)                                           AX  143
      Y2L = Y1 + RATIO*(Y2-Y1)                                           AX  144
C                                                                        AX  145
C     *** CALCULATE LABEL ANGLE                                          AX  146
      DX = X2L - X1L                                                     AX  147
      DY = Y2L - Y1L                                                     AX  148
      ANG = ATAN2(DY,DX)                                                 AX  149
C                                                                        AX  150
      XL = X1L                                                           AX  151
      YL = Y1L                                                           AX  152
      COSA = COS(ANG)                                                    AX  153
      SINA = SIN(ANG)                                                    AX  154
C                                                                        AX  155
C     *** REVERSE EVERYTHING IF ANGLE IN QUADRANTS 2 OR 3                AX  156
      IF (DX .GE. 0.) GO TO 90                                           AX  157
      XL = X2L                                                           AX  158
      YL = Y2L                                                           AX  159
      COSA = -COSA                                                       AX  160
      SINA = -SINA                                                       AX  161
      IF (DY .GE. 0.) ANG = ANG-3.1415926536                             AX  162
      IF (DY .LT. 0.) ANG = ANG+3.1415926536                             AX  163
   90 ANGD = ANG*180./3.1415926536                                       AX  164
C                                                                        AX  165
C     *** LOCATE AND PLOT LABEL                                          AX  166
      XL = XL + OFF*COSA + OFF*SINA                                      AX  167
      YL = YL + OFF*SINA - OFF*COSA                                      AX  168
C                                                                        AX  169
C     *** CALL NUMBER TO PLOT THE LABEL                                  AX  170
      IDG=NCHR-2                                                         AX  171
      CALL NUMBER (XL,YL,CHRSZ,OZL,ANGD,IDG)                             AX  172
C                                                                        AX  173
C     *** FINISH OFF THIS SEGMENT BY MEANS OF A PSUEDO REENTRY           AX  174
      TOTSZ = 0.                                                         AX  175
      SKPSZ = DIST                                                       AX  176
      NSV = 0                                                            AX  177
      X1 = X2L                                                           AX  178
      Y1 = Y2L                                                           AX  179
      CALL PLOT (X1,Y1,3)                                                AX  180
      GO TO 30                                                           AX  181
C                                                                        AX  182
C************************************************************************AX  183
C                  ENTRY FOR IPEN = 1                                    AX  184
C************************************************************************AX  185
C                                                                        AX  186
C     *** PLOT THE SAVED VECTORS IF ANY                                  AX  187
  100 IF (NSV .EQ. 0) RETURN                                             AX  188
      DO 110 I=1,NSV                                                     AX  189
          CALL PLOT (XSV(I),YSV(I),2)                                    AX  190
```

```
  110 CONTINUE                                                          AX  191
      NSV = 0                                                           AX  192
      RETURN                                                            AX  193
C                                                                       AX  194
      END                                                               AX  195-
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      SUBROUTINE VVKRV1                                                 AY    1
      SAVE                                                              AY    2
C                                                                       AY    3
C     THIS SUBROUTINE DETERMINES THE PARAMETERS NECESSARY TO            AY    4
C     COMPUTE AN SPLINE UNDER TENSION PASSING THROUGH A SEQUENCE        AY    5
C     OF PAIRS (X(1),Y(1),....,X(N),Y(N)) IN THE PLANE. THE             AY    6
C     SLOPES AT THE TWO ENDS OF THE CURVE MAY BE SPECIFIED OR           AY    7
C     OMITTED. FOR ACTUAL COMPUTATION OF POINTS ON THE CURVE IT         AY    8
C     IS NECESSARY TO CALL THE SUBROUTINE VVKRV2.                       AY    9
C                                                                       AY   10
C      *** AK CLINE, COMM. ACM 17,4(APR.1974), 221                      AY   11
C          MODIFIED BY GW LUNDBERG/SAI  APR 79                          AY   12
C                                                                       AY   13
C     COMMON VARIABLES ON INPUT --                                      AY   14
C     NPTS = THE NUMBER OF POINTS TO BE INTERPOLATED (N.GE.2),          AY   15
C     X = AN ARRAY CONTAINING THE N X-COORDINATES OF THE                AY   16
C         POINTS,                                                       AY   17
C     Y = AN ARRAY CONTAINING THE N Y-COODINATES OF THE                 AY   18
C         POINTS,                                                       AY   19
C     NSLP = A FLAG FOR ENDPOINT SLOPES.  IF < 0, THIS IS A CLOSED      AY   20
C         LOOP AND NO SLOPES ARE GIVEN.  IF = 0, THIS IS AN OPEN CURVE  AY   21
C         AND NO SLOPES ARE GIVEN.  IF = 1, THE FIRST SLOPE IS SUPPLIED. AY  22
C         IF =2 , THE SECOND SLOPE IS SUPPLIED.  IF = 3, BOTH           AY   23
C         SLOPES ARE SUPPLIED.                                          AY   24
C     SLP1,SLPN = THE DESIRED VALUES FOR THE SLOPE                      AY   25
C         OF THE CURVE AT (X(1),Y(1)) AND (X(N),Y(N)), RESPEC-          AY   26
C         TIVELY.  THESE QUANTITIES ARE IN RADIANS AND MEASURED         AY   27
C         COUNTER CLOCKWISE FROM THE POSITIVE X-AXIS.  THE POSITIVE     AY   28
C         SENSE OF THE CURVE IS ASSUMED TO BE THAT MOVING FROM THE      AY   29
C         POINT 1 TO POINT N.                                           AY   30
C     XP,YP = ARRAYS OF LENGTH AT LEAST N,                              AY   31
C     SIGMA = THE TENSION FACTOR.  THIS IS NON-ZERO AND                 AY   32
C         INDICATES THE CURVINESS DESIRED.  IF SIGMA IS VERY            AY   33
C         LARGE (E.G. 50.) THE RESULTING CURVE IS VERY NEARLY A         AY   34
C         POLYGONAL LINE.  A STANDARD VALUE FOR SIGMA IS 1.             AY   35
C                                                                       AY   36
C     ON OUTPUT -                                                       AY   37
C     NPTS,X,Y,SLP1,SLPN, AND SIGMA ARE UNALTERED,                      AY   38
C     XP,YP CONTAIN INFORMATION ABOUT THE CURVATURE OF THE              AY   39
C         CURVE AT THE GIVEN NODE,                                      AY   40
C     S = THE POLYGONAL ARCLENGTH OF THE CURVE.                         AY   41
C                                                                       AY   42
C                                                                       AY   43
      COMMON /VVKRV/  NPTS,NSLP,SLP1,SLPN,LSLP,TANGNT,S,                AY   44
     1                X(32),Y(32),XP(32),YP(32)                        AY   45
      COMMON /CNTRL/  SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN, AY   46
     1                FLST,TLST                                        AY   47
      COMMON /EXPVAL/ EXPMAX                                            AY   48
C                                                                       AY   48A
      DIMENSION TEMP(32)                                                AY   49
C                                                                       AY   50
      TEMAX=-9999.                                                      AY   51
      N = NPTS                                                          AY   52
      NM1 = N-1                                                         AY   53
      NP1 = N+1                                                         AY   54
      DELX1 = X(2)-X(1)                                                 AY   55
      DELY1 = Y(2)-Y(1)                                                 AY   56
      DELS1 = SQRT(DELX1*DELX1+DELY1*DELY1)                             AY   57
      DX1 = DELX1/DELS1                                                 AY   58
      DY1 = DELY1/DELS1                                                 AY   59
C                                                                       AY   60
C      *** DETERMINE SLOPES IF NECESSARY                                AY   61
C          CHECK IF A LOOP                                              AY   62
      IF (NSLP .LT. 0) GO TO 80                                         AY   63
```

```
      JMP = NSLP + 1                                                    AY   64
C                                                                       AY   65
C     *** SPECIAL HANDLING FOR TWO POINT LINES                          AY   66
      IF (N .EQ. 2) GO TO 40                                            AY   67
   10 GO TO (20,30,20,90),JMP                                           AY   68
C                                                                       AY   69
C     *** USE SECOND ORDER INTERPOLATION FOR ENDPOINT SLOPES            AY   70
   20 DELS2 = SQRT((X(3)-X(2))**2+(Y(3)-Y(2))**2)                       AY   71
      DELS12 = DELS1+DELS2                                              AY   72
      C1 = -(DELS12+DELS1)/DELS12/DELS1                                 AY   73
      C2 = DELS12/DELS1/DELS2                                           AY   74
      C3 = -DELS1/DELS12/DELS2                                          AY   75
      SX = C1*X(1)+C2*X(2)+C3*X(3)                                      AY   76
      SY = C1*Y(1)+C2*Y(2)+C3*Y(3)                                      AY   77
      SLP1 = ATAN2(SY,SX)                                               AY   78
      IF (NSLP .EQ. 2) GO TO 90                                         AY   79
C                                                                       AY   80
   30 DELNM1 = SQRT((X(N-2)-X(NM1))**2+(Y(N-2)-Y(NM1))**2)              AY   81
      DELN = SQRT((X(NM1)-X(N))**2+(Y(NM1)-Y(N))**2)                    AY   82
      DELNN = DELNM1+DELN                                               AY   83
      C1 = (DELNN+DELN)/DELNN/DELN                                      AY   84
      C2 = -DELNN/DELN/DELNM1                                           AY   85
      C3 = DELN/DELNN/DELNM1                                            AY   86
      SX = C3*X(N-2)+C2*X(NM1)+C1*X(N)                                  AY   87
      SY = C3*Y(N-2)+C2*Y(NM1)+C1*Y(N)                                  AY   88
      SLPN = ATAN2(SY,SX)                                               AY   89
      GO TO 90                                                          AY   90
C                                                                       AY   91
C     *** ONLY TWO POINTS SUPPLIED                                      AY   92
   40 GO TO (50,60,70,90),JMP                                           AY   93
C                                                                       AY   94
C     *** NO SLOPES GIVEN -- USE STRAIGHT LINE                          AY   95
C         (ACTUALLY, THIS CASE SHOULD NEVER OCCUR)                      AY   96
   50 XP(1) = 0.                                                        AY   97
      XP(2) = 0.                                                        AY   98
      YP(1) = 0.                                                        AY   99
      YP(2) = 0.                                                        AY  100
      S = SQRT ((X(2)-X(1))**2 + (Y(2)-Y(1))**2)                        AY  101
      RETURN                                                            AY  102
C                                                                       AY  103
C     *** FIRST SLOPE GIVEN                                             AY  104
   60 SLPN = ATAN2 (Y(2)-Y(1)-SLP1*(X(2)-X(1)),                         AY  105
     1              X(2)-X(1)-SLP1*(Y(2)-Y(1)))                        AY  106
      GO TO 90                                                          AY  107
C                                                                       AY  108
C     *** LAST SLOPE GIVEN                                              AY  109
   70 SLP1 = ATAN2 (Y(2)-Y(1)-SLPN*(X(2)-X(1)),                         AY  110
     1              X(2)-X(1)-SLPN*(Y(2)-Y(1)))                        AY  111
      GO TO 90                                                          AY  112
C                                                                       AY  113
C     *** CLOSED LOOP -- PERIODIC SPLINE -- CALCULATE SLOPES            AY  114
C         FOR JOIN                                                      AY  115
   80 DELN = SQRT((X(NM1)-X(N))**2+(Y(NM1)-Y(N))**2)                    AY  116
      DELNN = DELS1+DELN                                                AY  117
      C1 = -DELS1/DELN/DELNN                                            AY  118
      C2 = (DELS1-DELN)/DELS1/DELN                                      AY  119
      C3 = DELN/DELNN/DELS1                                             AY  120
      SX = C1*X(NM1)+C2*X(1)+C3*X(2)                                    AY  121
      SY = C1*Y(NM1)+C2*Y(1)+C3*Y(2)                                    AY  122
      IF (SX.EQ.0. .AND. SY.EQ.0.) SX = 1                               AY  123
      SLP1 = ATAN2(SY,SX)                                               AY  124
      SLPN = SLP1                                                       AY  125
C                                                                       AY  126
C     *** SET BOTH SLOPES                                               AY  127
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   90 SLPP1 = SLP1                                                        AY  128
      SLPPN = SLPN                                                        AY  129
C                                                                         AY  130
C     *** SET UP RIGHT HAND SIDES OF TRIDIAGONAL LINEAR SYSTEM FOR        AY  131
C         XP AND YP                                                       AY  132
  100 XP(1) = DX1-COS(SLPP1)                                              AY  133
      YP(1) = DY1-SIN(SLPP1)                                              AY  134
      TEMP(1) = DELS1                                                     AY  135
      S = DELS1                                                           AY  136
      IF (N.EQ.2) GO TO 120                                               AY  137
      DO 110 I=2,NM1                                                      AY  138
          DELX2 = X(I+1)-X(I)                                             AY  139
          DELY2 = Y(I+1)-Y(I)                                             AY  140
          DELS2 = SQRT(DELX2*DELX2+DELY2*DELY2)                           AY  141
          DX2 = DELX2/DELS2                                               AY  142
          DY2 = DELY2/DELS2                                               AY  143
          XP(I) = DX2-DX1                                                 AY  144
          YP(I) = DY2-DY1                                                 AY  145
          TEMP(I) = DELS2                                                 AY  146
          TEMAX = AMAX1(TEMAX,TEMP(I))                                    AY  147
          DELX1 = DELX2                                                   AY  148
          DELY1 = DELY2                                                   AY  149
          DELS1 = DELS2                                                   AY  150
          DX1 = DX2                                                       AY  151
          DY1 = DY2                                                       AY  152
C                                                                         AY  153
C     *** ACCUMULATE POLYGONAL ARCLENGTH                                  AY  154
          S =S+DELS1                                                      AY  155
  110 CONTINUE                                                            AY  156
  120 XP(N) = COS(SLPPN)-DX1                                              AY  157
      YP(N) = SIN(SLPPN)-DY1                                              AY  158
C                                                                         AY  159
C     *** DENORMALIZE TENSION FACTOR                                      AY  160
      SIGMAP = ABS(SIGMA)*FLOAT(N-1)/S                                    AY  161
      DELT1=SIGMAP*TEMAX                                                  AY  162
      IF (DELT1.LT.EXPMAX) GO TO 130                                      AY  163
      SIGMAP=0.9*EXPMAX/TEMAX                                             AY  164
      SGN=1.0                                                             AY  165
      IF (SIGMAP.LT.0.) SGN=-1.0                                          AY  166
      SIGMA=SIGMAP*SGN*S/FLOAT (N-1)                                      AY  167
  130 CONTINUE                                                            AY  168
C                                                                         AY  169
C     *** PERFORM FORWARD ELIMINATION ON TRIDIAGONAL SYSTEM               AY  170
      DELS = SIGMAP*TEMP(1)                                               AY  171
      EXPS = EXP(DELS)                                                    AY  172
      SINHS = .5*(EXPS-1./EXPS)                                           AY  173
      SINHIN = 1./(TEMP(1)*SINHS)                                         AY  174
      DIAG1 = SINHIN*(DELS*.5*(EXPS+1./EXPS)-SINHS)                       AY  175
      DIAGIN = 1./DIAG1                                                   AY  176
      XP(1) = DIAGIN*XP(1)                                                AY  177
      YP(1) = DIAGIN*YP(1)                                                AY  178
      SPDIAG = SINHIN*(SINHS-DELS)                                        AY  179
      TEMP(1) = DIAGIN*SPDIAG                                             AY  180
      IF (N.EQ.2) GO TO 150                                               AY  181
      DO 140 I=2,NM1                                                      AY  182
          DELS = SIGMAP*TEMP(I)                                           AY  183
          EXPS = EXP(DELS)                                                AY  184
          SINHS = .5*(EXPS-1./EXPS)                                       AY  185
          SINHIN = 1./(TEMP(I)*SINHS)                                     AY  186
          DIAG2 = SINHIN*(DELS*(.5*(EXPS+1./EXPS))-SINHS)                 AY  187
          DIAGIN = 1./(DIAG1+DIAG2-SPDIAG*TEMP(I-1))                      AY  188
          XP(I) = DIAGIN*(XP(I)-SPDIAG*XP(I-1))                           AY  189
          YP(I) = DIAGIN*(YP(I)-SPDIAG*YP(I-1))                           AY  190
          SPDIAG = SINHIN*(SINHS-DELS)                                    AY  191
```

```
          TEMP(I) = DIAGIN*SPDIAG                                        AY  192
          DIAG1 = DIAG2                                                  AY  193
  140 CONTINUE                                                           AY  194
  150 DIAGIN = 1./(DIAG1-SPDIAG*TEMP(NM1))                               AY  195
      XP(N) = DIAGIN*(XP(N)-SPDIAG*XP(NM1))                              AY  196
      YP(N) = DIAGIN*(YP(N)-SPDIAG*YP(NM1))                              AY  197
C                                                                        AY  198
C     *** PERFORM BACK SUBSTITUTION                                      AY  199
      DO 160 I=2,N                                                       AY  200
          IBAK = NP1-I                                                   AY  201
          XP(IBAK) = XP(IBAK)-TEMP(IBAK)*XP(IBAK+1)                      AY  202
          YP(IBAK) = YP(IBAK)-TEMP(IBAK)*YP(IBAK+1)                      AY  203
  160 CONTINUE                                                           AY  204
      RETURN                                                             AY  205
      END                                                                AY  206-
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      SUBROUTINE VVKRV2 (T,XS,YS)                                        AZ     1
      SAVE                                                               AZ     2
C                                                                        AZ     3
C     THIS SUBROUTINE PERFORMS THE MAPPING OF POINTS IN THE              AZ     4
C     INTERVAL (0.,1.) ONTO A CURVE IN THE PLANE.  THE SUBROUTINE        AZ     5
C     VVKRV1 SHOULD BE CALLED EARLIER TO DETERMINE CERTAIN               AZ     6
C     NECESSARY PARAMETERS.  THE RESULTING CURVE HAS A PARAMETRIC        AZ     7
C     REPRESENTATION BOTH OF WHOSE COMPONENTS ARE SPLINES UNDER          AZ     8
C     TENSION AND FUNCTIONS OF THE POLYGONAL ARCLENGTH PARAMETER.        AZ     9
C                                                                        AZ    10
C     COMMON VARIABLES AND PARAMETERS ON INPUT--                         AZ    11
C     T = A REAL VALUE OF ABSOLUTE VALUE LESS THAN OR                    AZ    12
C         EQUAL TO 1.  TO BE MAPPED TO A POINT ON THE CURVE.  THE        AZ    13
C         SIGN OF T IS IGNORED AND THE INTERVAL (0.,1.) IS MAPPED        AZ    14
C         ONTO THE ENTIRE CURVE.  IF T IS NEGATIVE THIS INDICATES        AZ    15
C         THAT THE SUBROUTINE HAS BEEN CALLED PREVIOUSLY (WITH ALL       AZ    16
C         OTHER INPUT VARIABLES UNALTERED) AND THAT THIS VALUE OF        AZ    17
C         T EXCEEDS THE PREVIOUS VALUE IN ABSOLUTE VALUE.  WITH          AZ    18
C         SUCH INFORMATION THE SUBROUTINE IS ABLE TO MAP THE POINT       AZ    19
C         MUCH MORE RAPIDLY.  THUS IF THE USER SEEKS TO MAP A            AZ    20
C         SEQUENCE OF POINTS ONTO THE SAME CURVE, EFFICIENCY IS          AZ    21
C         GAINED BY ORDERING THE VALUES INCREASING IN MAGNITUDE          AZ    22
C         AND SETTING THE SIGNS OF ALL BUT THE FIRST, NEGATIVE,          AZ    23
C     NPTS = THE NUMBER OF POINTS WHICH WERE INTERPOLATED                AZ    24
C         TO DETERMINE THE CURVE,                                        AZ    25
C     X,Y = ARRAYS CONTAINING THE X- AND Y-COORDINATES                   AZ    26
C         OF THE INTERPOLATED POINTS,                                    AZ    27
C     XP,YP = THE ARRAYS OUTPUT FROM VVKRV2 CONTAINING                   AZ    28
C         CURVATURE INFORMATION,                                         AZ    29
C     S = THE POLYGONAL ARCLENGTH OF THE CURVE,                          AZ    30
C     SIGMA = THE TENSION FACTOR (ITS SIGN IS IGNORED).                  AZ    31
C     LSLP = A FLAG WHICH IF >0 REQUESTS THE SLOPE                       AZ    32
C     TANGNT = THE SLOPE REQUESTED BY LSLP                               AZ    33
C                                                                        AZ    34
C     THE PARAMETERS NPTS,X,Y,XP,YP,S, AND SIGMA SHOULD BE INPUT         AZ    35
C     UNALTERED FROM THE OUTPUT OF VVKRV1.                               AZ    36
C                                                                        AZ    37
C     ON  OUTPUT--                                                       AZ    38
C     XS,YS = THE X- AND Y-COORDINATES OF THE IMAGE                      AZ    39
C         POINT ON THE CURVE.                                            AZ    40
C     T,NPTS,X,Y,XP,YP,S, AND SIGMA ARE UNALTERED.                       AZ    41
C                                                                        AZ    42
      COMMON /VVKRV/ NPTS,NSLP,SLP1,SLPN,LSLP,TANGNT,S,                  AZ    43
     1               X(32),Y(32),XP(32),YP(32)                           AZ    44
      COMMON /CNTRL/ SIG,SIGMA,INFO,NPTO,TSRT,DTIM,Z1,Z2,DCON,EHC,EXN,   AZ    45
     1               FLST,TLST                                           AZ    46
C                                                                        AZ    47
      N = NPTS                                                           AZ    48
C                                                                        AZ    49
C     *** DENORMALIZE SIGMA                                              AZ    50
      SIGMAP = ABS(SIGMA)*FLOAT(N-1)/S                                   AZ    51
C                                                                        AZ    52
C     *** STRETCH UNIT INTERVAL INTO ARCLENGTH DISTANCE                  AZ    53
      TN = ABS(T*S)                                                      AZ    54
C                                                                        AZ    55
C     *** FOR NEGATIVE T START SEARCH WHERE PREVIOUSLY TERMINATED.       AZ    56
C         OTHERWISE START FROM BEGINNING                                 AZ    57
      IF (T.LT.0.) GO TO 10                                              AZ    58
      I1 = 2                                                             AZ    59
      XS = X(1)                                                          AZ    60
      YS = Y(1)                                                          AZ    61
      SUM = 0.                                                           AZ    62
      IF (T.LT.0.) RETURN                                                AZ    63
C                                                                        AZ    64
```

```
C     *** DETERMINE INTO WHICH SEGMENT TN IS MAPPED                      AZ   65
   10 DO 30 I=I1,N                                                       AZ   66
         DELX = X(I)-X(I-1)                                              AZ   67
         DELY = Y(I)-Y(I-1)                                              AZ   68
         DELS = SQRT(DELX*DELX+DELY*DELY)                                AZ   69
         IF (SUM+DELS-TN) 20,40,40                                       AZ   70
   20    SUM = SUM+DELS                                                  AZ   71
   30 CONTINUE                                                           AZ   72
C                                                                        AZ   73
C     *** IF ABS(T) IS GREATER THAN 1., RETURN TERMINAL POINT ON          AZ   74
C         CURVE                                                          AZ   75
C                                                                        AZ   76
      XS = X(N)                                                          AZ   77
      YS = Y(N)                                                          AZ   78
      RETURN                                                             AZ   79
C                                                                        AZ   80
C     *** SET UP AND PERFORM INTERPOLATION                               AZ   81
   40 DEL1 = TN-SUM                                                      AZ   82
      DEL2 = DELS-DEL1                                                   AZ   83
      EXPS1 = EXP(SIGMAP*DEL1)                                           AZ   84
      SINHD1 = .5*(EXPS1-1./EXPS1)                                       AZ   85
      EXPS2 = EXP(SIGMAP*DEL2)                                           AZ   86
      SINHD2 = .5*(EXPS2-1./EXPS2)                                       AZ   87
      EXPS = EXPS1*EXPS2                                                 AZ   88
      SINHS = .5*(EXPS-1./EXPS)                                          AZ   89
      XS = (XP(I)*SINHD1+XP(I-1)*SINHD2)/SINHS+                          AZ   90
     1     ((X(I)-XP(I))*DEL1+(X(I-1)-XP(I-1))*DEL2)/DELS                AZ   91
      YS = (YP(I)*SINHD1+YP(I-1)*SINHD2)/SINHS+                          AZ   92
     1     ((Y(I)-YP(I))*DEL1+(Y(I-1)-YP(I-1))*DEL2)/DELS                AZ   93
      I1 = I                                                             AZ   94
      IF (LSLP .EQ. 0) RETURN                                            AZ   95
C                                                                        AZ   96
C     *** CALCULATE SLOPE                                                AZ   97
      COSHD1 = 0.5*(EXPS1+1.0/EXPS1)*SIGMAP                              AZ   98
      COSHD2 = 0.5*(EXPS2+1.0/EXPS2)*SIGMAP                              AZ   99
      XT = (XP(I)*COSHD1-XP(I-1)*COSHD2)/SINHS+                          AZ  100
     1     ((X(I)-XP(I))-(X(I-1)*XP(I-1)))/DELS                          AZ  101
      YT = (YP(I)*COSHD1-YP(I-1)*COSHD2)/SINHS+                          AZ  102
     1     ((Y(I)-YP(I))-(Y(I-1)-YP(I-1)))/DELS                          AZ  103
      TANGNT = ATAN2 (YT,XT)                                             AZ  104
      RETURN                                                             AZ  105
      END                                                                AZ  106-
```

```
      SUBROUTINE AXES (X,Y,FIRSTV,FINALV,SCALE,TSTEP,ASTEP,NDEC,ANGLE,IBBA     1
     1CD,NCHAR,LABEL)                                                          BA     2
C                                                                              BA     3
C     *** SAI SUBROUTINE AXES                                                  BA     4
C         GW LUNDBERG/SAI  DEC 76                                              BA     5
C                                                                              BA     6
C         X,Y = COORDINATES IN INCHES OF AXIS LINE STARTING                    BA     7
C               POINT                                                          BA     8
C         FIRSTV = STARTING VALUE FOR THE AXIS                                 BA     9
C         FINALV = ENDING VALUE FOR THE AXIS                                   BA    10
C         SCALE = INCHES/UNIT FOR FIRSTV,FINALV,TSTEP,ASTEP                    BA    11
C         TSTEP = STEP SIZE FOR TICS                                           BA    12
C         ASTEP = STEP SIZE FOR LABELED TICS                                   BA    13
C         NDEC = FORMAT FOR LABELS -- SEE SUBROUTINE NUMBER                    BA    14
C         ANGLE = ANGLE OF AXIS IN DEGRES FROM HORIZONTAL                      BA    15
C         IBCD = THE AXIS TITLE AS ARRAY OR HOLLERITH STRING                   BA    16
C         NCHAR = NUMBER OF CHARACTERS IN TITLE                                BA    17
C               ) 0, TIC MARKS, ANNOTATION AND TITLE PLOTTED ON                BA    18
C                    CLOCKWISE SIDE OF AXIS LINE                               BA    19
C               ( 0, ON COUNTER CLOCKWISE SIDE                                 BA    20
C                                                                              BA    21
C         THIS ROUTINE WAS WRITTEN FOR A MATRIX PLOTTER -- IT DOES             BA    22
C         NOT OPTIMIZE PEN MOVEMENTS.  THE ROUTINE SHOULD BE MACHINE           BA    23
C         INDEPENDENT                                                          BA    24
C                                                                              BA    25
C                                                                              BA    26
C     *** FOLLOWING ARE ADJUSTABLE -- IF LABEL > 0, ALL TICS ARE               BA    27
C         LABELED, IF LABEL = 0, THE LAST TIC IS NOT LABELED,                  BA    28
C         IF LABEL < 0, THE FIRST AND LAST ARE NOT LABELED                     BA    29
C                                                                              BA    30
C     *** DEFINE VARIOUS CHARACTER SIZES                                       BA    31
      SAVE                                                                     BA    32
      COMMON /PLTVEC/ HCT(20),OT(20),NH,OHC,HCG,PLTGRD,OXN,XNG,HC1,XN1,        BA    33
     1                TICSIZ,DIGSIZ,CHRSIZ,IPLDEV                              BA    34
C     INTEGER IBCD(3)                                                          BA    35
      CHARACTER*24 IBCD                                                        BA    35A
C                                                                              BA    36
C     *** STEP 1 -- DRAW AXIS AND TIC MARKS                                    BA    37
C         ---- -    ---- ---- --- --- -----                                    BA    38
C                                                                              BA    39
C     *** MOVE PEN TO START OF AXIS                                            BA    40
      X0=X                                                                     BA    41
      Y0=Y                                                                     BA    42
      CALL PLOT (X0,Y0,3)                                                      BA    43
C                                                                              BA    44
C     *** LOCATE THE OTHER END AND DRAW AXIS                                   BA    45
      COSA=COS(ANGLE*0.017453294)                                              BA    46
      SINA=SIN(ANGLE*0.017453294)                                              BA    47
      AXLEN=(FINALV-FIRSTV)*SCALE                                              BA    48
      X1=X0+AXLEN*COSA                                                         BA    49
      Y1=Y0+AXLEN*SINA                                                         BA    50
      CALL PLOT (X1,Y1,2)                                                      BA    51
C                                                                              BA    52
C     *** ADD THE TIC MARKS ON WRONG SIDE OF AXIS                              BA    53
      POS=FLOAT(ISIGN(1,NCHAR))                                                BA    54
      IF (TSTEP.EQ.0.) GO TO 20                                                BA    55
      NTIC=(FINALV-FIRSTV)/TSTEP+1.5                                           BA    56
      DO 10 J=1,NTIC                                                           BA    57
C                                                                              BA    58
C         *** MOVE PEN TO START OF TIC                                         BA    59
      X1=X0+FLOAT(J-1)*TSTEP*SCALE*COSA                                        BA    60
      Y1=Y0+FLOAT(J-1)*TSTEP*SCALE*SINA                                        BA    61
      CALL PLOT (X1,Y1,3)                                                      BA    62
C                                                                              BA    63
```

```
C         *** DRAW A TIC NORMAL TO AXIS                                  BA   64
      X1=X1+TICSIZ*POS*SINA                                              BA   65
      Y1=Y1-TICSIZ*POS*COSA                                              BA   66
      CALL PLOT (X1,Y1,2)                                                BA   67
   10 CONTINUE                                                           BA   68
C                                                                        BA   69
C     *** STEP 2 -- SET IN LABELED TICS ON CORRECT SIDE OF AXIS          BA   70
C         ---- -    --- -- ------- ---- -- ------- ---- -- ----         BA   71
C                                                                        BA   72
   20 IF (ASTEP.EQ.0.) GO TO 50                                          BA   73
      NTIC=(FINALV-FIRSTV)/ASTEP+1.5                                     BA   74
      NFRST=1                                                            BA   75
      NLST=NTIC                                                          BA   76
      IF (LABEL.LE.0) NLST=NLST-1                                        BA   77
      IF (LABEL.LT.0) NFRST=NFRST+1                                      BA   78
      DO 30 J=NFRST,NLST                                                 BA   79
      X1=X0+FLOAT(J-1)*ASTEP*SCALE*COSA                                  BA   80
      Y1=Y0+FLOAT(J-1)*ASTEP*SCALE*SINA                                  BA   81
      CALL PLOT (X1,Y1,3)                                                BA   82
C                                                                        BA   83
      X1=X1-TICSIZ*POS*SINA                                              BA   84
      Y1=Y1+TICSIZ*POS*COSA                                              BA   85
      CALL PLOT (X1,Y1,2)                                                BA   86
   30 CONTINUE                                                           BA   87
C                                                                        BA   88
C     *** STEP 3 -- ANNOTATE THE TIC MARKS                               BA   89
C         ---- -    -------- --- --- -----                              BA   90
C                                                                        BA   91
C     *** DETERMINE PERPENDICULAR OFFSET TO BOTTOM OF CHARACTER          BA   92
      OFFSET=TICSIZ+0.03                                                 BA   93
      IF (POS.NE.1.0) OFFSET=OFFSET+DIGSIZ                               BA   94
C                                                                        BA   95
C     *** CALCULATE LOCATION OF FIRST CHARACTER                          BA   96
      X0=X0-DIGSIZ*COSA                                                  BA   97
      Y0=Y0-DIGSIZ*SINA                                                  BA   98
      X0=X0-OFFSET*POS*SINA                                              BA   99
      Y0=Y0+OFFSET*POS*COSA                                              BA  100
C                                                                        BA  101
C     *** ANNOTATE THE TIC MARKS                                         BA  102
      NFRST=1                                                            BA  103
      NLAST=NTIC                                                         BA  104
      IF (LABEL.LE.0) NLAST=NLAST-1                                      BA  105
      IF (LABEL.LT.0) NFRST=NFRST+1                                      BA  106
      DO 40 J=NFRST,NLAST                                                BA  107
C                                                                        BA  108
C         *** GET FLOATING POINT VALUE OF ANNOTATION                     BA  109
      FPN=FIRSTV+FLOAT(J-1)*ASTEP                                        BA  110
C                                                                        BA  111
C         *** GET LOCATION AND PLOT FPN                                  BA  112
      X1=X0+FLOAT(J-1)*ASTEP*SCALE*COSA                                  BA  113
      Y1=Y0+FLOAT(J-1)*ASTEP*SCALE*SINA                                  BA  114
      CALL NUMBER (X1,Y1,DIGSIZ,FPN,ANGLE,NDEC)                          BA  115
   40 CONTINUE                                                           BA  116
C                                                                        BA  117
C     *** STEP 4 -- ADD AXIS TITLE                                       BA  118
C         ---- -    --- ---- -----                                      BA  119
C                                                                        BA  120
   50 IF (NCHAR.EQ.0) GO TO 60                                           BA  121
C     *** SET TITLE OFFSET -- DISTANCE FROM AXIS TO CHARACTERS           BA  122
      OFFSET=TICSIZ+DIGSIZ+0.10                                          BA  123
      IF (NCHAR.LT.0) OFFSET=OFFSET+CHRSIZ                               BA  124
C                                                                        BA  125
C     *** CALCULATE TITLE SIZE                                           BA  126
      TSIZ=CHRSIZ*FLOAT(IABS(NCHAR))                                     BA  127
```

```
C
C     *** CALCULATE OFFSET FROM BEGINNING OF AXIS TO FIRST CHARACTER
      OFF=0.5*(AXLEN-TSIZ)
C
C     *** CALCULATE LOCATION OF FIRST CHARACTER AND PLOT TITLE
      X0=X+OFF*COSA
      Y0=Y+OFF*SINA
      X0=X0-OFFSET*POS*SINA
      Y0=Y0+OFFSET*POS*COSA
      NCCAR=IABS(NCHAR)
      CALL SYMBOL (X0,Y0,CHRSIZ,IBCD,IDUM,ANGLE,NCCAR)
C
C         FINISHED
   60 RETURN
      END
```

BA 128
BA 129
BA 130
BA 131
BA 132
BA 133
BA 134
BA 135
BA 136
BA 137
BA 138
BA 139
BA 140
BA 141
BA 142-

```
      SUBROUTINE FRAME (X,Y,FRSTX,FINX,SIZX,TICX,STEPX,NDECX,FRSTY,FINY,BB     1
     1SIZY,TICY,STEPY,NDECY,LBLBOT,NB,LBLLFT,NL,LBLTOP,NT,LBLRGT,NR)     BB     2
C                                                                        BB     3
C     *** PURPOSE -- PREPARES AN ANNOTATED FOUR SIDED FRAME              BB     4
C         WITH LOWER LEFT CORNER AT (X,Y)                                BB     5
C             GWL/SAI  MARCH  77                                         BB     6
C                                                                        BB     7
C         SEE SUBROUTINE AXES FOR DESCRIPTION OF ARGUMENTS               BB     8
C                                                                        BB     9
      SAVE                                                               BB    10
      COMMON /PLTVEC/ HCT(20),OT(20),NH,OHC,HCG,PLTGRD,OXN,XNG,HCC,XNC,  BB    11
     1                TICZ,DIGZ,CHRZ,IPLDEV                             BB    12
      DIMENSION LBLTOP(6),LBLRGT(6)                                      BB    13
      CHARACTER*1 LBLRGT, LBLTOP                                         BB    13A
      CHARACTER*12 LBLLFT, LBLBOT                                        BB    13B
C                                                                        BB    14
C     *** CALCULATE THE AXES LENGTHS                                     BB    15
      XLEN=(FINX-FRSTX)*SIZX                                             BB    16
      YLEN=(FINY-FRSTY)*SIZY                                             BB    17
C                                                                        BB    18
C     *** PLACE GRIDDED LINES ON PLOT                                    BB    19
C                                                                        BB    20
      IF (ABS(PLTGRD).EQ.0.) GO TO 80                                    BB    21
      IF (PLTGRD.LT.0.) GO TO 50                                         BB    22
      CALL NEWPEN (2)                                                    BB    23
      STINC=(STEPY/10.)*SIZY                                             BB    24
      ILP=FINY/STEPY+.005                                                BB    25
      ILP=ILP*10-1                                                       BB    26
      STVAL=STINC                                                        BB    27
      J=1                                                                BB    28
      DO 20 I=1,ILP                                                      BB    29
      IF (J.EQ.2) GO TO 10                                               BB    30
      CALL PLOT (X,STVAL,3)                                              BB    31
      CALL PLOT (XLEN,STVAL,2)                                           BB    32
      STVAL=STVAL+STINC                                                  BB    33
      J=2                                                                BB    34
      GO TO 20                                                           BB    35
   10 CALL PLOT (XLEN,STVAL,3)                                           BB    36
      CALL PLOT (X,STVAL,2)                                              BB    37
      STVAL=STVAL+STINC                                                  BB    38
      J=1                                                                BB    39
   20 CONTINUE                                                           BB    40
      STINC=(STEPX/10.)*SIZX                                             BB    41
      ILP=FINX/STEPX+.005                                                BB    42
      ILP=ILP*10-1                                                       BB    43
      STVAL=STINC                                                        BB    44
      J=1                                                                BB    45
      DO 40 I=1,ILP                                                      BB    46
      IF (J.EQ.2) GO TO 30                                               BB    47
      CALL PLOT (STVAL,Y,3)                                              BB    48
      CALL PLOT (STVAL,YLEN,2)                                           BB    49
      STVAL=STVAL+STINC                                                  BB    50
      J=2                                                                BB    51
      GO TO 40                                                           BB    52
   30 CALL PLOT (STVAL,YLEN,3)                                           BB    53
      CALL PLOT (STVAL,Y,2)                                              BB    54
      STVAL=STVAL+STINC                                                  BB    55
      J=1                                                                BB    56
   40 CONTINUE                                                           BB    57
      CALL NEWPEN (1)                                                    BB    58
      GO TO 80                                                           BB    59
C                                                                        BB    60
C  PLOT GRIDDED LINES WITH MATRIX PLOTTER                                BB    61
C                                                                        BB    62
```

```
   50 IPLT=IFIX(PLTGRD)                                                    BB   63
      CALL NEWPEN (IPLT)                                                   BB   64
      STINC=(STEPY/10.)*SIZY                                               BB   65
      ILP=IFIX(FINY/STEPY+0.005)*10-1                                      BB   66
      STVAL=STINC                                                          BB   67
      DO 60 I=1,ILP                                                        BB   68
      IF (MOD(I,10).EQ.0) CALL NEWPEN (IPLT+1)                             BB   69
      CALL PLOT (X+0.01,STVAL,3)                                           BB   70
      CALL PLOT (XLEN,STVAL,2)                                             BB   71
      IF (MOD(I,10).EQ.0) CALL NEWPEN (IPLT)                               BB   72
      STVAL=STVAL+STINC                                                    BB   73
   60 CONTINUE                                                             BB   74
      STINC=(STEPX/10.)*SIZX                                               BB   75
      ILP=IFIX(FINX/STEPX+0.005)*10-1                                      BB   76
      STVAL=STINC                                                          BB   77
      DO 70 I=1,ILP                                                        BB   78
      IF (MOD(I,10).EQ.0) CALL NEWPEN (IPLT+1)                             BB   79
      CALL PLOT (STVAL,Y-0.02,3)                                           BB   80
      CALL PLOT (STVAL,Y,3)                                                BB   81
      CALL PLOT (STVAL,YLEN,2)                                             BB   82
      IF (MOD(I,10).EQ.0) CALL NEWPEN (IPLT)                               BB   83
      STVAL=STVAL+STINC                                                    BB   84
   70 CONTINUE                                                             BB   85
      CALL NEWPEN (0)                                                      BB   86
   80 CONTINUE                                                             BB   87
C                                                                          BB   88
C     *** PLOT THE FOUR SIDES WITH ANNOTATIONS                             BB   89
      CALL AXES (X,Y,FRSTX,FINX,SIZX,TICX,STEPX,NDECX,0.,LBLBOT,-NB,1)     BB   90
      CALL AXES (X,Y,FRSTY,FINY,SIZY,TICY,STEPY,NDECY,90.,LBLLFT,NL,1)     BB   91
      CALL AXES (X,Y+YLEN,FRSTX,FINX,SIZX,TICX,STEPX,NDECX,0.,LBLTOP,NT,BB   92
     1-1)                                                                  BB   93
      CALL AXES (X+XLEN,Y,FRSTY,FINY,SIZY,TICY,STEPY,NDECY,90.,LBLRGT,-NBB   94
     1R,-1)                                                                BB   95
C                                                                          BB   96
      RETURN                                                               BB   97
      END                                                                  BB   98
```

```
      SUBROUTINE OPENA                                                  BC     1
C                                                                       BC     2
C  OPEN SUBROUTINE FOR OZIPM4                                          BC     3
C                                                                       BC     4
      CHARACTER*80 IPATH                                                BC     5
      CHARACTER*1 IA,IA1                                                BC     6
C                                                                       BC     7
C  OPEN INPUT AND OUTPUT FILES FOR EKMA/OZIPM4                          BC     8
C                                                                       BC     9
   10 CONTINUE                                                          BC    10
      READ (14,100,END=99) IA, IA1, IPATH                               BC    11
      IUNIT = 0                                                         BC    12
      IF (IA .EQ. 'i' .OR. IA .EQ. 'I') IUNIT = 7                       BC    13
      IF (IA .EQ. 'o' .OR. IA .EQ. 'O') IUNIT = 10                      BC    14
      IF (IA .EQ. 'p' .OR. IA .EQ. 'P') IUNIT = 8                       BC    15
      IF (IA .EQ. 'r' .OR. IA .EQ. 'R') IUNIT = 9                       BC    16
      IF (IA .EQ. 'e' .OR. IA .EQ. 'E') IUNIT = 11                      BC    17
      IF (IA .EQ. 'm' .OR. IA .EQ. 'M') IUNIT = 54                      BC    18
C                                                                       BC    19
C  CHECK FOR CORRECT INPUT STRUCTURE                                    BC    20
C                                                                       BC    21
      IF (IA1 .NE. '=') IUNIT = 0                                       BC    22
      IF (IUNIT .NE. 0) GO TO 20                                        BC    23
      STOP                                                              BC    24
   20 CONTINUE                                                          BC    25
      IF (IUNIT .NE. 54) OPEN (IUNIT, FILE = IPATH)                     BC    26
C      THE FOLLOWING LINE IS THE ONLY EXTENSION TO FORTRAN 77 STANDARDS BC    27
C      IN THIS SOURCE CODE. IN ORDER TO CREATE A METAFILE FOR PLOTTING  BC    28
C      PURPOSES, THE LINE WILL NEED TO BE UNCOMMENTED AND POSSIBLY      BC    29
C      REWRITTEN TO MEET THE SPECIFICATIONS OF YOUR COMPUTER SYSTEM.    BC    30
C     IF (IUNIT .EQ. 54) OPEN (IUNIT, FILE = IPATH, FORM = 'BINARY')    BC    31
      GO TO 10                                                          BC    32
C                                                                       BC    33
   99 RETURN                                                            BC    34
  100 FORMAT(A,A,80A)                                                   BC    35
      END                                                               BC    36
```

```
      SUBROUTINE PLOTS (I1,I2,I3)                                       BD     1
      RETURN                                                            BD     2
      END                                                               BD     3
      SUBROUTINE NEWPEN (IPLT)                                          BD     4
      RETURN                                                            BD     5
      END                                                               BD     6
      SUBROUTINE PLOT (XXZE,YYZE,IP1)                                   BD     7
      RETURN                                                            BD     8
      END                                                               BD     9
      SUBROUTINE SYMBOL (ORGX,ORGY,CHRZ,ITL1,IDUM,FPS1,IS1)             BD    10
      RETURN                                                            BD    11
      END                                                               BD    12
      SUBROUTINE NUMBER (XL,YL,CHRSZ,OZL,ANGD,IDG)                      BD    13
      RETURN                                                            BD    14
      END                                                               BD    15
```

1. REPORT NO. | 2. | 3. RECIPIENT'S ACCESSION NO.

4. TITLE AND SUBTITLE User's Manual for OZIPM-4 (Ozone Isopleth Plotting with Optional Mechanisms/Version 4): Volume 2: Computer Code	5. REPORT DATE
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO. EPA-450/4-89-009b
9. PERFORMING ORGANIZATION NAME AND ADDRESS U. S. Environmental Protection Agency Office of Air Quality Planning and Standards Research Triangle Park, NC 27711	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED Final
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

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16. ABSTRACT

This document lists the OZIPM-4 program and describes modifications necessary to run the program on several different computers.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Ozone Photochemical modeling VOC control strategies		

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS (*This Report*) Unclassified	21. NO. OF PAGES 173
	20. SECURITY CLASS (*This page*) Unclassified	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE