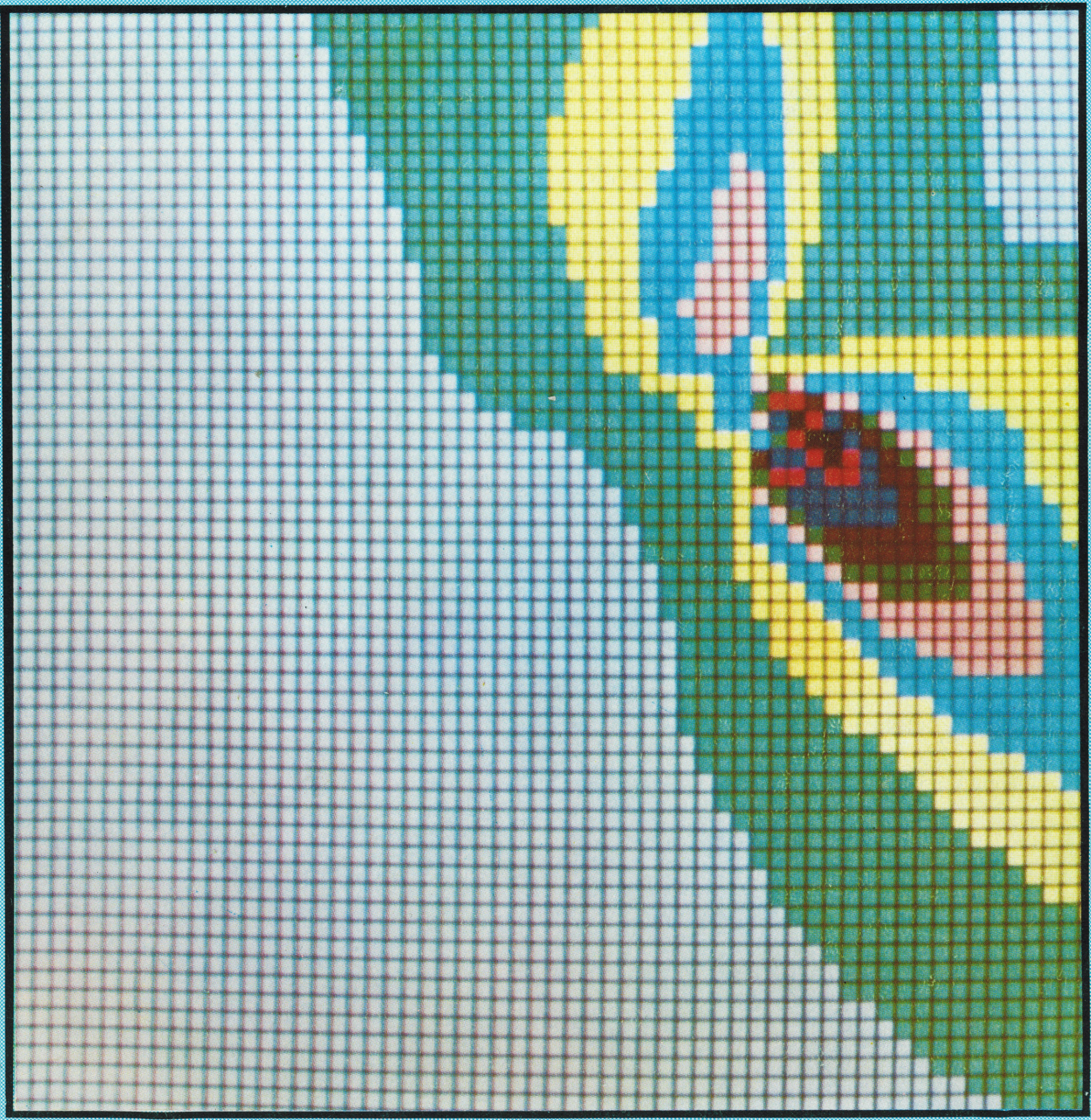
FINAL REPORT

Air pollution dispersion and prediction model for Shuaiba Industrial Area

EES-45

Volume IV — Software User's Manuals



SUBMITTED TO: SHUAIBA AREA AUTHORITY

KUWAIT INSTITUTE FOR SCIENTIFIC RESEARCH
P. O. BOX 24885 SAFAT
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The cover picture provides a graphic representation of the ground level NO_x concentration field in the Shuaiba region as simulated by a numerical diffusion computation; darker colors indicate higher concentrations. This picture was produced using the HAZIENDA image processing system at the Kuwait Scientific Center of IBM. We thank Mr. Jesus Rueda of IBM for the preparation and the production of this picture.

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FINAL REPORT

AIR POLLUTION DISPERSION AND PREDICTION MODEL FOR SHUAIBA INDUSTRIAL AREA

VOLUME IV – SOFTWARE USER'S MANUALS

EES-45

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SUBMITTED TO
SHUAIBA AREA AUTHORITY

"RESTRICTED"

KUWAIT INSTITUTE FOR SCIENTIFIC RESEARCH
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AUGUST 1983

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Preface

This report is Volume IV of a five-volume final report to the SAA for the project "Air Pollution Dispersion and Prediction Model for Shuaiba Industrial Area", EES-45. These five volumes contain:

- I - Executive Summary
- II - Technical Report
- III - Special Studies and Appendices
- IV - Software User's Manuals (this volume)
- V - Data and Program Listings

Volume IV contains the software user's manuals for all the computer programs developed or applied in this study. Such programs have been divided into four categories, according to their different use. The categories are:

1) Data analysis (presented in Section 1)
2) Model input preparation (presented in Section 2)
3) Diffusion models (presented in Section 3)
4) Data Base (presented in Section 4)

The listing of all these programs has been also provided separately to SAA.

TABLE OF CONTENTS

1. PROGRAMS FOR DATA ANALYSIS

These main types of data analysis programs have been specifically written for this study. They perform

1) data entry, formatting and checking
2) analysis of meteorological and emission data
3) computation and display of wind and stability

The above three categories of programs are fully described in the following subsections.

1.1 Data Entry, Formatting and Checking

1.1.1 Programmers

Mane Al-Sudairawi

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1.1.2 General Description

This manual briefly describes and informs the programs' user about

1) the reading of the data and their rewriting in formatted output files
2) the checking of the entered data by comparing hand with computerized data summation.

The data entered and checked were mainly: the Kuwait International Airport (KWI) hourly meteorological data, mixing heights, inversions; air quality data of the SAA monitoring stations (station 1, 2, 3); emission data; high volume and impinger samplers data; and tethersonde data. Three programming languages were used: FORTRAN, APL and ASSEMBLER. All APL programs are grouped in the APL workspace named DATA.

1.1.3 Program List

AIREXTR	APL
AIRSKPMS	APL
CHBHAQ	FORTRAN
CHHVL	FORTRAN
CHKKW	FORTRAN
CHKMW	FORTRAN
CHTKW	FORTRAN
DEFSCREN	ASSEMBLY
FOEMI	FORTRAN
FOHAQ1	FORTRAN
FOHAQ2	FORTRAN
FOINV	FORTRAN
FOMET	FORTRAN
FOMIX	FORTRAN
FO24AQ	FORTRAN
INVEXTR	APL
INVSKPMS	APL
MEXTR	APL
MIXEXTR	APL
MSKIPMISS	APL
MXSKPMS	APL
READFILE	APL
RWHVL	FORTRAN
RWMET	FORTRAN
RW24AQ	FORTRAN
TETH	FORTRAN

1.1.4. General Description of the Programs

A brief description and user's instructions to run these programs are presented below:

Program : AIREXTR

Language: APL

The AIREXTR function executes the CMS data file (previously read by the READFILE function) of the hourly air quality data into numerics. It gives error messages if the field being executed is not numerical, and if the station number, hour and day in the data file is not incremented properly.

Syntax : R NDAYS AIREXTR MAT

Where : NDAYS : is the number of days in the month

MAT: is the air quality data file read by the READFILE function

Program : AIRSKPMS

Language: APL

This function excludes the missing data of the air quality data if the computed percentage of missing data is equal to or greater than a certain value specified by the user. It also provides daily summations of hourly data, to be used for checking the data entry, in the global variable sum.

Syntax : R P AIRSKPMS MAT

Where : P.: is the percentage of missing data to be specified by the user.

MAT : is the hourly air quality data (output of AIREXTR function)

R : is the output of the AIRSKPMS function (hourly air quality data excluding missing data if the above condition is met).

Program: CHBHAQ

Language: FORTRAN

This program formats and writes the code for missing data (9.99) of the hourly air quality data file.

CHANGE EXEC can be used to run this program. The input in this exec is defined as unit 5 and is the hourly air quality data. The output is defined as unit 6, which is the formatted air quality file with the value of 9.99 written in the numerical field.

Program : CHHVL

Language: FORTRAN

This program is used to provide summations of high volume sampler data to be used for checking the data entry. The input data is the entered hi-volume sampler data file. The exec used is CHECK EXEC in which the input is defined as unit 5 and the output as unit 6, which is the summation to check the data entry.

Program: CHKKW

Language: FORTRAN

This program provides summations to check the wind data entry of KWI (averages of last 10 minutes).

The exec for running CHKKW program is CHECK EXEC. It specifies the input as unit 5 (KWI wind data). The output (unit 6) is the summation of this data to be used for checking.

Program : CHKMW

Language : FORTRAN

This program provides summations to check the hourly wind data files of the Mina Al-Ahmadi station.

CHECK EXEC is used to run CHKMW. The input defined as unit 5 is the Mina Al-Ahmadi wind data file. The output (unit 6) is the summation to be used to check the wind data.

Program : CHTKW

Language : FORTRAN

This program is used to change local to GMT time for the KWI wind data files (last 10 minutes averages).

The EXEC used to run this program is CHECK EXEC. The input (unit 5) is the KWI wind data file. The output (unit 6) is the KWI wind data in GMT time.

Program : DEFSCREN DEFSCREN

Language : ASSEMBLER

This program can be used to define a screen for general data entry. To use this program, the following steps need to be taken:

1. Copy DEFSCREN DEFSCREN A into f_n DEFSCREN A where f_n is any file name.
2. Edit f_n DEFSCREN A and prepare the data fields
3. Enter DEFSCREN f_n

4. Enter f_n f_{nl} f_{tl} f_{ml}

where f_n is the file name specified in step 1; f_{nl}, f_{ml} is any CMS file ID where data should be entered. The result is a CMS file with underscored characters where data should be entered.

Program: FOEMI

Language: FORTRAN

This program prepares the formatted structure of a CMS file to be used for entering the emission data.

No input is needed. To run this program,FORMAT EXEC must be used.

Output formatted file of the emission data is defined in unit 6.

Program: FOHAQ1

Language: FORTRAN

This program prepares the formatted structure of a file to be used for entering the hourly averages of the air quality data for stations 1, 2 and 3,

No input is needed. To run this program, FORMAT EXEC is used and the output is formatted in the file as unit 6.

Program: FOHAQ2

Language: FORTRAN

This program prepares the formatted structure of a file to be used to enter the hourly averages of air quality data for only one station.

No input is needed. FORMAT EXEC is used to run the FOHAQ2 program. The output with the formatted file (air quality data files) is defined in unit 6.

Program: FOINV

Language: FORTRAN

This program prepares the formatted structure of a file to be used for entering the inversion data.

No input is needed. To run FOINV, use FORMAT EXEC where the output formatted file is defined as unit 6.

Program: FOMET

Language: FORTRAN

This program prepares the formatted structure of a file to be used to enter the KWI hourly meteorological data.

No input is needed. FORMAT EXEC is used to run this program. The output, which is the formatted file, is defined as unit 6.

Program: FOMIX

Language: FORTRAN

This program prepares the formatted structure of a file to be used for entering the daily mixing height data.

No input is needed. FORMAT EXEC is used to run this program. The output formatted file is defined as unit 6.

Program: INVEXTR

Language: APL

This function executes the inversion data CMS file, previously read by the READFILE function, into numerical data. It gives error messages if the field being executed is not numerical and if the day or month in the data files is not incremented properly.

Syntax: R← INVEXTR MAT

Where: MAT: is the output of the READFILE function, which is the inversion data (character matrix).

R: is the inversion data (numerics).

Program: INVSKPMS

Language: APL

This program excludes missing inversion data if the computed percentage of missing data is greater than or equal to a certain value specified by the user. It also provides monthly summation output stored in the global variable SUM.

Syntax: R←PERC INVSKPMS MAT

Where: PERC: is the percentage of missing data to be specified by the user.

MAT: is the output of the INVEXTR function (numerical inversion data).

R: is the inversion data excluding the missing data if this condition is met.

Program: MEXTR

Language: APL

This program executes the hourly meteorological data read by READFILE function into numerics. It signals an error message if the field being executed is not a number.

Syntax: B NDAY MEXTR A

Where: NDAY: is the number of days in the month

A: is the output of the READFILE function, which is the hourly meteorological data file.

R: is the hourly meteorological data (numerical).

Program: MIXEXTR

Language: APL

This program executes the mixing height file, previously read by the READFILE function, into numerical data. It gives a global variable SUM with the monthly summation for one year to be used for checking data entry. This program gives error messages if the field being executed is not a number or if the day or month is not being incremented properly in the data file.

Syntax: R MIXEXTR MAT

Where: MAT: is the output of the READFILE function that has the mixing height file.

R: is the numerical mixing height data.

Program: MSKIPMISS

Language: APL

This program excludes the missing hourly meteorological data if the computed percentage of missing data is greater than or equal to a certain value specified by the user.

Syntax: R PERC MSKIPMISS A

Where: A: is the output of the MEXTR function (numerical hourly meteorological data).

PERC: is the percentage of missing data to be specified by the user.

R: is the meteorological data excluding those missing if this condition is met.

Program: MXSKPMS

Language: APL

This program excludes missing data of mixing height if the computed percentage of missing data is greater than or equal to a certain value to be specified by the user.

Syntax: R PERC MXSKPMS A

Where: A: is the output of the MIXEXTR function (numerical data of mixing height).

PERC: is the percentage of missing data to be specified by the user.

R: is the mixing height data excluding missing data if this condition is met.

Program : READFILE

Language: APL

This program reads the hourly meteorological file.

Syntax: A ← LEN READFILE FNAME

Where : LEN: is the record length of the CMS file.

FNAME: is the CMS file ID (between quotes).

Output result is stored in the character matrix A (two-dimensional array, of dimensions = number of records, record length).

An error message will appear if sharing of variable fails, or if the CMS file does not exist. If this occurs, the program must be returned and the CMS file ID must be checked.

Program: RWHVL

Language: FORTRAN

This program reads the high volume sampler data and writes it in a formatted data file.

The exec used to run this program is REAWRI EXEC, where input is defined as unit 5 and output as unit 6.

Program: RWMET

Language: FORTRAN

This is a program used to read the hourly meteorological data file (obtained from the KISR Engineering Department for 1977), and writes it in the formatted meteorological file. REAWRI EXEC is used to run this program. The input data is defined as unit 5 and the output as unit 6.

Program: RW24AQ

Language: FORTRAN

This program is used to read the 24 hour averages of air quality data and writes them in a formatted data file.

The exec used is REAWRI EXEC. The output (unit 5) is the air quality formatted file. The output (unit 6) is the 24 hour average air quality formatted data file.

Program: TETH

Language: FORTRAN

This program reads the tethersonde data and writes it in a formatted file.

TETH EXEC is used to run this program. The tethersonde input data is defined as unit 5 and the output formatted data file as unit 6.

1.2 Analysis of Meteorological and Emission Data

1.2.1 Programmers

Nasser El-Karmi

Maha Kortom

Nazik Al-Madani

1.2.2 General Description

This section contains information about available programs developed to do simple data analysis and plotting. The data analysis has been carried out using an advanced statistical package (SAS, Statistical Analysis System). The plotting programs to display the data analysis results were implemented on the HP 9825A computer in the EES Division.

The analysis of data mainly produced statistical tables of mean, standard deviation, minimum, maximum, range and percentage of missing data. The data analyzed were meteorological, air quality and emission data. Two types of parameters were analyzed: continuous and discontinuous.

The programming languages used were SAS, FORTRAN and the HP Language.

1.2.3 Program Lists

Data Analysis

AIRD1	SAS
AIRD	FORTRAN
DMYS	SAS
BAR	SAS
EM	FORTRAN
EM	SAS
EM1	SAS
MANA1	FORTRAN
STB	FORTRAN

Plotting Programs

I	(HP)
O	(HP)

1.2.4 General Description of Programs

1.2.4.1 Data Analysis Programs

Program : AIRD1

Language: SAS

This program makes daily analyses of the hourly air quality data. The results are statistical tables of a selected air quality parameter for one station for a given month. The output table contains the following information: daily averages, standard deviations, maximums, minimums, the hours at which the minimum and the maximum occurred, the data range, and the percentage of missing data.

To run this program the following command must be issued:

SAS AIRD1

The input to this program is the output of AIRD FORTRAN. It has the hourly air quality data for one station.

For any run of this program, proper modifications should be made. The CMS file ID of the input file should be modified in the second statement in the program. The parameter name to be analyzed should be changed whenever it occurs in the program. All parameter names are defined in the first INPUT statement. The output analysis is the CMS file AIRD1 LISTING.

Program: AIRD

Language: FORTRAN

This program extracts the hourly air quality data from the corresponding formatted file and writes them in three output files for stations 1, 2 and 3.

To run this program AIRD EXEC must be used. The input file is defined as unit 5. The three output files for stations 1, 2 and 3 are defined as units 10, 11 and 12. Each output file may contain some parameters different from the others.

Program: DMYS

Language: SAS

This program makes daily, monthly, yearly, seasonal, (winter starts December the previous year), and seasonal daily cycle tables for a certain continuous meteorological parameter of the hourly meteorological data files.

To run this program the following command must be issued:

SAS DMYS

The input to this program is the output of the MANAI FORTRAN program, which extracts the hourly data from the hourly meteorological data files. The meteorological input to the DMYS SAS program contains one year's data from December of one year through November of the following year. The output analysis is written in the DMYS LISTING file. Moreover, 13 CMS files are also produced having the names MASTERxx DATA, where xx is a number from 1-13. These output files are used for plotting analysis results. Each file contains the following: average, standard deviation, maximum, minimum, average + standard deviation, average-standard deviation. MASTER1 through MASTER12 contains the daily analysis for months 1-12. MASTER13 has the monthly analysis for the analyzed year.

To prepare for each run, the parameter name to be analyzed for a certain station should be modified wherever it occurs in the program. The parameter names of the station should be modified in the first INPUT statement. The second statement specifies the input CMS file ID. The year in the first IF statement should be the previous year. For the following IF statement, the number of days specified for months Feb. to Dec. should be modified according to the number of days in February. The year in the IF statement "IF YEAR = 1979 THEN DELETE" should always be the present year. All titles of tables in the TITLE statements should also be modified accordingly.

Program: BAR

Language: SAS

This program analyzes the discontinuous variables wind direction and stability. It displays results as bar charts and in tabular form. The results reflect the frequency percentage of occurrence of certain wind direction sectors and stability classes.

To run this program the following command must be issued:

SAS BAR

The input to this program is the hourly stability classes for one year extracted from the CRESTER preprocessor output by the STB FORTRAN program or the hourly wind direction values. The output is the bar chart and the frequency table written to BAR LISTING file. It is important to modify the variable name for which the analysis is to be made for whenever it is needed.

Program: EM

Language: FORTRAN

This program extracts the emission rate of a certain pollutant emitted from the various companies at SIA.

To run this program EM EXEC must be used. The input defined as unit 5 is the output of EEDLT FORTRAN. The output is written in unit 6 and has the pollutant code, company code and the emission rate of the pollutant.

Program: EM

Language: SAS

This program makes a statistical analysis of the emission data. The results are prepared in tabular form, with mean, standard deviation, minimum, maximum and range for each pollutant (five pollutants) for all companies.

To run this program the following command must be issued:

SAS EM

The input file to this program is the emission data of each pollutant from all companies. That is, the five output files of the program EM FORTRAN appended together in sequence.

The output statistical table is produced for each pollutant from all companies.

Program : EMI

Language: SAS

This program produces a statistical analysis and tables (mean, standard deviation, minimum, maximum, range) for a certain pollutant for each company.

To run this program the following command must be issued:

SAS EMI

The input to this program is the emission data output of the EM FORTRAN program. The output is the emission data analysis for a certain pollutant emitted from each company.

Program : MANA1

Language: FORTRAN

The MANA1 program extracts the hourly meteorological data for the present year of analysis and for December of the previous year. To run this program, MANAI EXEC must be used. Thirteen data input files are defined as units 10 to 22. These are the formatted one-year hourly meteorological files. The input file SEASON INPUT A is needed for the run and is defined as unit 4. This file has the four season names: WINTER, AUTUMN, SPRING AND SUMMER.

The output (unit 6) contains the hourly meteorological data.

Program : STB

Language: FORTRAN

This program extracts the hourly stability data from the CRSTER preprocessor program output.

To run this program, STB EXEC must be used. The input file (unit 5) is the output of the FORTRAN program PROCREAD, which reads the preprocessor unformatted output. The output hourly stability values for one year is defined as unit 6,

1.2.4.2 Plotting Program

A program has been implemented on the HP 9825A computer to make yearly plots using the monthly data analysis results of the continuous meteorological parameters.

The plot consists of five curves. These curves correspond to the following values:

- average
- maximum
- minimum
- average + standard deviation
- average - standard deviation.

The plotting program number is 1. Another program named 0 can be used to enter the data to be used for plotting. To run these programs, the program should be loaded and run. Both programs are interactive to let the user enter the input data. For example, 0 asks the parameter code, year, average, standard deviation, maximum and minimum values. Program 1 asks the input file data number to be used to make the plot.

1.3 Computation and Display of Wind and Stability

1.3.1 General Description

Programs written in APL language that compute the percentage frequency of occurrence of specific defined categories of wind speed (ranges) and wind direction (sectors) are now available in the workspace ROSES in machine EES103 of the KISR IBM computer. Similar analyses are made for atmospheric stability (classes) and wind direction (sectors).

Analyses of wind and stability patterns in Kuwait are displayed in tabular form (APL), and as wind and stability roses using the Tektronix (FORTRAN) package available in the Engineering Department in KISR.

The wind frequency computation uses the Kuwait International Airport (KWI) hourly meteorological data as input. Computations of the hourly atmospheric stability classes utilize the output of the modified version for Kuwait of the CRSTER preprocessor (FORTRAN program developed for the U.S. EPA).

Detailed technical description of the input data, computational methods and display techniques used can be found in a report already submitted to SAA as part of this project (KISR 844, Appendix B, abstract enclosed in Section 4 of Volume III of this final report).

1.3.2 Computations of Frequency Percentages of Wind and Stability in Kuwait

1.3.2.1 Programmer

Nazik Al-Madani

1.3.2.2 Language

APL

1.3.2.3 Main Programs and Subroutines list

Main Programs:

STAVG

STDOIT

SWRDOIT

WRAVG

WRDOIT

YWRDOIT

Subroutines:

MEXTR

READFILE

SSTTABLE

STEXTR

STROSES

STTABLE

SWRTABLE

WRIN

WROSES

WRITE

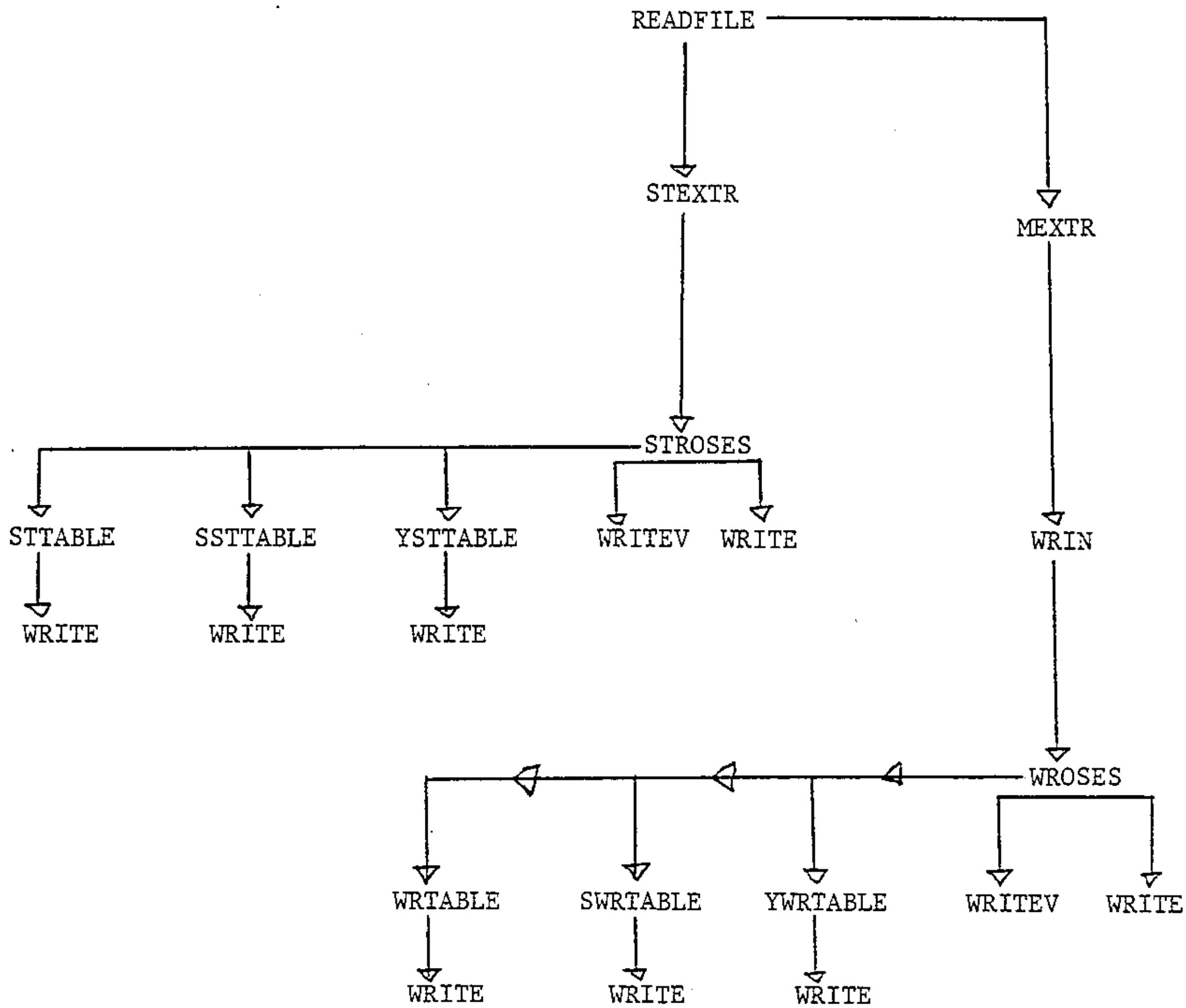
WRITEV

WRTABLE

YSTTABLE

YWRTABLE

1.3.2.4 Calling Hierarchy



1.3.2.5 General Description of Main Programs

Function: STAVG

This function averages previously computed stability frequency information either monthly, seasonally or yearly for a certain number of record years.

Syntax: STAVG

Where : The input to STAVG are CMS files prepared as input to the stability roses display program (STROSES FORTRAN A). The CMS file IDs are entered between quotes in lines 5, 6 or 7. More lines need to be inserted if more CMS files are to be used. Depending on the number of CMS files entered as input, statement 12 or 13 is used or modified. Also, statement 20 or 21 is used or modified. For example, if two input files are used, statements 13 and 21 are used. If three input files are used, statements 12 and 20 are to be used. The function called in statement 28 depends on the analysis type: i.e., if monthly, seasonal or yearly. Therefore, the functions called should be STTABLE, SSTTABLE or YSTTABLE.

The output is an averaged (monthly, seasonal or yearly) stability frequency table and input for the stability roses program both written in CMS files. FILE IDs to be specified by the user in an interactive mode.

Subroutines used are:

READFILE: read the input in CMS files.

STTABLE/SSTTABLE/YSTTABLE: Construct the monthly/seasonal/yearly stability frequency tables.

WRITE/WRITEV: Write the output stability frequency table, and prepare the input to the stability roses display program in CMS files.

Function: STDOIT

This function makes monthly, yearly and seasonal (winter starts with December of the previous year) stability frequency analyses. It displays results in tabular form and prepares the input file in the format needed by the stability roses display program.

Syntax: P STDOIT FID

Where: P: is a vector of two elements: Number of days in February, and number of days in the present year of analysis.

FID: The CMS file ID (between quotes) of the preprocessor output for one year of record.

Hourly wind direction values are obtained from the flow vector (which specifies the direction towards which the wind is blowing) by shifting it by 180°. In this function, the seasonal analysis is optional. If needed, the user should specify the previous year CMS file ID and its P vector. This is done interactively. Output CMS file IDs are required to be entered in the same mode.

Output is written in CMS files and these are monthly, yearly and seasonal (optional) frequency tables and the prepared input to the stability roses display program.

Subroutines used are:

READFILE: reads the output file of the preprocessor.

STEXTR: executes the data into numerics.

STROSES: makes stability frequency computations.

STTABLE/SSTTABLE/YSTTABLE: construct the monthly/seasonal/yearly stability frequency tables.

WRITEV/WRITE: write the output in CMS files.

Function: SWRDOIT

This function makes wind frequency computations and writes the frequency table and the input to the display program of the wind roses (WROSES FORTRAN A) in CMS files.

Syntax: SWRDOIT

Where: The function allows the user to enter the three CMS file IDs of the hourly meteorological data in an interactive mode. The two output files of the season are also written in CMS files, in which the users specify their IDs in an interactive mode.

Subroutines used are:

READFILE: reads the input files.

MEXTR: executes the data into numerics.

WRIN: prepares the wind data for the frequency computations.

WROSES: makes the frequency computations.

SWRTABLE: constructs the seasonal wind frequency table.

WRITEV/WRITE: writes the seasonal frequency table and the input to the wind roses program in two CMS files.

Function: WRAVG

This function averages previously computed wind frequencies written in CMS files (monthly, seasonal or yearly) for a certain number of years. The averaged wind frequency table and the corresponding input file for the wind roses display program are both written in CMS files.

Syntax: WRAVG

The input files to this function are those files prepared to be the input for the wind roses program. CMS file IDs are entered (between quotes) in lines 5, 6 or 7. More lines could be inserted if more input files are needed to be averaged. Statement 12 or 13 is used or modified depending on the number of input CMS files. Also, statement 19 or 20 is used or modified accordingly. For example, if two input files are used, statements 13 and 20 are used. If three input files are entered, then statements 12 and 19 should be used. The function executed in statement 29 to construct the frequency table depends on the kind of analysis to be made (monthly, seasonal or yearly). Therefore, statement 29 should call either the STTABLE, SSTTABLE OR YSTTABLE function.

Function: WRDOIT

This function makes one-month wind frequency analysis computations, and writes the output in two CMS files. One file is the wind frequency table, and the other one has the wind frequency information to plot the wind roses.

Syntax: TINF WRDOIT FNAME

Where: TINF: is a three element vector that has the following: the year, month, and no. of days in the month of the hourly meteorological file.

FNAME: is the CMS file ID of the meteorological data file (between quotes).

Subroutines used are:

READFILE: reads the CMS meteorological file.

MEXTR: transfers read file into numerical data.

WRIN: prepares the wind data for the frequency analysis.

WROSES: makes the wind frequency computations.

WRTABLE: constructs the monthly frequency table.

WRITEV/WRITE: writes the frequency table and the input for the wind roses display program in two CMS files.

Function: YWRDOIT

This function makes monthly (12 months), and yearly (1 year) wind frequency analyses and writes the output in CMS files (tables and input for the wind roses program).

Syntax: YWRDOIT

Where: The input files (hourly meteorological data) are to be entered by the user in an interactive mode. The output files (13 frequency tables and 13 input files for the wind roses program) are all written in CMS files specified by the user interactively.

Subroutines used are:

WRDOIT: makes the frequency computations.

WRTABLE/YWRTABLE: constructs the monthly/yearly wind frequency table.

WRITEV/WRITE: writes the output in CMS files.

1.3.2.6 Description of Subroutines

Function: MEXTR

This function executes the read meteorological files by the READFILE function into numerical data.

Syntax: B ← NDAY MEXTR A

Where: N DAY: is the number of days in the month.

A: is the output of the READFILE function.

B: is the numerical meteorological matrix.

This function gives an error message if the field being executed is not a number. If an error message is signalled, the CMS meteorological file must be checked.

Function: READFILE

This function reads the hourly meteorological file.

Syntax: A ← LEN READFILE FNAME

Where: LEN: is the record length of the CMS file.

FNAME: is the CMS file ID (between quotes).

Output result is stored in the character matrix A (two-dimensional array, of dimensions = number of records, record length).

An error message will appear if sharing of variable fails, or if the CMS file does not exist. If this occurs, the program must be rerun and the CMS file ID must be checked.

Function: SSTTABLE

This function constructs the seasonal stability frequency table.

Syntax: R ← SSTTABLE MAT

MAT: is the output of the STROSES function, which is percentage frequency computations (FREQT).

R: is the frequency table

This function allows the user to specify the meteorological station, season and year of record in an interactive mode.

Function: STEXTR

This function executes the stability and the flow vector into numerical data.

Syntax: R ← YNDAY STEXTR MAT

Where: YNDAY: is the number of days in the year of record.

MAT: is the output of the READFILE function.

R: is a vector that has the following: number of days in the year times 24, hourly stability values, hourly flow vector values, number of wind direction sectors and, finally, number of stability classes.

Function: STROSES

This function computes the percentage frequency of occurrence of concurrent stability classes and wind direction sectors. It also prepares the input data needed by the FORTRAN program that plots the stability roses.

Syntax: FREQT ← STROSES IN

Where: IN: is a vector (output of the STEXTR function) with this information: number of days in the year times 24, hourly stability values, hourly wind direction values, number of wind direction sectors, and number of stability classes.

FREQT: is the output frequency computations. The STROSES function has two global variables (Z and FMFREQ) that will be written by WRITEV and WRITE functions in a CMS file. Z is a vector that has these elements:

maximum value of cumulative frequency for each wind direction sector that may occur in the frequency table and number of circles to be specified to plot the stability roses. FMFREQ is the frequency information.

This program gives an error message if the total number of elements in the vector IN is wrong.

Function: STTABLE

This function constructs the monthly stability frequency table.

Syntax: R ← STTABLE MAT

MAT: is the output of the STROSES function (frequency computations stored in FREQT).

R: is the output constructed frequency table.

This function allows the user to specify the meteorological station, month and year of record in an interactive mode.

Function: SWRTABLE

This function constructs the wind frequency table.

Syntax: R ← SWRTABLE MAT

Where: MAT: is the output of WROSES function (FREQT).

R: is the constructed seasonal wind frequency table.

This program allows the user to specify the meteorological station, season and year in an interactive mode.

Function: WRIN

This function prepares the input for the frequency computations to be made by WROSES.

Syntax: R ← WRIN MAT

Where: MAT: is the hourly meteorological numerical data for one month (i.e., output of MEXTR).

R: is a vector that has the following: percentage of missing data, total number of wind records, number of valid records, wind speed values, wind direction values, number of wind direction classes, number of wind speed classes, and wind speed separator values.

Function: WROSES

This function makes the monthly frequency analysis and prepares the information to be used by the wind roses plotting program.

Syntax: FREQT ← WROSES IN

Where: IN : is the output file prepared by the WRIN function.

FREQT: is the output wind frequency computations.

This program gives an error message if the number of elements in the input vector IN is wrong.

Function: WRITE

This funciton writes any two-dimensional character matrix in a CMS file.

Syntax: DSNAME WRITE DATA

Where: DSNAME: is the CMS file ID (between quotes).

DATA: is the character matrix. The character matrix of FREQT and FMFREQ are written in CMS files using this function.

This function gives the user an option to print or stop the execution of the function if the CMS file specified is an existing file.

Function: WRITEV

This function writes a character vector in a CMS file.

Syntax: DSNAME WRITEV DATA

Where: DSNAME: is the CMS file ID (between quotes).

DATA: is the character vector. The vector Z is written by WRITEV.

This function gives you the option to stop the execution of the function if the specified CMS file is an existing one.

Function: WRTABLE

This function constructs the monthly wind frequency table.

Syntax: R ← WRTABLE MAT

Where: MAT is the output the WROSES function (frequency computations).

R: is the monthly frequency table.

The user should specify meteorological station, month and year in an interactive mode.

Function: YSTTABLE

This function constructs the yearly stability frequency table.

Syntax: R ← YSTTABLE MAT

MAT: is the output of the STROSES function, which is the frequency computations.

R: is the output yearly stability frequency table.

This function allows the user to interactively specify the meteorological station and the year.

Function: YWRTABLE

This function constructs the yearly wind frequency table.

Syntax: R ← YWRTABLE MAT

Where: MAT: is the output of WROSES (FREQT).

R: is the yearly wind frequency table.

User should specify meteorological station and year. interactively.

1.3.3 Display Programs of wind and stability roses

1.3.3.1 Programmer

Maha Kortom

1.3.3.2 Language

FORTRAN

The Tektronix package available in the Engineering Department were used.

1.3.3.3 Program Lists

WROSES FORTRAN A

STROSES FORTRAN A

1.3.3.4 Description and Run of Programs

The WROSES and STROSES programs plot wind and stability roses. The input to WROSES and STROSES are the CMS files prepared in APL by WROSES and STROSES, respectively (i.e., Z and FMFREQ). The expected maximum value of total frequency that may occur for any wind direction sector is considered to be 65, 55 and 45%, with the number of circles to be 13, 11, and 9 for the monthly, seasonal and yearly roses, respectively. Any modifications needed can be made in line 63 of the WROSES function and line 57 of the STROSES function.

The output is the display of wind and stability roses that can be printed by the Tektronix facility located in the Engineering building in KISR.

To run the programs WROSES and STROSES, two exec programs were prepared: WROSES EXEC A and STROSES EXEC A. In both execs the input files are defined as channel number 4 and could be modified whenever needed.

2. MODEL INPUT PREPARATION

2.1 Programmers:

Nazik Al-Madani

Mariam Al-Attiah

2.2 General Description

The meteorological and emission data for both the ISC short and long term models have been prepared by programs written in the APL and FORTRAN languages. The meteorological input for the ISC short term is the output of the CRSTER Preprocessor FORTRAN program. APL programs in the workspace PREPROC have been developed to prepare the meteorological data input for the Preprocessor. The meteorological input for the ISC long term is prepared by APL programs in the workspace LTERM. The emission data required by the ISC short and long term models are prepared by FORTRAN programs.

2.3 Data Preparation for the ISCLT Model

2.3.1 Meteorological Data

2.3.1.1 General Description

The ISCST meteorological input can be used by the model as the CRESTER Preprocessor unformatted output. The Preprocessor uses the following information as input: ceiling height, wind direction, wind speed, temperature, cloud cover, daily mixing height, latitude, longitude and time zone. It calculates and provides one-year hourly values of atmospheric stability wind speed, wind flow vector (the direction towards which the wind is blowing), randomized flow vector, temperature, and urban and rural mixing heights (see Table 2-1). The Preprocessor program CRSMETK FORTRAN is a modified version for Kuwait where the wind direction random variation is modified to be between -10 and +12, since the KIA wind direction is measured within an accuracy of 22.5 degrees.

TABLE 2-1. PREPROCESSOR OUTPUT FILE RECORD DESCRIPTION

Position of Variable Within the Record	Variable Name	Fortran Variable Type	
1	IYEAR	INTEGER	Year of record (last two digits)
2	IMONTH	INTEGER	Month
3	DAY1	REAL	Julian Day
4-27	KST	INTEGER	Array of 24 Stability Category Values
28-51	SPEED	REAL	Array of 24 Wind Speed Values ($m\ s^{-1}$)
52-75	TEMP	REAL	Array of 24 Ambient Temperature Values (^{o}K)
76-99	AFV	REAL	Array of 24 Flow Vector Values (degrees)
100-123	FVR	REAL	Array of 24 Randomized Flow Vectors (degrees)
124-171	HLH	REAL	Array dimensioned 2 by 24 containing 24 rural mixing height values and 24 urban mixing height values (m). The values are stored on the record in groups of two for each hour with the rural mixing height first followed by the urban mixing height for that hour

2.3.1.2 Input Definition and Program Run

Two input files are required by the CRSMETK program:

1) A surface meteorological data file that has hourly surface meteorological data for one year (see Table 2-2).

2) Upper data file that has the following:

- 366 random number cards
- initialization card (see Table 2-3)
- hourly mixing height cards starting December 31st of the year preceeding the year of record and ending January 1st of the year following the year of record (see Table 2-4).

The surface data and the hourly mixing height input data are prepared by the APL programs in the workspace PREPROC. The 366 random numbers are on the UNAMAP tape of the U.S. EPA (data set name: RANDOM).

To run CRSMETK, PROC EXEC is used where the surface meteorological file is defined as unit 8 and the upper meteorological input file is defined as unit 5. The output (on unit 9) of this program is written in machine code format.

2.3.1.3 List of Programs in the Workspace PREPROC

Main programs:

MDOIT

MIXDOIT

MIXMISS

MMISS

TABLE 2-2. DATA RECORD FORMAT FOR NCC MAGNETIC TAPES OF CD 144 SURFACE DATA - PREPROCESSOR REQUIRED DATA ONLY.

Record Positions	Format	Description
1-5	I5	NWS Surface Station WBAN Number
6-7	I2	Year of Record (last two digits)
8-9	I2	Month
10-11	I2	Day
12-13	I2	Hour
14-16	3A1	Ceiling Height
17-38	22X	Blank
39-40	I2	Wind direction (tens of degrees)
41-42	I2	Wind speed (knots)
43-46	4X	Blank
47-49	I3	Temperature
50-78	29X	Blank
79	A1	Opaque
80	1X	Blank

TABLE 2-3. PREPROCESSOR INITIALIZATION CARD FORMAT

Card Columns	Format	Description
1-5	I5	NWS Surface Station WBAN Number
6-7	I2	Year of Surface Data
8		Blank
9-18	F10.1	Latitude of the Surface Station (degrees to hundredths)
19-28	F10.1	Longitude of the Surface Station (degrees to hundredths)
29-30	F2.0	Time zone in which the Surface Station is located: 05 = Eastern 06 = Central 07 = Mountain 08 = Pacific
31-34	I4	Number of days in the year of record (365 for non-leap years; 366 for leap years)
35-44	F10.0	Random Number Seed*

*NOTE: The user is cautioned with regard to the random number generator used in the preprocessor program. The subroutine called in this program is entitled RANDU and is provided by Sperry Rand Corporation for use on the Environmental Protection Agency's Univac 1110. The user must contact his system personnel to obtain a suitable alternative to the RANDU subroutine. Because the same random number generator will not be used by all users, the randomized flow vectors may differ when comparing preprocessor file results from two different computers.

TABLE 2-4. PREPROCESSOR MIXING HEIGHT DATA CARD FORMAT.

Card Columns	Format	Description
1-5	I5	NWS Upper Air Station WBAN Number
6-7	I2	Year of record (last two digits)
8-9	I2	Month
10-11	I2	Day
12	1X	Blank
13-17	F5.0	Morning Mixing Height (m)
18-30	13X	Blank
31-35	F5.0	Afternoon Mixing Height (m)

Subroutines:

DCREAT

MEXTR

MIXEXTR

MIXPROC

MPROC

READFILE

WRITE

2.3.1.4 General Description of Main Programs

Function: MDOIT

This function prepares the surface meteorological input file to the CRSMETK FORTRAN program.

Syntax: MDOIT

Where: All input files (12 hourly meteorological data files) are entered by the user in an interactive mode. The user should also specify the year, month and number of days in the month. The output is written to a CMS file specified by the user.

The subroutines used in this function are:

READFILE: reads the hourly meteorological data file.

MEXTR: executes the read file into numerical data.

MPROC: prepares the hourly meteorological surface data in the format needed by the Preprocessor.

WRITE: writes the surface meteorological data in CMS file.

Function: MIXDOIT

This function prepares the hourly mixing height data for the Preprocessor.

Syntax: IN MIXDOIT FID

Where: IN: is a vector that has the following information: year of record (only the last two digits), and the number of days in February.

FID: is the daily mixing height data file entered between quotes.

The subroutines used in this function are:

READFILE: reads the CMS daily mixing height data file.

MIXEXTR: executes the data into numerics.

MIXPROC: prepares the daily mixing height data in the format needed by the Preprocessor.

WRITE: writes the output in a CMS file.

Function: MIXMISS

This function locates the missing data of the mixing height data file. All missing data should be interpolated since the Preprocessor assumes that no missing data exist.

Syntax: MIXMISS MAT

Where: MAT is the daily mixing height data file entered between quotes.

This program prints the month and day where data are missing.

The subroutines used in this function are:

READFILE: reads the daily mixing height data file.

MIXEXTR: executes the data into numerics.

DCREAT: picks the indices (month, day) where missing data occur.

Function: MMISS

This function locates where missing data occurred in the hourly meteorological data file to be interpolated.

Syntax: YNDAY MMISS MAT

Where: NDAY: is the number of days in the month

MAT: is the CMS file ID of the hourly meteorological data file entered between quotes.

The line numbers where missing data for any parameters occur are printed.

The subroutines used in this function are:

READFILE: reads the hourly meteorological data file.

MEXTR: executes the data into numerics.

2.3.1.5 <u>Subroutine General Description</u>

Function: DCREAT

This function creates a matrix that has the indices of a two-dimensional matrix.

Syntax: DD ← DCREAT D

Where: D is a zero matrix of three dimensions. The first and the second dimension of this matrix equals the dimension of the two-dimensional matrix for which the indices are to be found. The third dimension is two.

DD: is a three-dimensional matrix that has the indices of the two-dimensional matrix.

Function: MEXTR

This function executes the hourly meteorological data into numerics. It gives an error message if the field being executed is not a number.

Syntax: B ← NDAY MEXTR A

Where: NDAY: is the number of days of the month

A: is the hourly meteorological data (output of READFILE function).

B: is the hourly meteorological numerical data.

Function: MIXEXTR

This function executes the daily mixing height file into numerical data. It gives error messages if the field being executed is not a number and if the day or month is not incremented properly.

Syntax: R ← MIXEXTR MAT

Where: MAT: is the daily mixing height data file (output of the READFILE function).

R: is the daily mixing height numerical data.

Function: MIXPROC

This function prepares the daily mixing height input to the Preprocessor. It assumes no missing data.

Syntax: OUT ← MIXPROC MAT

Where: MAT: is the daily mixing height data (output of the MIXEXTR function).

OUT: is the daily mixing height data in the format needed by the Preprocessor.

Function: MPROC

This function prepares the hourly meteorological data for one month with the format required by the Preprocessor. It assumes no missing data.

Syntax: RV ← MPROC TINF

Where: TINF: is a vector that has the following: year of record (last two digits), month, number of days in that month.

RV: is the surface hourly meteorological data for one month needed by the Preprocessor.

Function: READFILE

This function reads any CMS file in the APL environment. It gives error messages if the sharing of variables failed or if the CMS file to be read is not an existing one.

Syntax: A ← LEN READFILE FNAME

Where: LEN: is the record length of the CMS file.

FNAME: is the CMS file ID between quotes.

Function: WRITE

This function writes a two-dimensional APL character matrix in a CMS file. It has an option to stop or continue writing if the CMS file is not a new one.

Syntax: DSNAME WRITE DATA

Where: DSNAME: is the CMS file ID (entered between quotes) to write on.

DATA: is the two-dimensional character matrix to be written.

2.3.2 Emission Data

Program : EEDST

Language: FORTRAN

This program prepares the emission data of a certain pollutant emitted from the various companies in the format needed for the ISC short term model.

To run this program EEDST EXEC is used. The input for each run of this program is the emission inventory of a certain company at SIA. The input file is defined as unit 9, and the name of the emission company file is entered as an argument to EEDST EXEC. This program could be run for all companies for a certain pollutant. The results of all runs for this pollutant are written to the output file defined as unit 10 in the EEDST EXEC. The user should enter the pollutant code and the starting and ending number of the emission forms for each company. This is done in an interactive mode.

Each emission card has the following information: Source, number, emission rate, X-coordinate (UTM), Y-coordinate (UTM), stack height, stack exit temperature, stack exit velocity and stack diameter. Each emission if tagged by its company code, stack number, sub-stack number and emission case number in this format:

Column	Parameter
81-82	company code
84-86	stack number
88-89	sub-stack number
91	emission case number

This field from columns 81-91 is not used by the ISC short term model.

2.4 Data Preparation for the ISC Long Term Model

2.4.1 Meteorological Data

2.4.1.1 General Description

The meteorological input required by the ISCLT program is:

- seasonal or annual STAR summaries: A STAR summary is a tabulation of the joint frequency of occurrence of wind speed and wind direction categories, classified according to Pasquill stability categories.
- the ambient air temperature by stability and season.
- the mixing heights of stability and/or wind speed and season.

The method to prepare this meteorological input may be found in Chapters 2 and 4 of the ISC models user's guide.

The meteorological input of the ISCLT program is prepared by an APL program in the workspace LTERM. The input is prepared for the winter (months 1, 2, 3, 11, 12) and the summer (months 4, 5, 6, 7, 8, 9, 10) seasons.

2.4.1.2 Program List

LTDATA, APL
PROCREAD, FORTRAN
READFILE, APL
SEAS, APL
SLTMIX, APL
SLTTEMP, APL
STAR, APL
WRITE, APL

2.4.1.3 General Description of Programs

Function: LTDATA

Language: APL

This function extracts the hourly meteorological data from the Preprocessor output that will be used to provide the meteorological input to the ISCLT model.

Syntax: YNDAY LTDATA DATA

Where: YNDAY: is the number of days in the year.

DATA: is the readable Preprocessor output (output of the PROCREAD program).

The outputs of this function are the global variables:

K S T : hourly stability values

W S P : hourly wind speed values

T E M P : hourly temperature values

W D I R : hourly flow vectors

R M H : hourly rural mixing height values

U M H : hourly urban mixing height values

Program: PROCREAD

Language: FORTRAN

This program reads the unformatted output of the CRSTER Preprocessor and writes it in a readable form.

The exec used to run this program is READP EXEC, where the input file (unformatted output of the Preprocessor) is defined as unit 9. The output is written in a file defined as unit 1.

Function: READFILE

Language: APL

This function reads any CMS file in the APL environment. It gives error messages if the sharing of variables failed or if the CMS file to be read is not an existing one.

Syntax: A ← LEN READFILE FNAME

Where: LEN: is the record length of the CMS file

FNAME: is the CMS file ID between quotes.

Function: SEAS

Language: APL

This function prepares the hourly meteorological data, to be summarized for the ISCLT, as a function of the winter and summer seasons.

Syntax: FEB SEAS DATA

Where: FEB: is the number of days in the month of February.

DATA: is any one of the global variables that are the output of the LTDATA function.

The output of this function is the same global variable used as input except the hourly data are in this order: first winter and then summer.

Function: SLTMIX

Language: APL

This function prepares the urban and mixing height input cards needed by the ISCLT program for each stability and wind speed category for the winter and summer seasons.

Syntax: SLTMIX FEB

Where: FEB: is the number of days in month of February.

The input to this funtion is the global variables R M H and U M H (outputs of the SEAS function).

The output is the two global variables: L U M H (the urban mixing height input of ISCLT program), and L R M H (the rural mixing height input of ISCLT program).

Function: SLTTEMP

Language: APL

This function prepares the temperature, for each stability class and season, to be used as input to the ISCLT model.

Syntax: SLTTEMP FEB

Where: FEB: is the number of days in month of February.

The global variable T E M P (output of the SEAS function) is used as input to this function. The output is stored in the global variable L T E M P.

Function: STAR

Language: APL

This function prepares the STAR summary of the ISCLT program.

Syntax: STAR FEB

Where: FEB: is the number of days in February.

The input to this function is the global variables: K S T, W S P, W D I R (outputs of the SEAS function).

Function: WRITE

Language: APL

This function is used to write the meteorological input to the ISCLT program in CMS files. For a brief description of this program, refer to Section 2.3.1.5.

2.4.2 Emission Data

Program : EEDLT

Language: FORTRAN

This program prepares the emission data cards for the ISCLT program. The exec used to run this program is EEDLT EXEC. The input and output defined in this exec are the same as in the EEDST program, which prepares the emission data for the ISCLT program, except that the emission data are already written in the format required by the ISCLT program. The emission data are also tagged in the manner previously mentioned in Section 2.3.2.

3. DIFFUSION MODELS

As discussed in Section 5 of Volume II of this final report, six diffusion models have been selected and applied for this study. They are:

- ISCST
- ISCLT
- PTMAX
- PTMTP
- CDM
- MC-LAGPAR.

User's instructions on how to apply these models are presented in the following sub-sections. The parts related to ISCST, ISCLT, and CDM have been taken directly from the official user's guide of these models.

3.1 ISCST

The following pages contain Chapter 3 (user's instructions) of the manual:

Bowers et al. (1978) Industrial Source Complex (ISC) Dispersion Model User's Guide, Volumes 1 and 2. EPA-450/4-79-0, 1 (NTIS PB-80-80-133 044, 133 051).

CHAPTER 3

USER'S INSTRUCTIONS FOR THE ISC SHORT-TERM (ISCST) MODEL PROGRAM

3.1 SUMMARY OF PROGRAM OPTIONS, DATA REQUIREMENTS AND OUTPUT

3.1.1 Summary of ISCST Program Options

The program options of the ISC Dispersion Model short-term computer program (ISCST) consist of three general categories:

- Meteorological data input options
- Dispersion model options
- Output options

Each category is discussed separately below.

a. Meteorological Data Input Options. Table 3-1 lists the meteorological data input options for the ISCST computer program. Hourly meteorological data may be input by card deck or by means of the preprocessed meteorological data tape (see Appendix G). If available, site-specific wind-profile exponents and vertical potential temperature gradients may be input for each stability category or for each combination of wind-speed and stability categories. The Rural Mode, Urban Mode 1 or Urban Mode 2 (see Section 2.2.1.1) may be selected by the user. Source-specific entrainment coefficients may also be used in the plume-rise calculations (see Section 2.3). Also, the user may direct the program to calculate plume rise as a function of downwind distance or to assume that the final plume rise applies at all downwind distances. If the wind system measurement height differs from 10 meters, the actual measurement height should be entered.

TABLE 3-1

METEOROLOGICAL DATA INPUT
OPTIONS FOR ISCST

Input of hourly data by preprocessed data tape or card deck
Site-specific wind-profile exponents
Site-specific vertical potential temperature gradients
Rural Mode or Urban Mode 1 or 2
Entrainment coefficients other than the Briggs (1975) coefficients
Final or distance dependent plume rise
Wind system measurement height other than 10 meters

TABLE 3-2

DISPERSION-MODEL OPTIONS FOR ISCST

Concentration or dry deposition calculations
Inclusion of effects of gravitational settling and/or dry deposition in concentration calculations
Inclusion of terrain effects (concentration calculations only)
Cartesian or polar receptor system
Discrete receptors (Cartesian or polar system)
Stack, volume and area sources
Pollutant emission rates held constant or varied by hour of the day, by season or month, by hour of the day and season, or by wind speed and stability
Time-dependent exponential decay of pollutants
Inclusion of building wake and stack-tip downwash effects
Time periods for which concentration or deposition calculations are to be made (1, 2, 3, 4, 6, 8, 12 and 24 hours and N days are possible, where N is the total number of days considered)
Specific days and/or time periods within a day for which concentration or deposition calculations are to be made

b. Dispersion Model Options. Table 3-2 lists the dispersion model options for the ISCST computer program. The user may elect to make either concentration or dry deposition calculations. In the case of concentration calculations, the effects of gravitational settling and/or dry deposition may be included in the calculations for areas of open terrain. Terrain effects may be included in the model calculations if the maximum terrain elevation does not exceed the minimum stack top elevation. In general, the gravitational settling and dry deposition options should not be used in complex terrain (see Sections 2.4.1.2.c and 2.4.3). The user may select either a Cartesian or a polar receptor system and may also input discrete receptor points with either system. ISCST calculates concentration or deposition values for stack, volume and area source emissions. The volume source option is also used to simulate line sources (see Section 2.4.2.3). Pollutant emission rates may be held constant or varied by hour of the day, by season or month, by hour of the day and season, or by wind speed and stability. The effects of time-dependent exponential decay of a pollutant as a result of chemical transformation or other removal processes may also be included in the model calculations (see Section 2.4.1). If a stack is located on or adjacent to a building, the user must input the building dimensions (length, width and height) in order for the program to consider the effects of the building's aerodynamic wake on plume dispersion. The user must select the time periods over which concentration is to be averaged or deposition is to be summed. The user must also select the specific days and/or time periods within specific days for which concentration or deposition calculations are to be made. For example, the user may wish to calculate 3-hour average concentrations for the third 3-hour period on Day 118.

c. Output Options. Table 3-3 lists the ISCST program output options. A more detailed discussion of the ISCST output information is given in Section 3.1.3.

TABLE 3-3

ISCST OUTPUT OPTIONS

Results of the calculations stored on magnetic tape
Printout of program control parameters, souree data and receptor data
Printout of tables of hourly meteorological data for each specified day
Printout of "N"-day average concentration or total deposition calculated at each receptor for any desired combinations of sources
Printout of the concentration or deposition values calculated for any desired combinations of sources at all receptors for any specified day or time period within the day
Printout of tables of highest and second-highest concentration or deposition values calculated at each receptor for each specified time period during an "N"-day period for any desired combinations of sources
Printout of tables of the maximum 50 concentration or deposition values calculated for any desired combinations of sources for each specified time period

The results of all ISCST calculations may be stored on magnetic tape. The user may also elect to print one or more of the following tables:

- The program control parameters, source data and receptor data
- Hourly meteorological inputs for each specified day
- The "N"-day average concentration or "N"-day total deposition calculated at each receptor for any desired combinations of sources
- The concentration or deposition values calculated for any desired combinations of sources at all receptors for any specified day or time period within a day
- The highest and second-highest concentration or deposition values calculated for any desired combinations of sources at each receptor for each specified averaging time (concentration) or summation time (deposition) during an "N"-day period
- The maximum 50 concentration or deposition values calculated for any desired combinations of sources for each specified averaging time (concentration) or summation time (deposition)

It should be noted that a given problem run may generate a large print output (see Section 3.2.5.b). Consequently, it may be more convenient to make multiple program runs for a given problem.

3.1.2 Data Input Requirements

This section provides a description of all input data parameters required by the ISCST program. The user should note that some input parameters are not read or are ignored by the program, depending on what values control parameters have been assigned by the user. Except where noted, all data are read from card images.

a. Program Control Parameter Data. These data contain parameters which provide user-control of all program options.

Parameter Name	
ISW(1)	Concentration/Deposition Option -- Directs the program to calculate either average concentration or total deposition. A value of "1" indicates average concentration and a "2" indicates total deposition. The default value equals "1".
ISW(2)	Receptor Grid System Option -- Specifies whether a right-handed rectangular Cartesian coordinate system or a polar coordinate system is used to reference the receptor grid. A value of "1" indicates the Cartesian coordinate system, and "2" indicates the polar coordinate system. Additionally, a "3" or "4" value will automatically generate a grid system using the Cartesian or polar coordinate systems, respectively, with user-defined starting locations and spacing distances. The default value equals "1".
ISW(3)	Discrete Receptor Option - Specifies whether a right-handed rectangular Cartesian coordinate system or a polar coordinate system is used to reference discrete receptor

Parameter Name	
ISW(3) (Cont.)	points. A value of "1" indicates the Cartesian coordinate system and a "2" indicates the polar coordinate system. The default value equals "1".
ISW(4)	Receptor Terrain Elevation Option — Allows the user to input terrain elevations for all receptor points. A value of "1" directs the program to read user-provided terrain elevations. Receptor elevations below stack base elevation are set equal to stack base elevation. A value of "0" assumes level terrain and no terrain elevations are read by the program. The default value equals "0".
ISW(5)	Output Tape Option -- Allows all calculated average concentration or total deposition values to be written onto a magnetic tape. A value of "1" writes calculated values to an output tape. Refer to Section 3.2.4.b for a complete description of the output produced from the use of this option. A "0" value does not write any calculations to an output tape. The default value equals "0".
ISW(6)	Print Input Data Option — Allows the user to print all input data parameters. A value of "0" indicates no input data are listed. A "1" indicates that all program control parameters and model constants, receptor site data and source data are printed. A "2" value is the same as the "1" option except that all hourly meteorological data used in the calculations are also printed.
ISW(7)-ISW(14)	Time Period Options — These options allow the user to compute average concentration or total deposition based on up to eight time periods. Parameters ISW(7) through ISW(14) respectively correspond to 1-, 2-, 3-, 4-, 6-,

Parameter Name	
	8-, 12- and 24-hour time periods. The user may choose any number of the eight time periods. A value of "1" for any of the eight parameters directs the program to compute average concentration or total deposition values for the corresponding time period. A "0" value for any of the eight time-period parameters directs the program not to make calculations for the corresponding time period. The default values equal "0".
ISW(7)- ISW(14)	
ISW(15)*	Output "N"-Day Table Option -- Allows the user to print average concentration or total deposition for the total number of days of meteorological data processed by the problem run for source group combinations chosen by the user. A value of "1" employs this option; "N"-day tables are not printed if ISW(15) has a "0" value. The default value equals "0".
ISW(16)*	Output Daily Tables Option -- Allows the user to print average concentration or total deposition values for all time periods and source groups specified by the user for each day of meteorological data processed. A value of "1" directs the program to print these tables; these tables are not printed if ISW(16) has a "0" value or if parameters ISW(7) through ISW(14) equal "0". The default value equals "0".
ISW(17)*	Output Highest and Second Highest Tables Option -- Allows the user to print the highest and second highest average concentration or total deposition calculated at each recep-

*The four parameters ISW(15) through ISW(18) pertain to output table options. Refer to Section 3.1.3 for a more complete summary of the contents of each type of output table.

Parameter Name	
ISW(17)* (Cont.)	tor. A set of the highest and second highest tables is printed for each time period and source group combination chosen by the user. A value of "1" directs the program to print these tables; these tables are not printed if ISW(17) has a "0" value or if parameters ISW(7) through ISW(14) equal "0". The default value equals "0".
ISW(18)*	Output Maximum 50 Tables Option -- Specifies whether or not tables of the 50 highest calculated average concentration or total deposition values are printed for each time period and source group specified by the user. A "1" value employs this option; these tables are not printed if ISW(18) has a "0" value or if parameters ISW(7) through ISW(14) equal "0". The default value equals "0".
ISW(19)	Meteorological Data Option -- A "1" value directs the program to read hourly meteorological data from FORTRAN logical unit IMET in a format compatible with that generated by the preprocessor program (see Appendix G). A "2" value directs the program to read hourly meteorological data in a card image format. The default value equals "1".
ISW(20)	Rural/Urban Option -- Specifies whether rural or urban surface mixing heights are read from the hourly meteorological data. Also, this parameter option provides two urban modes of adjustment of input stability categories (see Table 2-3). A value of "0" directs the pro-

*The four parameters ISW(15) through ISW(18) pertain to output table options. Refer to Section 3.1.3 for a more complete summary of the contents of each type of output table.

Parameter Name	
ISW(20) (Cont.)	gram to read rural mixing heights. A "1" value causes the program to read urban mixing heights with Urban Mode 1 adjustments to the input stability categories. A "2" value causes the program to read urban mixing heights with Urban Mode 2 adjustments to the input stability categories. The default value equals "0". It should be noted that if Meteorological Data Option (ISW(19)) has a value of "2", the program automatically assigns a "0" value to ISW(20) and ignores any conflicting value entered by the user.
ISW(21) (Cont.)	Wind Profile Exponent Option — This option allows the user to enter wind profile exponent values or allows the program to provide default wind profile exponent values. If a value of "1" is entered, the program provides default values. See Table 2-2 for the default values used by the program. If a value of "2" is entered, the program reads user-provided wind profile exponents in input parameter PDEF. These values remain constant throughout the problem run. If a value of "3" is entered, the program reads user-provided wind profile exponent values in input parameter P for each hour of meteorological data processed by the program. Note that the ISW(21) equals "3" option assumes the hourly meteorological data are in a card image format (ISW(19) = "2"). The default value of ISW(21) equals "1".
ISW(22)	Vertical Potential Temperature Gradient Option — This option allows the user to enter vertical potential temperature gradient values or allows the program to provide default vertical potential temperature gradient values. If a value of "1" is entered, the program provides default

Parameter Name	
ISW(22) (Cont.)	values. See Table 2-2 for the default values used by the program. If a value of "2" is entered, the program reads user-provided vertical potential temperature gradient values in input parameter DTHDEF. These values remain constant throughout the problem run. If a value of "3" is entered, the program reads user-provided vertical potential temperature gradient values in input parameter DTHDZ for each hour of meteorological data processed by the program. Note that the ISW(22) equals "3" option assumes hourly meteorological data are in a card image format (ISW(19) equals "2"). The default value of ISW(22) equals "1".
ISW(23)	Variable Source Emission Rate Option -- Allows the user to specify scalars which are multiplied by the sources' average emission rates. This parameter is employed by the user when it is desired to vary the average emission rates for <u>all sources</u>. It is also possible to vary the emission rates for individual sources with the QFLG parameter option. These scalars may vary as a function of season, month, hour of the day, hour of the day and season, or wind speed and stability category. A value of "1" allows the user to enter four seasonal scalars; a "2" allows the user to enter twelve monthly scalars; a "3" allows the user to enter twenty-four scalars for each hour of the day; a "4" value allows the user to enter thirty-six scalars for six wind speed categories for each of the six stability categories; a "5" value allows the user to enter ninty-six scalars for twenty-four hourly values for each of the four seasons. A "0" value directs

Parameter Name	Parameter
	the program not to vary average emission rates for <u>all sources</u>, and allows the use of the QFLG parameter option for the individual sources. The default value of this parameter equals "0".
ISW(24)	Plume Rise Option -- Allows the program to consider only the final plume rise at all downwind receptor locations if a value of "1" is entered. If a value of "2" is entered, the program computes plume rise as a function of the downwind distance of each receptor. The default value of ISW(24) equals "1".
ISW(25)	Stack-Tip Downwash Option -- Allows the program to use the physical stack height entered by the user or to modify the physical stack height of all stack-type sources entered in order to account for stack-tip downwash effects (Briggs, 1973). If a value of "1" is entered, all physical stack heights entered by the user are used throughout the problem run; if a value of "2" is entered, all physical stack heights entered are modified to account for stack-tip downwash. The default value of ISW(25) equals "1".
NSOURC	Number of Sources -- This parameter specifies the total number of sources to be processed by the problem run.
NXPNTS	X-Axis/Range Receptor Grid Size -- This parameter specifies the number of east-west receptor grid locations for the Cartesian coordinate system X-axis, or the number of receptor grid ranges (rings) in the polar coordinate system (depending on which receptor grid system is chosen by

Parameter Name	
NXPNTS (Cont.)	the user with parameter ISW(2)). A "0" value causes the program to assume that no regular (non-discrete) receptor grid is used.
NYPNTS	Y-Axis/Radial Receptor Grid Size -- This parameter specifies the number of north-south receptor grid locations for the Cartesian coordinate system Y-axis, or the number of receptor grid direction radials in the polar grid system (depending on which receptor grid system is chosen by the user with parameter ISW(2)). A "0" value causes the program to assume that no regular (non-discrete) receptor grid is used.
NXWYPT	Number of Discrete Receptors -- This parameter indicates the total number of discrete receptors to be processed by the problem run. A "0" value causes the program to assume that no discrete receptors are used.
NGROUP	Number of Source Groups -- This parameter specifies the number of source groups desired. Each source group consists of any desired combination of sources. A "0" value defines one source group which consists of all sources. The default value equals "0". A maximum of 150 source groups are allowed.
IPERD	Single Time Period Interval Option -- This parameter allows the user to specify one time period interval out of all possible time period intervals within a day. The use of this option directs the program to print only one time period interval specified for daily output tables (see Section 3.1.3.b). For example, if the user desires to print only

Parameter Name	
IPERD (Cont.)	the fifth 3-hour time period, IPERD requires a value of "5". Also, parameter ISW(9) must equal "1" in order to compute average concentration or total deposition based on a 3-hour time period. A "0" value directs the program to consider all intervals of a given time period.
NHOURS	Number of Hours Per Day of Hourly Meteorological Data -- This parameter is used only when hourly meteorological data are read from card images (parameter ISW(19) equals "2"). This parameter specifies the number of hours per day of meteorological data. For example, one need not enter 24 hours of meteorological data in order to calculate a 3-hour average concentration from only 3 hours of meteorological data.
NDAYS	Number of Days of Meteorological Data -- This parameter is used only when hourly meteorological data are read from card images (parameter ISW(19) equals "2"). This parameter specifies the total number of days of meteorological data to be processed by the program. The default value assumes one day (a value equal to "1") of meteorological data.
NSOGRP	Number of Sources Defining Source Groups -- This parameter is not read if the parameter NGROUP has a "0" value. This parameter is an array (NGROUP long) which indicates how many source identification numbers are read by the program in order to define each source group. The source identification numbers themselves are read in parameter IDSOR. Refer to parameter IDSOR for an example of the use of the parameter NSOGRP in association with parameter IDSOR. A maximum of 150 source groups may be used.

Parameter Name	
	Source Identification Numbers Defining Source Groups -- This parameter is not read if parameter NGROUP has a "0" value. This parameter is an array which contains the source identification numbers and/or the lower and upper bounds of source identification numbers to be summed over, which are used to define a source group. This parameter is used in association with parameter NSOGRP discussed above. The following should illustrate the interactive use of parameters NGROUP, NSOGRP and IDSOR. Let us assume that we have 50 sources whose identification numbers are 10, 20, 30, . . ., 490, 500. First, if one desires only to see the average concentration or total deposition calculated from all sources, the parameter NGROUP should equal "0". The parameters NSOGRP and IDSOR are not required by the program and are not input by the user. Next, let us assume that one desires to see the average concentration or total deposition contribution
IDSOR	individually of sources with identification numbers 10, 100, 200, 300, 400 and 500 as well as the combined contributions of sources with numbers 10 through 100, 50 through 260, 100 through 200 plus 400 through 500, and of all sources combined (10 through 500). Hence, the average concentration or total deposition contributions from six individual sources are desired plus the contributions from each of four sets of combined sources for a total of ten source groups. Thus, a value of "10" must be entered for parameter NGROUP. For parameter NSOGRP, one enters the ten values: 1, 1, 1, 1, 1, 1, 2, 2, 4 and 2. For parameter IDSOR, one enters the source identification numbers: 10, 100, 200, 300, 400, 500, 10, -100, 50, -260, 100, -200, 400, -500, 10 and -500. Now let us examine the relationship between those values entered in parameters NSOGRP and IDSOR. The first six entries of both NSOGRP

Parameter Name	
IDSOR (Cont.)	and IDSOR are in a one-to-one correspondence; the "1" value entered in parameter NSOGRP implies that only one source identification number is read by the program in the IDSOR array in order to define a complete source group. The seventh entry in parameter NSOGRP (a "2") indicates that the source identification numbers 10 and -100 (the seventh and eighth entries in IDSOR) define a source group. The minus sign preceding source identification number "100" indicates to the program to inclusively sum over all sources with identification numbers ranging from "10" to "100". The user need not be concerned by the fact that no source number of, say, "43" exists. The program only sums over those source numbers defined (in this case, 10, 20, 30, . . ., 90, 100). The eighth entry in parameter NSOGRP (a "2") specifies a source group including source numbers "50" through "260" which are the next set of values in parameter IDSOR. If one desires to see source contributions from consecutive source numbers, and also desires to exclude some source numbers, the next entry in parameter NSOGRP (a "4") illustrates this procedure. The value "4" implies that four source numbers are read by the program in order to define a source group. The four source identification numbers read by the program in parameter IDSOR, which are the source numbers following the last source numbers used to define the preceding source group, are 100, -200, 400, -500. This arrangement implies that inclusive summing over all sources from "100" to "200" and "400" to "500" is desired, excluding source numbers "210" to "390". Finally, it is still possible to obtain the combined contribution from all sources as shown in the last source group. In summary, we have: (1) Parameter NGROUP is a value which represents the number of source groups

Parameter Name	
IDSOR (Cont.)	desired; (2) The values in parameter NSOGRP indicate the number of source identification numbers read by the program in parameter IDSOR; and, (3) parameter IDSOR contains the source identification numbers used to define a source group, where a minus sign preceding a source number implies inclusive summing from the previous source number entered to the source number with the minus sign. The number of source identification numbers cannot exceed two hundred values for parameter IDSOR.

b. Meteorological-Related Constants. These data consist of parameters related to the meteorological conditions of the problem run. They are constants which are initialized at the beginning of the problem run and remain constant throughout the problem run (as opposed to the hourly meteorological data which change throughout the problem run).

Parameter Name	
PDEF	Wind Profile Exponents -- These data are read by the program only if option ISW(21) has a value equal to "2". This parameter is an array containing wind profile exponents for six stability categories, where each stability category contains six values for the six wind speed categories. A total of thirty-six wind profile exponents are entered by the user.
DTHDEF	Vertical Potential Temperature Gradients -- These data are read by the program only if option ISW(22) has a value equal to "2". This parameter is an array containing vertical potential temperature gradients (degrees Kelvin/meter) for six stability categories, where each stability category con-

Parameter Name	
DTHDEF (Cont.)	tains six values for the six wind speed categories. A total of thirty-six vertical potential temperature gradients are entered by the user.
UCATS	Wind Speed Categories -- This parameter contains five values which specify the upper bound of the first through fifth wind speed categories (meters/second). The program assumes no upper limit on the sixth wind speed category. The default values equal 1.54, 3.09, 5.14, 8.23 and 10.8 meters per second for the first through fifth categories, respectively.
BETA1	Adiabatic Entrainment Coefficient -- This parameter is used by the plume rise section of the model as the entrainment coefficient for adiabatic conditions (vertical potential temperature gradients less than or equal to zero). The default value equals 0.6 (Briggs, 1975).
BETA2	Stable Entrainment Coefficient -- This parameter is used by the plume rise section of the model as the entrainment coefficient for stable conditions (vertical potential temperature gradients greater than zero). The default value equals 0.6 (Briggs, 1975).
ZR	Wind Speed Reference Height -- This parameter specifies the height (meters) at which the wind speed was measured. The default value equals 10.0 meters.
DECAY*	Decay Coefficient -- This parameter is the decay coefficient (seconds^{-1}) used to describe decay of a pollutant due to

*This parameter is read by the program only if the hourly meteorological data are in a preprocessed format (parameter ISW(19) equals "1").

Parameter Name	
DECAY*	chemical depletion. The default value equals "0" for no decay.
IDAY*	Meteorological Julian Day Indicator -- This parameter consists of an array of 366 entries, where each entry indicates whether or not a meteorological day of data is processed by the program. The entry number of the array corresponds to the Julian Day of meteorological data. For example, the 140th entry IDAY(140) corresponds to Julian Day 140. An entry with a "1" value directs the program to process the corresponding day of meteorological data. A "0" value directs the program to ignore that corresponding day. The default assumes "0" values for all 366 entries.
ISS*	Surface Station Number -- This parameter specifies the surface station number of the meteorological data being used. The surface station number usually corresponds to the WBAN station identification number for a given observation station. The number is usually a five-digit integer.
ISY*	Year of Surface Station Data -- This parameter specifies the year of the surface station meteorological data. Only the last two digits of the year are entered.
IUS*	Upper Air Station Number -- This parameter specifies the upper air station number of the meteorological data being used. The upper air station number usually corresponds to

*This parameter is read by the program only if the hourly meteorological data are in a preprocessed format (parameter ISW(19) equals "1").

Parameter Name	
IUS* (Cont.)	the WBAN station identification number for a given observation station. The number is usually a five-digit number.
IUY*	Year of Upper Air Station Data -- This parameter specifies the year of the upper air station meteorological data. Only the last two digits of the year are entered.

c. Identification Labels and Model Constants. These data consist of parameters pertaining to heading and identification labels and program constants.

Parameter Name	
TITLE	Heading Label -- This parameter allows the user to enter up to 60 characters in order to identify a problem run. The information entered in this parameter appears at the top of each page of print output.
IQUN	Source Emission Rate Label -- This parameter provides the user with up to 12 characters in order to identify the emission rate units of all sources. The default label is (GRAMS/SEC) when calculating average concentration and (GRAMS) when calculating total deposition. All area source emission rate labels automatically include units of per square meter.
ICHIUN	Output Units Label -- This parameter provides the user with a 28-character label in order to identify the units of aver-

*This parameter is read by the program only if the hourly meteorological data are in a preprocessed format (parameter ISW(19) equals "1").

Parameter Name	
ICHIUN (Cont.)	age concentration or total deposition. The default value is (MICROGRAMS/CUBIC METER) for average concentration calculations and (GRAMS/SQUARE METER) for total deposition calculations.
TK	Source Emission Rate Conversion Factor -- This parameter allows the user to scale the source emission rate for all sources in order to convert the emission rate units. This parameter is used in conjunction with label parameters IQUN and ICHIUN. The default value equals 1.0×10^6 for average concentration calculations and 1.0 for total deposition calculations.
IMET	FORTRAN Logical Unit Number for Hourly Meteorological Data -- This parameter specifies the FORTRAN logical unit number of the device from which the hourly meteorological data are read. The default value equals "9" for hourly meteorological data which are in a preprocessed format. The default value for card image meteorological data is the same as the logical unit number for all card input data.
ITAP	FORTRAN Logical Unit Number of Output Tape -- This parameter is ignored by the program if no output tape is generated by the problem run (ISW(5) equals "0"). This parameter specifies the FORTRAN logical unit number of the output device with which the output tape is externally associated. The default value equals "3".

d. Receptor Data. These data consist of the (X, Y) or (range, theta) locations of all receptor points. Also included are the receptor terrain elevations.

Parameter Name	
GRIDX	Receptor Grid X-Axis or Range Data -- This parameter is read by the program only if input parameters NXPNTS and NYPNTS are both greater than zero. This parameter is an array which has different functions depending on the value of ISW(2). If ISW(2) equals "1", this parameter contains NXPNTS values of the X-axis receptor grid points (meters). If ISW(2) equals "2" or "4", this parameter contains NXPNTS values of the receptor grid ranges (rings) in meters. If ISW(2) equals "3", the first entry of this parameter contains the starting location (meters) of the X-axis receptor grid and the second entry contains the incremental value (meters) with which the remaining NXPNTS values of the X-axis are generated.
GRIDY	Receptor Grid Y-Axis or Direction Radial Data -- This parameter is read by the program only if input parameters NXPNTS and NYPNTS are both greater than zero. This parameter is an array which has different functions depending on the value of ISW(2). If ISW(2) equals "1", this parameter contains NYPNTS values of the Y-axis receptor grid points (meters). If ISW(2) equals "2", this parameter contains NYPNTS values of the direction radials (degrees) for the receptor grid. The program requires that these values not be fractional values but integer values within the range of 1 to 360 degrees. The default value equals "360" degrees. If ISW(2) equals "3", the first entry of this parameter contains the starting location (meters) of the Y-axis receptor grid and the second entry contains the incremental value (meters) with which the remaining NYPNTS values of the Y-axis are generated. If ISW(2) equals "4", the first entry of this parameter contains the starting direction radial location (degrees)

Parameter Name	
GRIDY (Cont.)	of the receptor grid and the second entry contains the incremental value (degrees) with which the remaining NYPNTS direction radial values of the receptor grid are generated. All values generated must be integers within the range of 1 to 360 degrees. The default value equals "360" degrees.
XDIS	Discrete Receptor X or Range Data -- This parameter is read by the program only if parameter NXWYPT is greater than zero. This parameter is an array which has different functions depending on the value of parameter ISW(3). If ISW(3) equals "1", this parameter contains NXWYPT discrete receptor X locations (meters). If ISW(3) equals "2", this parameter contains NXWYPT discrete receptor range locations (meters). The values entered in this parameter are used in association with those in parameter YDIS.
YDIS	Discrete Receptor Y or Direction Data -- This parameter is read by the program only if NXWYPT is greater than zero. This parameter is an array which has different functions depending on the value of parameter ISW(3). If ISW(3) equals "1", this parameter contains NXWYPT discrete receptor Y locations (meters). If ISW(3) equals "2", this parameter contains NXWYPT discrete receptor direction values (degrees). These direction values must not be fractional in value, but integer values within the range of 1 to 360 degrees where the default value is "360" degrees. The values entered in this parameter are used in association with those in parameter XDIS.
GRIDZ	Receptor Terrain Elevation Data -- This parameter is read only if parameter ISW(4) equals "1". This parameter is an

Parameter Name	
GRIDZ (Cont.)	array which contains all the receptor terrain elevations (feet)* for the receptor grid and discrete receptors. The terrain elevations for the receptor grid are entered first (if there is a receptor grid). Receptor elevation Z_{ij} corresponds to the i^{th} X coordinate (range) and j^{th} Y coordinate (direction radial). Begin with Z_{11} and enter NXPNTS values (Z_{11}, Z_{21}, Z_{31}, ...). Then, starting with a new card image, enter NXPNTS values (Z_{12}, Z_{22}, Z_{32}, ...). Continue until all regular receptor elevations have been entered. The terrain elevations for the discrete receptors (if any) are entered next. Beginning with a new card image, enter the terrain elevations for the discrete receptor points in the order the discrete receptor locations were entered into parameters XDIS and YDIS.

e. Source Data. These data consist of all necessary information required for each source entered by the user. Because the program can process three types of sources (stack, volume and area), some source types require more information than other types. The following input parameters are required by all source types.

Parameter Name	
NSO	Source Identification Number -- This parameter is a number which uniquely identifies each source. The program uses this identification number for any output tables that are generated requiring individual source identification. This number must be a positive number.

* Ground elevations in feet are required for this otherwise metric program to afford compatibility with the units used in the routinely available U.S.G.S. topographic maps.

Parameter Name	
ITYPE	Source Type Indicator — This parameter specifies the type of source. If a value of "0" is entered, this is a stack-type source. Similarly, a "1" is entered for a volume-type source. A "2" is entered for an area-type source. Consult Sections 2.4.1 and 2.4.2 for a technical discussion of these source types.
NVS	Number of Gravitational Settling Categories — This parameter specifies the number of gravitational settling categories to be considered. This parameter is used for sources with particulates or droplets with significant gravitational settling velocities. A maximum of 20 categories is allowed for each source.
QFLG	Variational Source Emission Rate Option — This parameter is ignored by the program if ISW(23) has a non-zero value. This parameter allows the user to specify scalars which are multiplied by this individual source's average emission rate. These scalars may vary as a function of season, month, hour of the day, season and hour of the day, or stability category and wind speed. The implementation of this parameter is the same as that of parameter ISW(23). Refer to the description of parameter ISW(23) for an explanation of what values are associated with each variational function.
Q	Emission Rate — This parameter specifies the average emission rate of the source. If average concentration is calculated, the units for stack and volume sources are mass per time and for area sources are mass per square meter per time. If total deposition is calculated, the units

Parameter Name	
Q (Cont.)	for stack and volume sources are mass and for area sources are mass per square meter.
XS	X Location -- This parameter specifies the relative X location (meters) of the center of a stack or volume source and of the southwest corner of an area source.
YS	Y Location -- This parameter specifies the relative Y location (meters) of the center of a stack or volume source and of the southwest corner of an area source.
ZS	Source Elevation -- This parameter specifies the elevation (meters above mean sea level) of the source at the source base.
Stack-Source Parameters	
WAKE	Wake Effects Option -- This parameter pertains only to stacks with building wake effects (parameters HB, HL and HW greater than zero). Enter a "0" value to calculate an "upper bound" average concentration or total deposition. Enter a "1" value to calculate a "lower bound" average concentration or total deposition. The appropriate value for this parameter depends on building shape and stack placement with respect to the building. Consult Section 2.4.1.1.d for a technical discussion of building wake effects. The default value equals "0".
HS	Stack Height -- This parameter specifies the height of the stack above the ground (meters).
TS	Stack Exit Temperature -- This parameter specifies the stack exit temperature in degrees Kelvin. If this value is less

Stack-Source Parameters

TS (Cont.)	than the ambient air temperature for a given hour, the program sets this parameter equal to the ambient air temperature.
VS	Stack Exit Velocity -- This parameter specifies the stack exit velocity in meters per second.
D	Stack Diameter -- This parameter specifies the inner stack diameter in meters.
HB*	Building Height -- This parameter specifies the height of a building adjacent to this stack (meters).
HL*	Building Length -- This parameter specifies the length of a building adjacent to this stack (meters).
HW*	Building Width -- This parameter specifies the width of a building adjacent to this stack (meters).

Volume-Source Parameters

H	Center Height -- This parameter specifies the height of the center of the volume source above the ground (meters).
SIGZO	Initial Vertical Dimension -- This parameter specifies the initial vertical dimension σ_{zo} of the volume source (meters).

*If non-zero values are entered for parameters HB or HL and HW, the program automatically uses the building wake effects option (see Section 2.4.1.1.d). However, if HB, HL, and HW are not punched, or are equal to "0," wake effects for the respective source are not considered.

Volume-Source Parameters

SIGYO — Initial Horizontal Dimension -- This parameter specifies the initial horizontal dimension σ_{yo} of the volume source (meters).

Area-Source Parameters

H — Effective Emission Height -- This parameter specifies the effective emission height of the area source (meters).

XO — Area Source Width -- This parameter specifies the width x_o of the square area source (meters).

Gravitational Settling Categories Parameters

PHI — Mass Fraction -- This parameter is an array which specifies the mass fraction of particulates for each settling velocity category. A maximum of 20 values per source may be entered.

VSN — Settling Velocity -- This parameter is an array which specifies the gravitational settling velocity (meters/second) for each settling velocity category. A maximum of 20 values per source may be entered.

GAMMA — Surface Reflection Coefficient -- This parameter is an array which contains the surface reflection coefficient for each settling velocity category. A maximum of 20 values per source may be entered.

Parameter Name	
QTK	Source Emission Rate Scalars -- This parameter is applicable only to sources whose emission rates are multiplied by variational scalar values. If parameter ISW(23) is greater than zero, this parameter applies to all sources in the problem run. If parameter ISW(23) equals zero, this parameter is read by the program for each source for which the parameter QFLG is greater than zero. If both parameters ISW(23) and QFLG equal zero for all sources, this parameter is not read by the program. This parameter is an array which contains the source emission rate scalars used to multiply the average emission rate of a (all) source(s). The format in which the scalar values are entered depends on the value of either parameter QFLG or ISW(23) (whichever parameter is applicable). If this value equals "1", enter four seasonal scalars in the order of Winter, Spring, Summer and Fall. If the QFLG (or ISW(23)) parameter has a value of "2", enter 12 monthly scalar values beginning with January and ending with December. If the value equals "3", enter 24 scalar values for each hour of the day beginning with the first hour and ending with the twenty-fourth hour. If the value equals "4", enter six sets of scalar values for the six wind speed categories for a total of 36 scalar values. Each of the six sets of scalar values represents a Pasquill stability beginning with category A and ending with category F. Each set is started on a new card image. If the value equals "5", four sets of scalar values are entered where each set contains 24 hourly values (analogous to a value equal to "3" option) for a total of 96 scalar values. The four sets of scalar values represents the four seasons in the order of Winter, Spring, Summer and Fall. Each set is started on a new card image.

f. Hourly Meteorological Data. These data may be entered in one of two formats (governed by the value entered in parameter ISW(19)). One format is that generated by the preprocessor program (see Appendix G). This format usually resides on magnetic tape where the tape device is externally associated with the logical unit specified by parameter IMET. All hourly data required by the program are contained on the tape. The other format is card image. The following data are required for each hour only when the card image format is chosen by the user.

Parameter Name	
JDAY	Julian Day -- This parameter specifies the Julian Day of this day of meteorological data. This parameter is read by the program for only the first hour of data for each day. This parameter is ignored for the second and successive hours of each day of data. This parameter is used by the program to determine the month or season if required by other program options. The default value equals "1" (Julian Day 1).
AFV	Wind Flow Vector -- This parameter specifies the direction (degrees) toward which the wind is blowing.
AWS	Wind Speed -- This parameter specifies the mean wind speed (meters/second) measured at the reference height specified in parameter ZR.
HLH	Mixing Height -- This parameter specifies the height of the top of the surface mixing layer (meters).
TEMP	Ambient Air Temperature -- This parameter specifies the ambient air temperature (degrees Kelvin).

Parameter Name	
DTHDZ	Vertical Potential Temperature Gradient (Optional) -- This parameter specifies the vertical potential temperature gradient (degrees Kelvin/meter) for a given hour. The value for this parameter is used by the program only if parameter ISW(22) equals "3".
IST	Pasquill Stability Category -- This parameter specifies the Pasquill stability category. A value of "1" equals category A, "2" equals B, "3" equals C, etc.
P	Wind Profile Exponent (Optional) -- This parameter specifies the wind profile exponent for a given hour. The value for this parameter is used by the program only if parameter ISW(21) equals "3".
DECAY	Decay Coefficient -- This parameter specifies the decay coefficient (seconds^{-1}) for chemical or other removal processes for a given hour. This parameter overrides any value entered in parameter DECAY described earlier in Section 3.1.2.b. The default value equals "0" for no decay.

3.1.3 Output Information

The ISCST program generates six categories of program output. Each category is optional to the user. That is, the user controls what output the program generates for a given problem run. In the following paragraphs, each category of output is related to the input parameter that controls the output category. All program output are printed except for the magnetic tape output.

a. Input Parameter Output. The user may desire to see all input parameters used by the program. If input parameter ISW(6) equals "1", the program will print all program control input parameters, meteorological-related and information constants, receptor data and source data. Additionally, if parameter ISW(6) equals "2", the program will also print all hourly meteorological data processed by the program for a given problem run.

b. Daily Concentration (Deposition) Output. This category of output prints calculated values of average concentration or total deposition for each day of meteorological data processed by the program for a given problem run. For each day, tables consisting of average concentration or total deposition values at each receptor point are printed for all combinations of user-defined time periods and source groups. For example, suppose combinations of 1-, 3- and 24-hour time periods and five source groups (NGROUP equals "5") are specified and input parameter IPERD equals "0". Thirty-three tables would be generated by all time period intervals (24 1-hour tables, eight 3-hour tables and one 24-hour table) for a total of 165 tables for all source groups for each day of meteorological data. Input parameters ISW(7) through ISW(14) and IPERD specify the time periods and time period interval, respectively, for which average concentration or total deposition values are printed. The source group combinations are specified by input parameters NGROUP, NSOGRP and IDSOR. Input parameter ISW(16) controls the employment of this output category.

c. "N"-Day Concentration (Deposition) Output. This category prints the average concentration or total deposition calculated over the number of days ("N") of meteorological data processed by a given problem run. Tables consisting of average concentration or total deposition values at each receptor point are printed for all source group combinations defined by the user with input parameters NGROUP, NSOGRP and IDSOR. Input parameter ISW(15) specifies the use of this output category.

d. <u>Highest and Second-Highest Concentration (Deposition) Output</u>. This category prints tables of the highest and second-highest average concentration or total deposition values calculated at each receptor point. Tables are produced for all user-defined combinations of time periods and source groups. For example, suppose 3- and 8-hour time periods and ten source groups (NGROUP equals "10") are specified. Twenty-two tables would be produced by all time periods (tables of highest values and tables of second-highest values) for a total of 220 tables for all source groups for the example problem run. Input parameters ISW(7) through ISW(14), and NGROUP, NSOGRP and IDSOR provide user control of the desired time periods and source groups, respectively. The employment of this output category is controlled by input parameter ISW(17).

e. <u>Maximum 50 Concentration (Deposition) Output</u>. This category produces tables of the maximum 50 average concentration or total deposition values calculated for the problem run. Each table prints the maximum 50 values including when and at which receptor each value occurred. Tables are printed for all user-defined combinations of time periods and source groups which are specified by input parameters ISW(7) through ISW(14), and NGROUP, NSOGRP and IDSOR, respectively. Input parameter ISW(18) controls the use of this output category.

f. <u>Tape Concentration (Deposition) Output</u>. This category writes the results of average concentration or total deposition calculations to a magnetic tape whose tape device is linked to the program through input parameter ITAP. If ISW(5) equals "1", the program writes to tape records of the average concentration or total deposition values for all user-defined combinations of time periods and source groups for each day of meteorological data processed by the program. Each tape record includes the average concentration or total deposition values calculated at each receptor point. Also, all concentration or deposition values generated by the "N"-day output option (see category c above) are written to tape <u>only if</u> the "N"-day output option (ISW(15)) is exercised by the user.

An illustration of each of the above print output categories is shown in Section 3.2.4. Also discussed is the order in which the tables and tape records are generated for each output category.

3.2 USER'S INSTRUCTIONS FOR THE ISCST PROGRAM

3.2.1 Program Description

The ISC short-term (ISCST) program is designed to use hourly meteorological data to calculate ground-level concentration or deposition values produced by emissions from multiple stack, volume and area sources. The receptors at which concentration or deposition values are calculated may be defined on a (X, Y) right-handed Cartesian coordinate system grid or an (r, θ) polar coordinate system grid. The polar coordinate system defines 360 degrees as north (positive Y-axis), 90 degrees as east (positive X-axis), 180 degrees as south and 270 degrees as west. Discrete or arbitrarily placed receptors may also be defined by the user using either type of coordinate system. This program also has the user option of assigning elevations above mean sea level to each source and receptor. The stack, volume or area sources may be individually located anywhere, but must be referenced using a Cartesian coordinate system relative to the origin of the receptor coordinate system.

Average concentration or total deposition values may be calculated for 1-, 2-, 3-, 4-, 6-, 8-, 12- or 24-hour time periods. "N"-day average concentration or total deposition values for the total number of days of meteorological data processed by the program may also be computed for each receptor. Average concentration or total deposition values may be printed for source groups, where a source group consists of any user-defined combination of sources.

The ISCST program accepts hourly meteorological input data in either of two options. One option reads hourly meteorological data from a magnetic tape unit or other similar external input device. These data are read in a format compatible with the meteorological data format generated by the preprocessor program (see Appendix G). The other option reads hourly meteorological data from cards in a card image format.

The ISCST program produces several categories of output of calculated concentration or deposition values. All categories of output are optional to the user. Average concentration or total deposition values may be printed for all receptors for all combinations of time intervals and source groups for any number of days of meteorological data. The average concentration or total deposition values calculated over an "N"-day period may be printed for all source groups defined by the user. Also, the highest and second-highest average concentration or total deposition values calculated at each receptor for all combinations of time periods and source groups may be printed. The maximum 50 calculated average concentration or total deposition values may also be printed for all combinations of time periods and source groups defined by the user. The program may also generate an output tape file consisting of all calculated concentration or deposition values for each receptor for each user-defined combination of time periods and source groups for each day of meteorological data processed by the program. Additionally, all average concentration or total deposition values calculated over an "N"-day period may be written to the output tape file for all user-defined source groups.

The ISCST program is written in FORTRAN IV. Its design assumes that 4 Hollerith characters can be stored in a computer word. The basic program requires about 21,500 UNIVAC 1100 Series 36-bit words. Another 43,500 words of data storage are currently allocated for a total of 65,000 computer words. With this current allotment of executable storage, the program may be run with up to 400 receptors and 100 sources. The card reader or input device to this program is referenced as FORTRAN logical unit 5 and the printer or output device as logical unit 6. The

ISCST program is composed of a main program (ISCST), nine subroutines (INCHK, MODEL, DYOUT, MAXOT, MAX50, VERT, SIGMAZ, UPWIND and ERFX) and a BLOCK DATA subprogram (BLOCK). The source codes for all of these routines are listed in Appendix A. Appendix H contains a logic flow description of the ISCST program.

3.2.2 Control Language and Data Deck Setup

a. Control Language Requirements. The following example illustrates the required control statement runstream for a typical run on a UNIVAC 1100 Series Operating System:

```
@RUN   ISCST, . . .
@ASG,A PROGFILE.
@ASG,A METFILE.
@USE 9,METFILE.
@ASG,CP OUTPUTFILE. }
@USE 3,OUTPUTFILE.  }   Optional, required only if ISW(5) = 1
@XQT PROGFILE.ABSISCST
 Card input data deck
@FIN
```

The first control statement initiates the runstream with job name ISCST where the parameters following the job name may vary with each computer installation. The second control statement assigns the existing program file PROGFILE to the run. It is assumed that this file contains the absolute element (executable version) of the program. The third and fourth control statements assign an existing meteorological data input file METFILE and associate FORTRAN logical unit number 9 with the meteorological file. These control statements may be optional if the user has provided meteorological data in the card input data deck (accompanying the card input data). However, most cases require a meteorological data file which is external to the card input data. The fifth and sixth control statements create an optional output data file OUTPUTFILE for saving calculated concentration or deposition values and associate FORTRAN logical unit number 3 with the output data file. These control statements are required only if parameter ISW(5) equals "1". The ISCST program is ready to execute as performed by the seventh control statement. All card input data required for the problem run immediately follows the execute card. The final control card terminates the runstream.

The following job control statement runstream is given for a typical run on an IBM 360 Operating System:

```
//ISCST JOB(12345),'TYPICAL RUNSTREAM'
//JOBLIB DD DSNAME=PROGFILE,DISP=(OLD,PASS)
//STEP1 EXEC PGM=ABSISCST
//FT05F001 DD DDNAME=SYSIN
//FT06F001 DD SYSOUT=A
//FT09F001 DD DSN=METFILE,UNIT=TAPE,
//             VOL=SER=METTP,DCB=RECFM=V,
//             DISP=OLD
//FT03F001 DD DSN=OUTPUTFILE,UNIT=TAPE,      )   Optional,
//             VOL=SER=SAVTP,DCB=RECFM=V,    >   required only
//             DISP=(NEW,KEEP)               )   if ISW(5)=1.
//GO.SYSIN DD*
  Card input data deck
//
```

The first job control statement initiates the runstream with job identification ISCST and account number 12345. The second and third control statements obtain the library file PROGFILE in which the absolute, executable deck ABSISCST is located. The fourth and fifth control statements link FORTRAN logical unit numbers 05 and 06 as the card reader and printer, respectively. Control statement six defines an existing meteorological data input tape file METFILE with a reel identification of METTP and links

FORTRAN logical unit 09 with the meteorological file. This file is usually required in a job runstream unless the hourly meteorological data are contained in the card input data deck. Control statement seven defines a new output tape file OUTPUTFILE with a reel identification of SAVTP and links FORTRAN logical unit number 03 with the output file. This output file is optional and is required only if parameter ISW(5) equals "1". The program is executed by control card eight which is immediately followed by the card input data deck. The null statement at the end terminates the job runstream.

Another example of the required control statements is shown for use on a CDC 6500 Operating System:

```
ISCST,,,.
REQUEST,TAPE09,VRN=METTP,HY.
REQUEST,TAPE03,VRN=SAVTP,RW,HY.      { Optional, required only
                                         if ISW(5) = 1.
ATTACH,ABSISCST,PROGFILE.
ABSISCST.
7/8/9 multipunch in card column one
  Card input data deck
6/7/8/9 multipunch in card column one
```

The first control statement identifies the job name as ISCST where other parameters may be used if desired. The second control statement requests an input tape where the assigned file name TAPE09 is defined as an input file and is linked to FORTRAN logical unit number 9 by a CDC FORTRAN program control card. This statement is required only if the hourly meteorological data are not included in the card input data deck. The third control statement requests an output tape where the assigned file name TAPE03 is defined as an output file and is linked to FORTRAN logical unit number 3 by a CDC FORTRAN program control card. This control statement is required only if parameter ISW(5) equals "1". The fourth control statement accesses the permanent program file PROGFILE and assigns the local file name ABSISCST to the runstream. It is assumed that PROGFILE is an executable version of the ISCST program. The fifth control statement executes the ISCST program. An end-of-record follows as indicated by the 7/8/9 multipunch in column one, which separates the control statements from the card input data deck. The 6/7/8/9 multipunch in column one terminates the control statement runstream.

Regardless of the operating system, the control statement runstream serves three primary functions. First, all necessary program, input and output data files must be assigned or created. Second, FORTRAN logical unit numbers must be associated with all data files so that the ISCST program can reference the data files through the use of the logical unit number parameters (IMET and ITAP). Third, the ISCST program is executed with an accompanying card input data deck.

b. Data Deck Setup. The card input data required by the ISCST program depends on the program options desired by the user. The card input data may be partitioned into seven major groups of card input. Figure 3-1 illustrates the input deck setup. The seven card input deck groups are itemized below:

(1) Title Card (1 card)
(2) Program Control Cards (2 cards)
(3) Receptor Cards
(4) Source Group Data Cards (optional, required only if NGROUP > 0)
(5) Meteorological-Related and Model Constants Cards
(6) Source Data Cards
(7) Hourly Meteorological Data Cards (optional, required only if ISW(19) = 2)

An example card input data deck for the ISCST program is presented in Appendix C. A description of the input format and contents of each of the seven card groups is provided below in Section 3.2.3.a.

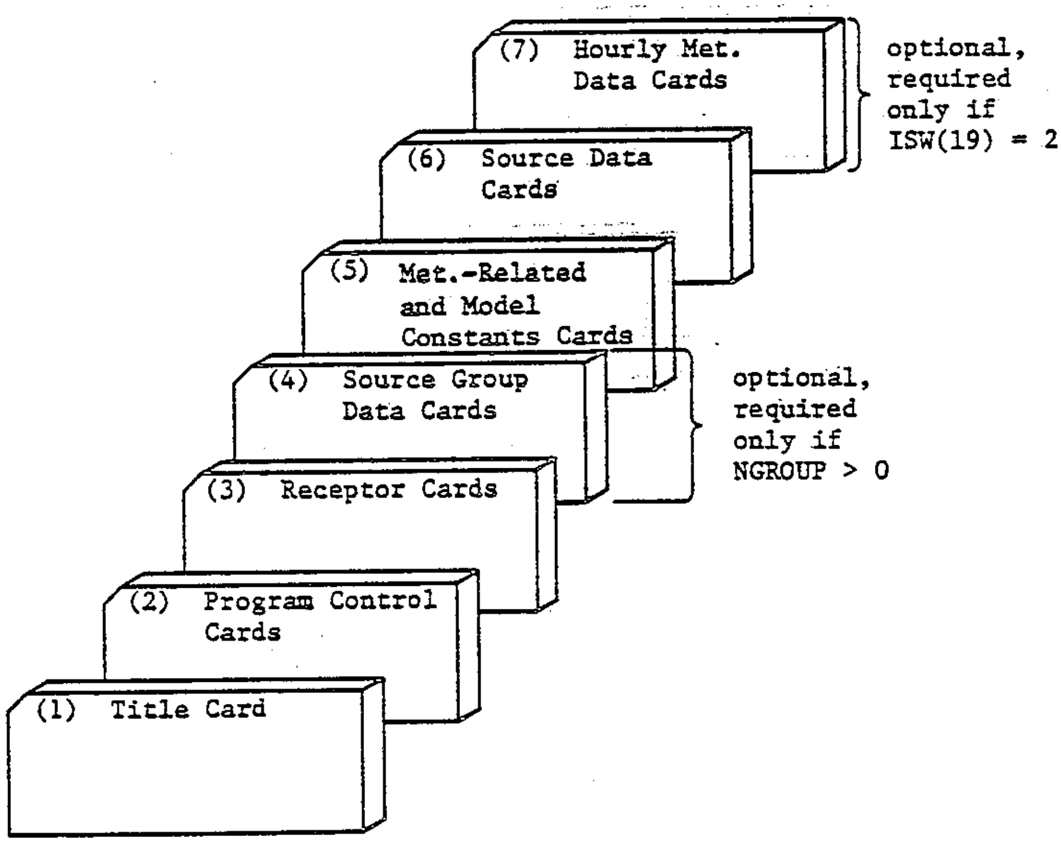


FIGURE 3-1. Input data deck setup for the ISCST program.

3.2.3 Input Data Description

Section 3.1.2 provides a summary description of all input data requirements of the ISCST program. This section provides the user with the format and order in which the program requires the input data. The input parameter names used in this section correspond to those used in Section 3.1.2. Two forms of input data are read by the program. One form is card image input data (80 characters per record) in which all required input data may be entered. The other form is magnetic tape which contains hourly meteorological data in a format generated by the preprocessor program. Both forms are discussed below.

a. Card Input Requirements. The ISCST program reads all card image input data in a fixed-field format with the use of FORTRAN "A", "I", "F" and "E" editing codes. The card input data are partitioned into seven card groups which are discussed in Section 3.2.2.b and shown in Figure 3-1. The input parameters contained in Card Groups (2) and (4) correspond with those described in category "a" of Section 3.1.2. Moreover, Card Groups (1) and (5) correspond with categories "b" and "c", Group (3) with category "d", Group (6) with category "e" and Group (7) with category "f". Table 3-4 is a list of all card image input data which may be entered. For each input parameter, Table 3-4 provides the Card Group (and the card number within the Card Group, if possible), parameter name, card columns within which the value of the input parameter must reside, FORTRAN editing code and a brief description which includes default values or maximum values allowed, if applicable. The order in which the input parameters are listed in Table 3-4 is the order in which the ISCST program reads the input parameters. The user should note that many card input parameters and even entire Card Groups are ignored or not read by the program, depending on the options chosen by the user.

Card Groups (1) and (2) consist of a total of three cards. Card Group (1) consists of one card and contains the parameter TITLE.

TABLE 3-4

ISCST PROGRAM CARD INPUT PARAMETERS, FORTRAN EDIT CODE (FORMAT) AND DESCRIPTION

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
1	TITLE	1-60	15A4	60-character heading label
2, 1	ISW(1)	1-2	I2	1 = calculate concentration 2 = calculate deposition Default assumes 1
2, 1	ISW(2)	3-4	I2	1 = Cartesian coordinate receptor grid system 2 = polar coordinate receptor grid system 3 = program generates Cartesian coordinate grid 4 = program generates polar coordinate grid Default assumes 1
2, 1	ISW(3)	5-6	I2	1 = discrete receptors referenced with Cartesian coordinate system 2 = discrete receptors referenced with polar coordinate system Default assumes 1
2, 1	ISW(4)	7-8	I2	0 = no receptor terrain elevations are input 1 = program reads receptor terrain elevations Default assumes 0
2, 1	ISW(5)	9-10	I2	0 = no output tape containing concentration or deposition values is written

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
2, 1	ISW(5) (Cont.)	9-10	I2	1 = output tape containing concentration or deposition values is written to tape on logical unit ITAP Default assumes 0
2, 1	ISW(6)	11-12	I2	0 = no input data are printed 1 = print all input data except hourly meteorology data 2 = same as 1 but hourly meteorological data are also printed Default assumes 0
2, 1	ISW(7)	13-14	I2	0 = no 1-hour time periods 1 = 1-hour average concentration or total deposition calculated Default assumes 0
2, 1	ISW(8)	15-16	I2	0 = no 2-hour time periods 1 = 2-hour average concentration or total deposition calculated Default assumes 0
2, 1	ISW(9)	17-18	I2	0 = no 3-hour time periods 1 = 3-hour average concentration or total deposition calculated Default assumes 0
2, 1	ISW(10)	19-20	I2	0 = no 4-hour time periods 1 = 4-hour average concentration or total deposition calculated Default assumes 0

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
2, 1	ISW(11)	21-22	I2	0 = no 6-hour time periods 1 = 6-hour average concentration or total deposition calculated Default assumes 0
2, 1	ISW(12)	23-24	I2	0 = no 8-hour time periods 1 = 8-hour average concentration or total deposition calculated Default assumes 0
2, 1	ISW(13)	25-26	I2	0 = no 12-hour time periods 1 = 12-hour average concentration or total deposition calculated Default assumes 0
2, 1	ISW(14)	27-28	I2	0 = no 24-hour time period 1 = 24-hour average concentration or total deposition calculated Default assumes 0
2, 1	ISW(15)	29-30	I2	0 = print no "N"-day output tables 1 = print "N"-day average concentration or total deposition output tables Default assumes 0
2, 1	ISW(16)	31-32	I2	0 = print no daily time period tables 1 = print daily average concentration or total deposition tables for each time period and source group for each day of meteorological data Default assumes 0

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
2, 1	ISW(17)	33-34	I2	0 = print no highest and second highest tables 1 = print highest and second highest average concentration or total deposition calculated at each receptor for each time period and source group Default assumes 0
2, 1	ISW(18)	35-36	I2	0 = print no maximum 50 tables 1 = print the maximum 50 average concentration or total deposition values calculated for each time period and source group Default assumes 0
2, 1	ISW(19)	37-38	I2	1 = hourly meteorological data is read from logical unit IMET in a preprocessed format 2 = hourly meteorological data is read from cards Default assumes 1
2, 1	ISW(20)	39-40	I2	0 = Rural Mode Option 1 = Urban Mode-1 Option 2 = Urban Mode-2 Option Default assumes 0
2, 1	ISW(21)	41-42	I2	1 = program provides default wind profile exponent values 2 = user enters 36 wind profile exponents for 6 wind speed and 6 stability categories in Card Group 5 below

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format	Description
2, 1	ISW(21) (Cont.)	41-42	I2	3 = user enters hourly wind profile exponents in Card Group 7 below Default assumes 1
2, 1	ISW(22)	43-44	I2	1 = program provides default vertical potential tempterature gradient values 2 = user enters 36 vertical potential temperature gradients for 6 wind speed and 6 stability categories 3 = user enters hourly vertical potential temperature gradients in Card Group 7 below Default assumes 1
2, 1	ISW(23)	45-46	I2	0 = emission rates for all sources do not vary 1 = emission rates vary seasonally for all sources 2 = emission rates vary monthly for all sources 3 = emission rates vary each hour per day for all sources 4 = emission rates vary by wind speed and stability category for all sources 5 = emission rates vary seasonally and each hour per day Default assumes 0. A zero value entered for this parameter allows the user to vary emission rates for individual sources by the use of input parameter QFLG

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
2, 1	ISW(24)	47-48	I2	1 = program uses final plume rise for all receptor locations 2 = program computes plume rise as a function of the receptor location Default assumes 1
2, 1	ISW(25)	49-50	I2	1 = physical stack heights are not modified to account for downwash 2 = physical stack heights are modified to account for stack downwash Default assumes 1
2, 2	NSOURC*	1-6	I6	Number of sources
2, 2	NXPNTS*	7-12	I6	Number of grid points in the X-axis or number of ranges (rings) for the receptor grid. A zero value implies no receptor grid
2, 2	NYPNTS*	13-18	I6	Number of grid points in the Y-axis or number of direction radials for the receptor grid. A zero value implies no receptor grid
2, 2	NXWYPT*	19-24	I6	Number of discrete receptor points. A zero value implies no discrete receptor points

*See Equation (3-1) for the maximum value allowed by the program for this input parameter

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
2, 2	NGROUP	25-30	I6	Number of source group combinations. A zero value assumes one source group which consists of all sources. Maximum number = 150
2, 2	IPERD	31-36	I6	Print "N"th time interval only for all time periods specified for daily table output. Enter "N" in this parameter. Default assumes all intervals for each desired time period are printed. This parameter is ignored if ISW(16) = 0
2, 2	NHOURS	37-42	I6	Enter number of hours per day of meteorological data. This parameter is ignored if ISW(19) = 1
2, 2	NDAYS	43-48	I6	Enter number of days of meteorological data. This parameter is ignored if ISW(19) = 1
3, 1	GRIDX	1-80	8F10.0	This parameter is not read if NXPNTS or NYPNTS equals 0. Enter NXPNTS X-axis (ISW(2) = 1) or NXPNTS range (ISW(2) = 2 or 4) receptor grid locations (meters). If ISW(2) = 3, enter the

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
3, 1	GRIDX (Cont.)	1-80	8F10.0	starting X-axis grid location in columns 1-10 and the incremental value in columns 11-20 (meters).
3, 2	GRIDY	1-80	8F10.0	This parameter is not read if NXPNTS or NYPNTS equals 0. Enter NYPNTS Y-axis (ISW(2) = 1) receptor grid locations (meters) or NYPNTS direction radial (ISW(2) = 2) locations in integer degrees within the range of 1 to 360 degrees. If ISW(2) = 3, enter the starting axis grid location (meters) in columns 1-10 and the incremental value in columns 11-20 (meters). If ISW(2) = 4, enter the starting direction radial location in columns 1-10 and the incremental value in columns 11-20. Enter values which generate integer directions within the range of 1 to 360 degrees.
3, 3	XDIS	1-80	8F10.0	This parameter is not read if NXWYPT = 0. Enter NXWYPT X (ISW(3) = 1) or range ISW(3) = 2) discrete receptor locations (meters).
3, 4	YDIS	1-80	8F10.0	This parameter is not read if NXWYPT = 0. Enter NXWYPT discrete Y receptor locations

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
3, 4	YDIS (Cont.)	1-80	8F10.0	in meters (ISW(3) = 1) or NXWYPT discrete direction receptor locations in integer degree values (ISW(3) = 2) within the range of 1 to 360 degrees.
3, 5	GRIDZ	1-80	8F10.0	This parameter, which is an array defining receptor elevations (feet MSL), is not read if ISW(4) = 0. For the regular receptor grid (if any), receptor elevation Z_{ij} corresponds to the i^{th} X coordinate (range) and j^{th} Y coordinate (direction radial). Begin with Z_{11} and enter NXPNTS values (Z_{11}, Z_{21}, Z_{31}, ...). Then, starting with a new card image, enter NXPNTS values (Z_{12}, Z_{22}, Z_{32}, ...). Continue until all regular receptor elevations have been entered. For the discrete receptor locations (if any), enter NXWYPT elevation values, beginning with a new card image, in the order the discrete receptor locations were entered in XDIS and YDIS.
4*, 1	NSOGRP	1-80	20I4	Enter the number of source identification numbers required to define a source group for each source group combination. Enter NGROUP values. A maximum of 150 values may be entered.

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
4*, 2	IDSOR	1-78	13I6	Enter the source identification numbers used to define a source group for each source group combination. A minus sign preceding a source identification number implies inclusive summing from the previous source number entered to the source number with the minus sign. A maximum of 200 values may be entered.
5, 1-6	PDEF	1-60	6F10.0	This parameter is read only if ISW(21) = 2. Enter 36 wind profile exponents. For each of the six Pasquill stability categories, enter 6 values per card for each of the 6 wind speed categories.
5, 7-12	DTHDEF	1-60	6F10.0	This parameter is read only if ISW(22) = 2. Enter 36 vertical potential temperature gradients (degrees Kelvin/meter). For each of the six Pasquill stability categories, enter 6 values per card for each of the 6 wind speed categories.
5, 13	ZR	1-10	F10.0	Enter the wind speed reference height z_1 (meters). Default assumes 10.0 meters.
5, 13	UCATS	11-60	5F10.0	Enter the upper bound of the first through fifth wind speed categories (meters/second). Default assumes 1.54, 3.09, 5.14, 8.23 and 10.8 meters per second.

*This card group is not read if parameter NGROUP equals 0.

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
5, 14	TK	1-8	E8.0	Enter the source emission rate conversion factor in order to convert the emission rate units. Default assumes 1.0 x 10^6 for concentration and 1.0 for deposition.
5, 14	BETA1	9-16	F8.0	Enter the adiabatic entrainment coefficient. Default assumes 0.6 (Briggs, 1975).
5, 14	BETA2	17-24	F8.0	Enter the stable entrainment coefficient. Default assumes 0.6 (Briggs, 1975).
5, 14	DECAY	25-32	F8.0	This parameter is ignored if ISW(19) = 2. Enter the decay coefficient (seconds^{-1}) for chemical depletion of a pollutant. Default assumes no decay.
5, 14	IQUN	33-44	3A4	A 12-character label identifying the emission rate units of all sources. Default assumes (grams/second) for concentration and (grams) for deposition. Units of per square meter are automatically included for area sources.
5, 14	ICHIUN	45-72	7A4	A 28-character label identifying the units of concentration or deposition. Default assumes (micrograms/cubic meter) for concentration and (grams/square meter) for deposition.
5, 14	IMET	73-74	I2	FORTRAN logical unit number of hourly meteorological data. Default assumes "9" if ISW(19) = 1 and "5" (or current read unit) if ISW(19) = 2.

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
5, 14	ITAP	75-76	I2	FORTRAN logical unit number of concentration or deposition output tape. Default assumes "3".
5, 15-19	IDAY	1-80	80I1	This parameter is not read if ISW(19) = 2. This parameter consists of an array of 366 entries where each entry corresponds to the 366 Julian Days in a year. An entry set to "1" indicates that the corresponding Julian Day will be processed by the program. For example, if IDAY(140) = 1 then Julian Day 140 will be processed by the program. Default assumes 0 for all days.
5, 20	ISS	1-6	I6	This parameter is not read if ISW(19) = 2. Enter the surface station number of the hourly meteorological data. This number must match the station number read from the meteorological tape.
5, 20	ISY	7-12	I6	This parameter is not read if ISW(19) = 2. Enter the year (last two digits only) of the surface station meteorological data. The year must match the corresponding year read from the meteorological tape,
5, 20	IUS	13-18	I6	This parameter is not read if ISW(19) = 2. Enter the upper air station number of the hourly meteorological data. The number must match the station number read from the meteorological tape.

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
5, 20	IUY	19-24	I6	This parameter is not read if ISW(19) = 2. Enter the year (last two digits only) of the upper air station meteorological data. The year must match the corresponding year read from the meteorological tape.
6, 1*	NSO	1-5	I5	Enter a unique source identification number for the problem run. Must be a positive integer.
6, 1*	ITYPE	6	I1	0 = stack-type source 1 = volume-type source 2 = area-type source
6, 1*	WAKE	7	I1	This parameter pertains only to stack-type sources with building wake effects. If 0 is entered or left blank, an "upper bound" concentration or deposition is calculated. If 1 is entered, a "lower bound" concentration or deposition is calculated (see Section 2.4.1.1.d).
6, 1*	NVS	8-9	I2	Enter the number of gravitational settling categories. Maximum number allowed = 20. Default assumes 0.
6, 1*	QFLG	10	I1	This parameter is ignored if ISW(23) > 0. Enter emission rate variation indicator. See input parameter ISW(23) for options. Default assumes 0.

*This card is repeated for each source (NSOURC times).

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
6, 1*	Q	11-18	F8.0	Enter emission rate. For concentration and type 0 and 1 sources, units are mass per time and for type 2 sources, units are mass per square meter per time. For deposition and type 0 and 1 sources, units are in mass and for type 2 source units are in mass per square meter.
6, 1*	XS	19-25	F7.0	X-coordinate (east-west location) in meters of the center of a stack or volume source and the southwest corner of an area source.
6, 1*	YS	26-32	F7.0	Y-coordinate (north-south location) in meters of the center of a stack or volume source and the southwest corner of an area source.
6, 1*	ZS	33-38	F6.0	Elevation of the source at the source base (meters above mean sea level).
6, 1*	HS	39-44	F6.0	Enter source height (meters). For type 0 sources, enter stack height; for type 1 sources, enter height at the center of the volume source; for type 2 sources, enter the effective emission height.
6, 1*	TS	45-50	F6.0	For type 0 sources, enter the stack exit temperature (degrees Kelvin); for type 1 sources, enter the initial vertical dimension σ_{zo} in meters.

*This card is repeated for each source (NSOURC times).

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
6, 1*	VS	51-56	F6.0	For type 0 sources, enter the stack exit velocity (meters per second); for type 1 sources, enter the initial horizontal dimension σ_{yo} in meters; for type 2 sources, enter the width (meters) of a square area source.
6, 1*	D	57-62	F6.0	For type 0 sources, enter the inner stack diameter (meters).
6, 1*	HB**	63-68	F6.0	For type 0 sources, enter the height (meters) of a building adjacent to this stack source.
6, 1*	HL**	69-74	F6.0	For type 0 sources, enter the length (meters) of a building adjacent to this stack source.
6, 1*	HW**	75-80	F6.0	For type 0 sources, enter the width (meters) of a building adjacent to this stack source.
6, 2*	PHI	1-80	8F10.0	This parameter is not read if NVS equals zero from card 1 for a given source. Enter the mass fraction of particulates for each gravitational settling category. Enter NVS values.

*This card is repeated for each source (NSOURC times).

**If non-zero values are entered for parameters HB or HL and HW, the program automatically uses the building wake effects option (see Section 2.4.1.1.d). However, if HB, HL, and HW are not punched or are equal to "0," wake effects for the respective source are not considered.

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
6, 3*	VSN	1-80	8F10.0	This parameter is not read if NVS equals zero from card 1 for a given source. Enter the gravitational settling velocity (meters per second) for each gravitational settling category. Enter NVS values.
6, 4*	GAMMA	1-80	8F10.0	This parameter is not read if NVS equals zero from card 1 for a given source. Enter the surface reflection coefficient for each gravitational settling category. Enter NVS values.
6, 5**	QTK	1-80	8F10.0	Enter the source emission rate scalars in a manner depending on the value of ISW(23) or QFLG (whichever parameter is applicable). If ISW(23) or QFLG = 1 enter 4 seasonal scalars in the order of winter, spring, summer and fall (1 card); if = 2, enter twelve monthly scalars beginning with January and ending with December (2 cards); if = 3, enter 24 scalars for each hour of the day (3 cards); if = 4, enter 6 scalars per card for each wind speed category and 6 cards for each of the six Pasquill stability categories (A-F) (6 cards); and if = 5, enter 24 hourly scalars for each of the four seasons (12 cards).

*This card is repeated for each source (NSOURC times).

**This card is not read if ISW(23) = 0 and QFLG = 0 for all sources. Otherwise if ISW(23) > 0 then this card is read once; if ISW(23) = 0, this card is read for each source for which QFLG > 0.

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
7*, 1**	JDAY	6-8	I3	Enter the Julian Day of this day of hourly meteorological data. This is used to compute the season or month if required for any sources which have variational emission rates.
7*, 1**	AFV	9-16	F8.0	Enter the direction (degrees) toward which the wind is blowing. This value is also used as the random wind flow vector by the model.
7*, 1**	AWS	17-24	F8.0	Enter the mean wind speed (meters per second) measured at reference height z_1.
7*, 1**	HLH	25-32	F8.0	Enter the height of the top of the surface mixing layer (meters).
7*, 1**	TEMP	33-40	F8.0	Enter the ambient air temperature (degrees Kelvin).
7*, 1**	DTHDZ	41-48	F8.0	This parameter is read only if ISW(22) = 3. Enter the vertical potential temperature gradient (degrees Kelvin per meter).
7*, 1**	IST	56	I1	Enter the Pasquill stability category (1 = A, 2 = B, 3 = C, etc.)

*This card group is not read if ISW(19) = 1. If ISW(19) = 2, this card group is repeated NDAYS times.

**This card is repeated for each hour of the day (NHOURS times).

TABLE 3-4 (Continued)

Card Group, Card Number	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
7*, 1**	P	57-64	F8.0	This parameter is read only if ISW(21) = 3. Enter the wind profile exponent.
7*, 1**	DECAY	65-72	F8.0	Enter the decay coefficient (seconds^{-1}) for chemical removal of a pollutant for this hour. Default assumes no decay. This value overrides any value entered in parameter DECAY in Card Group 5.

*This card group is not read if ISW(19) = 1. If ISW(19) = 2, this card group is repeated NDAYS times.

**This card is repeated for each hour of the day (NHOURS times).

Card Group (2) consists of the "ISW" array which contains most of the program's control or specification parameters. Also contained in Card Group (2) are parameters which specify the number of sources (NSOURC), the size of the receptor grid (NXPNTS and NYPNTS), the number of discrete receptors (NXWYPT) and the number of source group combinations (NGROUP). The maximum number of sources and receptors is not limited to individual parameters but is a function of four parameters. This function can be described as

$$\text{LIMIT} \geq \text{NPNTS} \cdot (\text{NAVG} \cdot \text{NGROUP} + 2) + \text{NXPNTS} + \text{NYPNTS} + 2 \cdot \text{NXWYPT} + 215 \cdot \text{NSOURC} + A + B + C \qquad (3\text{-}1)$$

where

NSOURC = number of input sources (see card columns 1-6 of the second card of Card Group (2))

NXPNTS = number of X points or ranges in the receptor grid (see card columns 7-12 of the second card of Card Group (2))

NYPNTS = number of Y points or direction radials in the receptor grid (see card columns 13-18 of the second card of Card Group (2))

NXWYPT = number of discrete receptors (see card columns 19-24 of the second card of Card Group (2))

NPNTS = NXPNTS · NYPNTS + NXWYPT (total number of receptors)

NAVG = number of time periods. This equals the number of time period parameters (ISW(7) through ISW(14) in the first card of Card Group (2)) set to "1"

NGROUP = number of source group combinations (see card columns 25-30 of the second card of Card Group (2)). For the purpose of computing the required data storage for a problem run, assume NGROUP equals "1" in Equation (3-1) if NGROUP equals "0" in Card Group (2)

A = NPNTS • NGROUP if ISW(15) equals "1" in the first card of Card Group (2); otherwise A equals "0"

B = 4 • NAVG • NPNTS • NGROUP if ISW(17) equals "1" in the first card of Card Group (2); otherwise B equals "0"

C = 201 • NAVG • NGROUP if ISW(18) equals "1" in the first card of Card Group (2); otherwise C equals "0"

and

LIMIT = 43,500. This is the current data storage allocation of the program (consult Section 3.2.7 for modification of this value)

Card Group (3) consists of parameters which contain the receptor location information. If the user chooses not to define a receptor grid (either NXPNTS or NYPNTS = "0"), the program does not read parameters GRIDX and GRIDY. Likewise, parameters XDIS and YDIS are not read by the program if the user chooses not to specify any discrete receptors (NXWYPT ="0"). All receptor location values are entered in a continuous manner with 8 values per card image in fields of 10 columns. Begin a new card image for each parameter input (GRIDX, GRIDY, XDIS and YDIS). Similarly, all receptor terrain elevations are entered into parameter GRIDZ (if ISW(4) equals "1" in Card Group (2)), with 8 values per card in 10 column-wide fields. A new card image is started, though, for each set of X-axis (range) locations entered per Y-axis point (radial). This format is described in Table 3-4 and Section 3.1.2.d.

Card Group (4) contains the parameters which define what sources constitute each source group combination. This Card Group is not read by the program if NGROUP equals "0" in the second card of Group (2). Parameter NSOGRP reads up to 20 integer values per card in 4-column fields. Parameter IDSOR reads up to 13 integer values per card in 6-column fields.

Card Group (5) consists of meteorological-related parameters which remain constant once they are set, and identification labels and model constants. The first parameter in this Card Group (PDEF) consists of six cards, and is read by the program only if ISW(21) equals "2" in Card Group (2). Likewise, the second parameter (DTHDEF) consists of six cards, and read by the program only if ISW(22) equals "2". The following two cards (cards 13 and 14) are read by the program and contain parameters which have program-provided default values as indicated in Table 3-4. The user should note that the default values of the units conversion factor (TK), the units label for source emission rates (IQUN) and the units label for concentration or deposition (ICHIUN) are compatible. That is, the default mass units of the source emission rates (grams) is scaled by the default conversion value which is compatible with the default mass units of concentration (micrograms) or deposition (grams). Cards 15 through 19 in this Card Group consist of the IDAY parameter. IDAY is not read by the program if ISW(19) equals "2" in Card Group (2). This parameter is an array where each column on the 80-column card image for each card represents a Julian Day. For example, to indicate that Julian Day 140 of the hourly meteorological data is to be processed by the program, IDAY(140) is set to "1" which is column 60 of the second card of the IDAY parameter. The remaining parameters consist of one card (the 20th possible card of this Card Group) and are not read if ISW(19) equals "2" in Card Group (2).

Card Group (6) contains all source data parameters. Except for the last parameter (card 5) in this Card Group (QTK), this Card Group is repeated for each source input (NSOURC times). The first card of this

Card Group consists of the principal parameters used to define the characteristics of a source. Cards 2 to 4 pertain to the gravitational settling categories of particulates (parameters PHI, VSN and GAMMA) and are read by the program only when parameter NVS in columns 8-9 of the first card is greater than "0" for a given source. If NVS is greater than "0", cards 2 to 4 are read immediately following the first source card for which NVS is greater than "0". It should be noted that cards 2 to 4 of this Card Group may actually consist of more than 3 cards. That is, if NVS is greater than "8", the program will read more than one card for each of the three settling category parameters (PHI, VSN and GAMMA). Hence, depending on the value of NVS, the program reads no cards, 3 cards, 6 cards or 9 cards for parameters PHI, VSN and GAMMA. After the first through fourth cards are read for all sources, card 5 (consisting of the source emission rate scalar array (QTK)) is read provided one of two options is exercised by the user. That is, either ISW(23) is greater than "0" in Card Group (2) or any number of the QFLG parameter in card 1 of this Card Group are greater than "0" for all input sources. If both ISW(23) and QFLG are equal to "0" for all sources, card 5 of this Card Group is not read by the program. If ISW(23) is greater than "0", card 5 is read once and contains the source emission rate scalars for all sources. Also, the QFLG parameter in card 1 of this Card Group is ignored for all input sources. If ISW(23) equals "0", card 5 is repeated each time a QFLG parameter is greater than "0" for a source. The source emission rate scalars contained in card 5 of this Card Group allow the user to vary emission rates as a function of season*, month*, hour of the day, wind speed and Pasquill stability category, or season and hour of the day. As mentioned in the descriptions of parameter QTK in Table 3-4 and Section 3.1.2.e, the value of ISW(23) or QFLG (whichever is applicable) governs the number and manner in which the source emission rate scalars are entered into parameter QTK. If ISW(23) (or QFLG) equals "1", QTK

*The program determines the season or month based on the Julian Day or month value read from the hourly meteorological data. Consult Table 3-5 for the conversion used by the program of Julian Day to month or season, and month to season.

TABLE 3-5

JULIAN DAY TO MONTH/SEASON OR MONTH TO SEASON CONVERSION CHART FOR LEAP YEARS*

Winter				Spring						Summer						Autumn						Winter	
Jan = 1		Feb = 2		Mar = 3		Apr = 4		May = 5		Jun = 6		Jul = 7		Aug = 8		Sep = 9		Oct = 10		Nov = 11		Dec = 12	
1	1	1	32	1	61	1	92	1	122	1	153	1	183	1	214	1	245	1	275	1	306	1	336
2	2	2	33	2	62	2	93	2	123	2	154	2	184	2	215	2	246	2	276	2	307	2	337
3	3	3	34	3	63	3	94	3	124	3	155	3	185	3	216	3	247	3	277	3	308	3	338
4	4	4	35	4	64	4	95	4	125	4	156	4	186	4	217	4	248	4	278	4	309	4	339
5	5	5	36	5	65	5	96	5	126	5	157	5	187	5	218	5	249	5	279	5	310	5	340
6	6	6	37	6	66	6	97	6	127	6	158	6	188	6	219	6	250	6	280	6	311	6	341
7	7	7	38	7	67	7	98	7	128	7	159	7	189	7	220	7	251	7	281	7	312	7	342
8	8	8	39	8	68	8	99	8	129	8	160	8	190	8	221	8	252	8	282	8	313	8	343
9	9	9	40	9	69	9	100	9	130	9	161	9	191	9	222	9	253	9	283	9	314	9	344
10	10	10	41	10	70	10	101	10	131	10	162	10	192	10	223	10	254	10	284	10	315	10	345
11	11	11	42	11	71	11	102	11	132	11	163	11	193	11	224	11	255	11	285	11	316	11	346
12	12	12	43	12	72	12	103	12	133	12	164	12	194	12	225	12	256	12	286	12	317	12	347
13	13	13	44	13	73	13	104	13	134	13	165	13	195	13	226	13	257	13	287	13	318	13	348
14	14	14	45	14	74	14	105	14	135	14	166	14	196	14	227	14	258	14	288	14	319	14	349
15	15	15	46	15	75	15	106	15	136	15	167	15	197	15	228	15	259	15	289	15	320	15	350
16	16	16	47	16	76	16	107	16	137	16	168	16	198	16	229	16	260	16	290	16	321	16	351
17	17	17	48	17	77	17	108	17	138	17	169	17	199	17	230	17	261	17	291	17	322	17	352
18	18	18	49	18	78	18	109	18	139	18	170	18	200	18	231	18	262	18	292	18	323	18	353
19	19	19	50	19	79	19	110	19	140	19	171	19	201	19	232	19	263	19	293	19	324	19	354
20	20	20	51	20	80	20	111	20	141	20	172	20	202	20	233	20	264	20	294	20	325	20	355
21	21	21	52	21	81	21	112	21	142	21	173	21	203	21	234	21	265	21	295	21	326	21	356
22	22	22	53	22	82	22	113	22	143	22	174	22	204	22	235	22	266	22	296	22	327	22	357
23	23	23	54	23	83	23	114	23	144	23	175	23	205	23	236	23	267	23	297	23	328	23	358
24	24	24	55	24	84	24	115	24	145	24	176	24	206	24	237	24	268	24	298	24	329	24	359
25	25	25	56	25	85	25	116	25	146	25	177	25	207	25	238	25	269	25	299	25	330	25	360
26	26	26	57	26	86	26	117	26	147	26	178	26	208	26	239	26	270	26	300	26	331	26	361
27	27	27	58	27	87	27	118	27	148	27	179	27	209	27	240	27	271	27	301	27	332	27	362
28	28	28	59	28	88	28	119	28	149	28	180	28	210	28	241	28	272	28	302	28	333	28	363
29	29	29	60	29	89	29	120	29	150	29	181	29	211	29	242	29	273	29	303	29	334	29	364
30	30			30	90	30	121	30	151	30	182	30	212	30	243	30	274	30	304	30	335	30	365
31	31			31	91			31	152			31	213	31	244			31	305			31	366

*For non-leap years, subtract 1 from Julian Day numbers corresponding to calendar days after February 28.

contains 4 seasonal scalars in the order of Winter, Spring, Summer and Fall (1 card). If ISW(23) (or QFLG) equals "2", enter 12 monthly scalars beginning with January and ending with December (2 cards). If ISW(23) (or QFLG) equals "3", enter 24 scalars for each hour of the day beginning with hour 1 and ending with hour 24 (3 cards). If ISW(23) (or QFLG) equals "4", enter 6 scalars per card for each wind speed category (1 to 6) and 6 cards for each of the six Pasquill stability categories (A to F) for a total of 36 scalars (6 cards). If ISW(23) (or QFLG) equals "5", enter 24 hourly scalars for each hour and 4 sets for each season (12 cards). Hence, card 5 of this Card Group may actually consist of more than one card depending on the value of ISW(23) (or QFLG).

Card Group (7) contains the hourly meteorological data parameters. This Card Group is not read if ISW(19) equals "1"; instead all hourly meteorological data are read from an input tape described in the following paragraph (Section 3.2.3.b). This Card Group is repeated for each day of meteorological data to be processed (NDAYS times). All meteorological data parameters are contained on one card image which is read for each hour per day of meteorological data (NHOURS times).

b. <u>Tape Input Requirements</u>. The ISCST program accepts an input tape file of hourly meteorological data in a format generated by the preprocessor program (see Appendix G). Although an input tape file is optional, most problem run cases call for hourly meteorological data contained in this format. If input parameter ISW(19) equals "1", the program reads hourly meteorology from an input tape file. If ISW(19) equals "2", the program reads hourly meteorological data in a card image format, requiring no input tape file. The program reads the input tape file from the FORTRAN logical unit number specified in parameter IMET. The user is required to assign the input meteorological tape and associate the same logical unit number as specified by IMET to the input tape (see Section 3.2.2.a). The user must also provide the surface station number and year, and the upper air station number and year which are specified in parameters ISS, ISY, IUS and IUY, respectively. The user does not need to know the specific format of the hourly meteorological data contained in the input tape file. For a description of the specific format of the input tape file, the reader is referred to Section G.5 of Appendix G.

3.2.4 Program Output Data Description

The ISCST program generates several categories of printed output and an optional output tape file. The following paragraphs describe the format and content of both forms of program output.

a. Printed Output. The ISCST program generates five categories of printed output, four of which are tables of average concentration or total deposition values. All five categories of printed output are optional to the user. That is, the user must indicate which categories are desired to be printed for a particular problem run. The five categories are:

- Input Data (Card and Tape) Listing
- Daily Calculated Average Concentration or Total Deposition Tables
- "N"-Day Calculated Average Concentration or Total Deposition Tables
- Highest and Second Highest Calculated Average Concentration or Total Deposition Tables
- Maximum 50 Calculated Average Concentration or Total Deposition Tables

The first line of each page of printed output is a heading used to identify the problem run (see input parameter TITLE in Section 3.2.3.a).

The user may list all input data parameters used by the program for a particular problem run. If input parameter ISW(6) equals "1" (discussed in Section 3.2.3.a), the program lists all program control parameters, meteorological-related constants and identification labels, receptor data and source data. Figure 3-2 is an illustration of the content and format of an input data listing for a typical problem run. The first page of the input data listing mostly consists of the program control parameter values, number of input sources and number of receptors. The second and third pages are a listing of meteorological-related constants such as the Julian Days to be processed by the program (printed only if ISW(19) equals "1"), wind speed categories, wind profile exponents and vertical potential temperature gradients. Also included are the locations of the receptor grid and discrete receptors. If receptor terrain elevations are input (ISW(4) equals "1"), a listing of the receptor elevations for all receptors is produced (not shown). The following page is a listing of source data parameters for all sources. Subsequent pages related to the input sources may be printed if NVS or QFLG are greater than zero. If NVS is greater than zero for an input source, a listing is produced of the mass fraction, settling velocity and surface reflection coefficient for each gravitational settling category. If QFLG is greater than zero for an input source, a listing is produced of the source scalars used to vary the source's emission rate. (Also, if ISW(23) is greater than zero, a listing is produced similar to the listing for QFLG greater than zero.)

Additionally, the user may also direct the program to print all hourly meteorology processed by the program. If ISW(6) equals "2", the program produces a list of the meteorological data for each day processed as shown in Figure 3-3. Hence, a page is generated for each day of meteorology processed by the program (NDAYS pages if ISW(19) equals "2" or the number of entries set to "1" in the IDAY array if ISW(19) equals "1").

The next category of optional printed output are tables of average concentration or total deposition values calculated for each day

```
*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

CALCULATE (CONCENTRATION=1,DEPOSITION=2)                          ISW(1) =  1
RECEPTOR GRID SYSTEM (RECTANGULAR=1 OR 3, POLAR=2 OR 4)           ISW(2) =  1
DISCRETE RECEPTOR SYSTEM (RECTANGULAR=1,POLAR=2)                  ISW(3) =  2
TERRAIN ELEVATIONS ARE READ (YES=1,NO=0)                          ISW(4) =  0
CALCULATIONS ARE WRITTEN TO TAPE (YES=1,NO=0)                     ISW(5) =  0
LIST-ALL INPUT DATA (NO=0,YES=1,MET DATA ALSO=2)                  ISW(6) =  2

COMPUTE AVERAGE CONCENTRATION (OR TOTAL DEPOSITION)
WITH THE FOLLOWING TIME PERIODS:
  HOURLY (YES=1,NO=0)                                             ISW(7) =  0
  2-HOUR (YES=1,NO=0)                                             ISW(8) =  0
  3-HOUR (YES=1,NO=0)                                             ISW(9) =  0
  4-HOUR (YES=1,NO=0)                                            ISW(10) =  0
  6-HOUR (YES=1,NO=0)                                            ISW(11) =  0
  8-HOUR (YES=1,NO=0)                                            ISW(12) =  0
  12-HOUR (YES=1,NO=0)                                           ISW(13) =  0
  24-HOUR (YES=1,NO=0)                                           ISW(14) =  1
PRINT "N"-DAY TABLE(S) (YES=1,NO=0)                              ISW(15) =  1

PRINT THE FOLLOWING TYPES OF TABLES WHOSE TIME PERIODS ARE
SPECIFIED BY ISW(7) THROUGH ISW(14):
  DAILY TABLES (YES=1,NO=0)                                      ISW(16) =  1
  HIGHEST & SECOND HIGHEST TABLES (YES=1,NO=0)                   ISW(17) =  1
  MAXIMUM 50 TABLES (YES=1,NO=0)                                 ISW(18) =  1
METEOROLOGICAL DATA INPUT METHOD (PRE-PROCESSED=1,CARD=2)        ISW(19) =  1
RURAL-URBAN OPTION (RURAL=0,URBAN MODE 1=1,URBAN MODE 2=2)       ISW(20) =  0
WIND PROFILE EXPONENT VALUES (DEFAULTS=1,USER ENTERS=2,3)        ISW(21) =  1
VERTICAL POT. TEMP. GRADIENT VALUES (DEFAULTS=1,USER ENTERS=2,3) ISW(22) =  1
SCALE EMISSION RATES FOR ALL SOURCES (NO=0,YES>0)                ISW(23) =  0
PROGRAM CALCULATES FINAL PLUME RISE ONLY (YES=1,NO=2)            ISW(24) =  2
PROGRAM ADJUSTS ALL STACK HEIGHTS FOR DOWNWASH (YES=2,NO=1)      ISW(25) =  1

NUMBER OF INPUT SOURCES                                           NSOURC = 16
NUMBER OF SOURCE GROUPS (=0,ALL SOURCES)                          NGROUP =  5
TIME PERIOD INTERVAL TO BE PRINTED (=0,ALL INTERVALS)              IPERD =  0
NUMBER OF X (RANGE) GRID VALUES                                   NXPNTS = 19
NUMBER OF Y (THETA) GRID VALUES                                   NYPNTS = 19
NUMBER OF DISCRETE RECEPTORS                                      NXWYPT = 64
SOURCE EMISSION RATE UNITS CONVERSION FACTOR                          TK = .10000+07
ENTRAINMENT COEFFICIENT FOR UNSTABLE ATMOSPHERE                    BETA1 = .600
ENTRAINMENT COEFFICIENT FOR STABLE ATMOSPHERE                      BETA2 = .600
HEIGHT ABOVE GROUND AT WHICH WIND SPEED WAS MEASURED                  ZR = 10.00  METERS
LOGICAL UNIT NUMBER OF METEOROLOGICAL DATA                          IMET =  9
DECAY COEFFICIENT FOR PHYSICAL OR CHEMICAL DEPLETION               DECAY = .000000
SURFACE STATION NO.                                                  ISS = 14913
YEAR OF SURFACE DATA                                                 ISY = 64
UPPER AIR STATION NO.                                                IUS = 14918
YEAR OF UPPER AIR DATA                                               IUY = 64
ALLOCATED DATA STORAGE                                             LIMIT = 43500 WORDS
REQUIRED DATA STORAGE FOR THIS PROBLEM RUN                         MIMIT = 18211 WORDS
```

FIGURE 3-2. Example input data listing (ISW(6) option).

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

*** METEOROLOGICAL DAYS TO BE PROCESSED ***
(IF=1)

```
0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 1 0 0 0   0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 1 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0   0 1 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 1 0   0 0 0 0 0 0 0 0 1 0
0 0 0 0 1 0 0 0 0 0   0 1 0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0 1 0 0 0   0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0   0 0 0 0 0 0
```

*** NUMBER OF SOURCE NUMBERS REQUIRED TO DEFINE SOURCE GROUPS ***
(NSOGRP)

1, 2, 2, 1, 2,

*** SOURCE NUMBERS DEFINING SOURCE GROUPS ***
(IDSOR)

1, 2, -11, 12, -15, 16, 1, -16,

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** WIND PROFILE EXPONENTS ***

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.10000+00	.10000+00	.10000+00	.10000+00	.10000+00	.10000+00
B	.15000+00	.15000+00	.15000+00	.15000+00	.15000+00	.15000+00
C	.20000+00	.20000+00	.20000+00	.20000+00	.20000+00	.20000+00
D	.25000+00	.25000+00	.25000+00	.25000+00	.25000+00	.25000+00
E	.30000+00	.30000+00	.30000+00	.30000+00	.30000+00	.30000+00
F	.30000+00	.30000+00	.30000+00	.30000+00	.30000+00	.30000+00

FIGURE 3-2. (Continued)

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

*** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
(DEGREES KELVIN PER METER)

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.00000	.00000	.00000	.00000	.00000	.00000
B	.00000	.00000	.00000	.00000	.00000	.00000
C	.00000	.00000	.00000	.00000	.00000	.00000
D	.00000	.00000	.00000	.00000	.00000	.00000
E	.20000-01	.20000-01	.20000-01	.20000-01	.20000-01	.20000-01
F	.35000-01	.35000-01	.35000-01	.35000-01	.35000-01	.35000-01

*** X-COORDINATES OF RECTANGULAR GRID SYSTEM ***
(METERS)

-3000.0,	-2000.0,	-1500.0,	-1250.0,	-1000.0,	-800.0,	-600.0,	-400.0,	-200.0,	.0,
200.0,	400.0,	600.0,	800.0,	1000.0,	1250.0,	1500.0,	2000.0,	3000.0,	

*** Y-COORDINATES OF RECTANGULAR GRID SYSTEM ***
(METERS)

-3000.0,	-2000.0,	-1500.0,	-1250.0,	-1000.0,	-800.0,	-600.0,	-400.0,	-200.0,	.0,
200.0,	400.0,	600.0,	800.0,	1000.0,	1250.0,	1500.0,	2000.0,	3000.0,	

*** RANGE,THETA COORDINATES OF DISCRETE RECEPTORS ***
(METERS,DEGREES)

(555.0, 317.0),	(620.0, 318.0),	(685.0, 320.0),	(735.0, 322.0),	(800.0, 326.0),
(860.0, 331.0),	(900.0, 336.0),	(920.0, 341.0),	(940.0, 346.0),	(940.0, 351.0),
(935.0, 356.0),	(910.0, 1.0),	(950.0, 6.0),	(1015.0, 11.0),	(1055.0, 16.0),
(1075.0, 21.0),	(1075.0, 26.0),	(1045.0, 31.0),	(995.0, 36.0),	(910.0, 41.0),
(855.0, 43.0),	(755.0, 45.0),	(620.0, 47.0),	(525.0, 49.0),	(460.0, 51.0),
(355.0, 56.0),	(355.0, 66.0),	(355.0, 76.0),	(355.0, 86.0),	(350.0, 96.0),
(345.0, 106.0),	(335.0, 116.0),	(325.0, 126.0),	(380.0, 136.0),	(420.0, 141.0),
(430.0, 146.0),	(480.0, 151.0),	(505.0, 156.0),	(535.0, 161.0),	(575.0, 166.0),
(620.0, 171.0),	(665.0, 176.0),	(705.0, 181.0),	(730.0, 186.0),	(745.0, 191.0),
(755.0, 196.0),	(755.0, 201.0),	(745.0, 206.0),	(730.0, 211.0),	(705.0, 216.0),
(690.0, 221.0),	(690.0, 226.0),	(690.0, 231.0),	(680.0, 236.0),	(665.0, 241.0),
(645.0, 246.0),	(615.0, 251.0),	(575.0, 256.0),	(530.0, 261.0),	(475.0, 266.0),
(410.0, 271.0),	(365.0, 276.0),	(365.0, 286.0),	(410.0, 296.0),	(

FIGURE 3-2. (Continued)

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

*** SOURCE DATA ***

SOURCE NUMBER	TYPE	WAKE	NUMBER PART. CATS.	EMISSION RATE TYPE=0,1 (GRAMS/SEC) TYPE=2 (GRAMS/SEC) *PER METER**2	X (METERS)	Y (METERS)	BASE ELEV. (METERS)	HEIGHT (METERS)	TEMP. TYPE=0 (DEG.K) VERT.DIM TYPE=1 (METERS)	EXIT VEL. TYPE=0 (M/SEC) HORZ.DIM TYPE=1,2 (METERS)	DIAMETER TYPE=0 (METERS)	BLDG. HEIGHT TYPE=0 (METERS)	BLDG. LENGTH TYPE=0 (METERS)	BLDG. WIDTH TYPE=0 (METERS)
1	2	0	6	.10000+00	-13.3	-13.3	.0	10.00	.00	26.60	.00	.00	.00	.00
2	1	0	6	.13000+00	20.0	.0	.0	.90	1.00	4.70	.00	.00	.00	.00
3	1	0	6	.13000+00	30.0	.0	.0	2.60	1.00	4.70	.00	.00	.00	.00
4	1	0	6	.13000+00	40.0	.0	.0	4.30	1.00	4.70	.00	.00	.00	.00
5	1	0	6	.13000+00	49.0	.0	.0	6.10	1.00	4.70	.00	.00	.00	.00
6	1	0	6	.13000+00	59.0	.0	.0	7.80	1.00	4.70	.00	.00	.00	.00
7	1	0	6	.13000+00	69.0	.0	.0	9.60	1.00	4.70	.00	.00	.00	.00
8	1	0	6	.13000+00	79.0	.0	.0	11.30	1.00	4.70	.00	.00	.00	.00
9	1	0	6	.13000+00	89.0	.0	.0	13.00	1.00	4.70	.00	.00	.00	.00
10	1	0	6	.13000+00	99.0	.0	.0	14.80	1.00	4.70	.00	.00	.00	.00
11	1	0	6	.13000+00	109.0	.0	.0	16.50	1.00	4.70	.00	.00	.00	.00
12	1	0	0	.26300+01	121.0	.0	.0	22.50	11.60	10.80	.00	.00	.00	.00
13	1	0	0	.26300+01	144.0	.0	.0	22.50	11.60	10.80	.00	.00	.00	.00
14	1	0	0	.26300+01	167.0	.0	.0	22.50	11.60	10.80	.00	.00	.00	.00
15	1	0	0	.26300+01	190.0	.0	.0	22.50	11.60	10.80	.00	.00	.00	.00
16	0	0	0	.50000+01	201.0	.0	.0	50.00	340.00	0.00	1.00	25.00	90.00	50.00

FIGURE 3-2. (Continued)

```
*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

*** SOURCE PARTICULATE DATA ***

*** SOURCE NUMBER =      1 ***

MASS FRACTION =
 .10000,  40000,  28000,  .12000,  .06000,  .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000,  .82000,  .72000,  .65000,  .59000,  .50000,

*** SOURCE NUMBER =      2 ***

MASS FRACTION =
 .10000,  40000,  .28000,  .12000,  .06000,  .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000,  .82000,  .72000,  .65000,  .59000,  .50000,

*** SOURCE NUMBER =      3 ***

MASS FRACTION =
 .10000,  .40000,  .28000,  .12000,  .06000,  .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000,  82000,  .72000,  .65000,  59000,  .50000,
```

FIGURE 3-2. (Continued)

```
*** --  HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION  -- ***

                    *** SOURCE PARTICULATE DATA ***

*** SOURCE NUMBER =     4 ***

MASS FRACTION =
 .10000, .40000, .28000, .12000, .06000, .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000, .82000, .72000, .65000, .59000, .50000,

*** SOURCE NUMBER =     5 ***

MASS FRACTION =
 .10000, .40000, .28000, .12000, .06000, .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000, .82000, .72000, .65000, .59000, .50000,

*** SOURCE NUMBER =     6 ***

MASS FRACTION =
 .10000, .40000, .28000, .12000, .06000, .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000, .82000, .72000, .65000, .59000, .50000,
```

FIGURE 3-2. (Continued)

```
*** --  HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION  -- ***

                    *** SOURCE PARTICULATE DATA ***

*** SOURCE NUMBER =     7 ***

MASS FRACTION =
 .10000, .40000, .28000, .12000, .06000, .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000, .82000, .72000, .65000, .59000, .50000,

*** SOURCE NUMBER =     8 ***

MASS FRACTION =
 .10000, .40000, .28000, .12000, .06000, .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000, .82000, .72000, .65000, .59000, .50000,

*** SOURCE NUMBER =     9 ***

MASS FRACTION =
 .10000, .40000, .28000, .12000, .06000, .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000, .82000, .72000, .65000, .59000, .50000,
```

FIGURE 3-2. (Continued)

```
*** --  HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION  -- ***

*** SOURCE PARTICULATE DATA ***

*** SOURCE NUMBER =    10 ***

MASS FRACTION =
 .10000, .40000, .28000, .12000, .06000, .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000, .82000, .72000, .65000, .59000, .50000,

*** SOURCE NUMBER =    11 ***

MASS FRACTION =
 .10000, .40000, .28000, .12000, .06000, .04000,

SETTLING VELOCITY(METERS/SEC) =
  .0010,  .0070,  .0190,  .0370,  .0610,  .0990,

SURFACE REFLECTION COEFFICIENT =
1.00000, .82000, .72000, .65000, .59000, .50000,
```

FIGURE 3-2. (Continued)

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE NO. = 1

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.10000+01	2	.10000+01	3	.10000+01	4	.10000+01	5	.10000+01	6	.10000+01
7	.10000+01	8	.30000+01	9	.30000+01	10	.50000+01	11	.30000+01	12	.50000+01
13	.90000+01	14	.90000+01	15	.30000+01	16	.10000+01	17	.10000+01	18	.10000+01
19	.10000+01	20	.10000+01	21	.10000+01	22	.10000+01	23	.10000+01	24	.10000+01

FIGURE 3-2. (Continued)

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* METEOROLOGICAL DATA FOR DAY 51 *

HOUR	FLOW VECTOR (DEGREES)	RANDOM FLOW VECTOR (DEGREES)	WIND SPEED (MPS)	MIXING HEIGHT (METERS)	TEMP. (DEG. K)	INPUT STABILITY CATEGORY	ADJUSTED STABILITY CATEGORY
1	160.0	158.9	5.14	761.2	261.5	4	4
2	160.0	163.0	3.60	764.2	260.4	5	5
3	150.0	154.0	3.60	767.2	259.0	5	5
4	150.0	151.0	4.63	770.2	258.7	5	5
5	150.0	140.0	5.66	773.1	258.1	4	4
6	140.0	143.0	6.17	776.1	257.0	4	4
7	150.0	152.0	6.17	779.1	257.0	4	4
8	150.0	155.0	5.66	782.1	257.0	4	4
9	160.0	162.0	4.63	785.1	256.5	3	3
10	160.0	157.0	5.14	788.1	258.7	4	4
11	170.0	173.0	5.14	791.0	260.9	4	4
12	160.0	162.0	6.17	794.0	262.6	4	4
13	150.0	148.0	4.63	797.0	263.7	3	3
14	160.0	160.0	6.69	800.0	264.8	4	4
15	150.0	154.0	6.17	800.0	264.8	4	4
16	150.0	146.0	6.69	800.0	265.4	4	4
17	160.0	158.0	6.17	800.0	264.0	4	4
18	160.0	157.0	4.12	802.9	263.1	5	5
19	160.0	165.0	3.60	809.5	262.0	5	5
20	160.0	161.0	4.63	816.1	260.9	5	5
21	160.0	165.0	5.14	822.7	259.8	5	5
22	160.0	156.0	3.60	829.3	259.3	5	5
23	150.0	146.0	4.12	835.9	258.7	5	5
24	160.0	160.0	5.66	842.5	258.1	4	4

FIGURE 3-3. Example listing of a day of meteorological data (ISW(6) option).

("daily") of meteorology processed by the program. If ISW(16) equals "1", tables are printed for each day for all user-defined combinations of source groups and time periods. As shown in Figure 3-4, each table consists of the calculated average concentration or total deposition values for all receptors. Although the concentration or deposition values in the output tables include five decimal places in order to show low values arising from low emissions or low values relative to the highest values, the results of the model calculations should not be considered to be accurate to five or more significant figures. The calculated concentration or deposition values are printed first for the receptor grid (if any). The heading of the table indicates the day, time period, time period interval* and sources that represent the printed values. The heading information is also listed in a cryptic format in the upper right-hand corner of the page. The maximum average concentration or total deposition value found among the table of receptor grid values is printed. Next, the calculated values for the discrete receptors (if any) are printed beginning on a new page with a heading similar to that printed for the receptor grid.

The user may direct the program to print tables of calculated concentration averaged over "N"-days or deposition summed over "N"-days where "N" represents the total number of days of meteorology processed by the program run. If ISW(15) equals "1", tables are printed for all user-defined source groups. As shown in Figure 3-5, each table consists of the calculated concentration or deposition values for all receptors. The calculated values are first printed for the receptor grid (if any). The heading of the table indicates the number of days over which the table is produced ("N") and which sources contributed to the calculated values. The heading information is listed in a cryptic format in the upper right-hand corner of the page. The maximum value found for the receptor grid is printed. Beginning on a new page, the calculated

*See Table 3-6 for the hours which define a particular time period interval.

TABLE 3-6

TIME PERIOD INTERVALS AND CORRESPONDING HOURS OF THE DAY

Time Period Interval Number	Time Period							
	1-Hour	2-Hour	3-Hour	4-Hour	6-Hour	8-Hour	12-Hour	24-Hour
1	0-1	0-2	0-3	0-4	0-6	0-8	0-12	0-24
2	1-2	2-4	3-6	4-8	6-12	9-16	12-24	-
3	2-3	4-6	6-9	8-12	12-18	16-24	-	
4	3-4	6-8	9-12	12-16	18-24	-	-	-
5	4-5	8-10	12-15	16-20	-	-	-	-
6	5-6	10-12	15-18	20-24	-	-	-	-
7	6-7	12-14	18-21	-	-	-	-	-
8	7-8	14-16	21-24	-	-	-	-	-
9	8-9	16-18	-	-	-	-	-	-
10	9-10	18-20	-	-	-	-	-	-
11	10-11	20-22	-	-	-	-	-	-
12	11-12	22-24	-	-	-	-	-	-
13	12-13	-	-	-	-	-	-	-
14	13-14	-	-	-	-	-	-	-
15	14-15	-	-	-	-	-	-	-
16	15-16	-	-	-	-	-	-	-
17	16-17	-	-	-	-	-	-	-
18	17-18	-	-	-	-	-	-	-
19	18-19	-	-	-	-	-	-	-
20	19-20	-	-	-	-	-	-	-
21	20-21	-	-	-	-	-	-	-
22	21-22	-	-	-	-	-	-	-
23	22-23	-	-	-	-	-	-	-
24	23-24	-	-	-	-	-	-	-

DAILY: 31
24-HR/PD 1
SGROUPS 3

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* DAILY 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* ENDING WITH HOUR 24 FOR DAY 31 *
* FROM SOURCES: 13, -15,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 203.91974 AND OCCURRED AT (200.0, -200.0) *

Y-AXIS / (METERS) /	X-AXIS (METERS) -3000.0	-2000.0	-1500.0	-1250.0	-1000.0	-800.0	-600.0	-400.0	-200.0
3000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
2000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
1500.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
1250.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
1000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
800.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
600.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
400.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
200.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-200.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-400.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-600.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-800.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-1000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-1250.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-1500.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001
-2000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00016
-3000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00001	.00133

FIGURE 3-4. Example listing of a "daily" average concentration output table (ISW(16) option). Note that the results in the concentration or deposition output tables are in fixed point rather than scientific notation for user convenience. No claim of model accuracy to five decimal places is made for this or any concentration or deposition output table.

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* DAILY 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* ENDING WITH HOUR 24 FOR DAY 51 *
* FROM SOURCES: 12, -15,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 205.91974 AND OCCURRED AT (200.0, -200.0) *

Y-AXIS (METERS) /	X-AXIS (METERS) .0	200.0	400.0	600.0	800.0	1000.0	1250.0	1500.0	2000.0
3000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
2000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	00000	.00000	.00000
1500.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
1250.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
1000.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
800.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
600.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
400.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
200.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000
-200.0 /	.00000	205.91974	4.73236	.00000	.00000	.00000	.00000	.00000	.00000
-400.0 /	.00016	39.61426	125.83667	1.06694	.00174	.00000	.00000	.00000	.00000
-600.0 /	.00207	12.47965	143.40366	39.36904	1.03534	.00552	.00001	.00000	.00000
-800.0 /	.00719	6.62089	89.20360	71.92775	15.99400	.65719	00321	.00002	.00000
-1000.0 /	.01426	4.20003	46.50354	81.25763	35.18431	7.47949	.19736	.00201	.00000
-1250.0 /	.02333	2.66060	10.46155	60.00740	49.16711	22.64871	3.46626	.15321	.00007
-1500.0 /	.03083	1.81599	8.23092	40.99999	49.97206	29.62180	12.84532	1.87130	.00433
-2000.0 /	.03957	.97937	3.31048	13.90630	30.64077	34.20594	21.43504	12.10795	.73466
-3000.0 /	.04127	.40632	1.34330	2.12759	6.60176	15.35725	18.09126	19.29385	8.21911

FIGURE 3-4. (Continued)

DAILY: 51
24-HR/PD 1
SGROUP# 3

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* DAILY 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* ENDING WITH HOUR 24 FOR DAY 51 *
* FROM SOURCES: 12, -13,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 205.91974 AND OCCURRED AT (200.0, -200.0) *

Y-AXIS (METERS) /	X-AXIS (METERS) 3000.0
3000.0 /	.00000
2000.0 /	.00000
1500.0 /	.00000
1250.0 /	.00000
1000.0 /	.00000
800.0 /	.00000
600.0 /	.00000
400.0 /	.00000
200.0 /	.00000
.0 /	.00000
-200.0 /	.00000
-400.0 /	.00000
-600.0 /	.00000
-800.0 /	.00000
-1000.0 /	.00000
-1250.0 /	.00000
-1500.0 /	.00000
-2000.0 /	.00002
-3000.0 /	.21505

FIGURE 3-4. (Continued)

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* DAILY 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* ENDING WITH HOUR 24 FOR DAY 51 *
* FROM SOURCES: 12, -15,
* FOR THE DISCRETE RECEPTOR POINTS *

- RNG -	- DIR -	CON.	- RNG -	- DIR -	CON.	- RNG -	- DIR -	CON:
555.0	317.0	.00000	620.0	318.0	.00000	685.0	320.0	.00000
735.0	322.0	.00000	800.0	326.0	.00000	860.0	331.0	.00000
900.0	336.0	.00000	920.0	341.0	.00000	940.0	346.0	.00000
940.0	351.0	.00000	935.0	356.0	.00000	910.0	1.0	.00000
950.0	6.0	.00000	1015.0	11.0	.00000	1035.0	16.0	.00000
1075.0	21.0	.00000	1075.0	26.0	.00000	1045.0	31.0	.00000
995.0	36.0	.00000	910.0	41.0	.00000	855.0	43.0	.00000
755.0	43.0	.00000	620.0	47.0	.00000	525.0	49.0	.00000
460.0	51.0	.00000	355.0	56.0	.00000	355.0	66.0	.00000
355.0	76.0	.00000	355.0	86.0	.00000	350.0	96.0	.00006
345.0	106.0	.74947	335.0	116.0	61.66626	325.0	126.0	270.49908
380.0	136.0	261.61783	420.0	141.0	215.76077	450.0	146.0	146.44760
480.0	151.0	77.02698	505.0	156.0	29.76986	535.0	161.0	10.57386
575.0	166.0	3.52426	620.0	171.0	.71228	665.0	176.0	.06247
705.0	181.0	.00185	730.0	186.0	.00001	745.0	191.0	.00000
755.0	196.0	.00000	795.0	201.0	.00000	745.0	206.0	.00000
730.0	211.0	.00000	705.0	216.0	.00000	690.0	221.0	.00000
690.0	226.0	.00000	690.0	231.0	.00000	680.0	236.0	.00000
665.0	241.0	.00000	645.0	246.0	.00000	615.0	251.0	.00000
575.0	256.0	.00000	530.0	261.0	.00000	475.0	266.0	.00000
410.0	271.0	.00000	365.0	276.0	.00000	365.0	286.0	.00000
410.0	296.0	.00000						

FIGURE 3-4. (Continued)

"N"-DAY
10 DAYS
SGROUPS 2

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* 10-DAY AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *

* FROM SOURCES: 2, -11,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 19.55864 AND OCCURRED AT (200.0, 200.0) *

Y-AXIS (METERS) /	X-AXIS (METERS) -3000.0	-2000.0	-1500.0	-1250.0	-1000.0	-800.0	-600.0	-400.0	-200.0
3000.0 /	.00379	.13594	.00312	.01310	.00069	.00004	.00000	.00000	.00000
2000.0 /	.50859	.01042	.00740	.30030	.18698	.02593	.00087	.00001	.00000
1500.0 /	.42209	.31490	.02203	.02690	.39072	.02864	.06255	.00008	.00000
1250.0 /	.50142	1.10515	.27417	.03600	.06412	.53477	.39810	.01316	.00003
1000.0 /	.65580	.01970	1.60911	.60320	.06706	.60307	.85516	.22028	.00065
800.0 /	.65771	1.06125	1.54827	2.40363	1.11891	.12821	.24350	1.11938	.01404
600.0 /	.72733	1.25936	1.69907	1.72136	3.67227	2.93072	.30923	.90024	.40827
400.0 /	.61007	1.39884	1.90263	2.63202	3.36572	3.56341	7.26782	1.16263	3.12629
200.0 /	.28045	.77120	1.00568	2.00136	4.13097	5.34441	8.15958	11.19211	8.97102
.0 /	.20275	.39000	.61642	.02080	1.15974	1.65148	2.62001	4.05777	12.49825
-200.0 /	.12277	.15415	.14332	.11660	.07122	.03092	.00346	.00012	.00000
-400.0 /	.04033	.01506	.00294	.00058	.00004	.00000	.00000	.00000	.00000
-600.0 /	.00604	.00020	.00001	.00000	.00000	.00000	.00000	.00000	.00174
-800.0 /	.00039	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.01884
-1000.0 /	.00001	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.05645
-1250.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00005	.11626
-1500.0 /	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00115	.17334
-2000.0 /	.00000	.00000	.00000	.00000	.00000	.00001	.00002	.00648	.25791
-3000.0 /	.00000	.00000	.00000	.00000	.00023	.00355	.00154	.03177	.27111

FIGURE 3-5. Example listing of an "N"-day average concentration output table (ISW(15) option).

"N"-DAY
10 DAYS
SGROUPS 2

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* 10-DAY AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *

* FROM SOURCES: 2, -11,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 19.58864 AND OCCURRED AT (200.0, 300.0) *

Y-AXIS (METERS) /	X-AXIS (METERS) .0	200.0	400.0	600.0	800.0	1000.0	1250.0	1500.0	2000.0
3000.0 /	.00021	.00917	.08403	.29060	.31158	.14985	.21665	.24463	.19389
2000.0 /	.00046	.04783	.50843	.50412	.33097	.47071	.37864	.49311	.71405
1500.0 /	.00060	.17286	.95553	.50400	.71404	.60200	1.07729	1.15517	.68717
1250.0 /	.00076	.40580	1.03341	.95639	.82038	1.17887	1.57224	1.93075	.78791
1000.0 /	.00099	1.02864	.98524	1.29437	1.60237	2.20016	2.31409	1.22928	.45536
800.0 /	.00128	2.06470	1.84034	1.00974	3.30100	3.54509	1.69871	1.05281	.37186
600.0 /	.00176	3.37712	2.81676	5.20137	4.28234	2.52872	1.03737	.62806	.15742
400.0 /	.00402	4.96269	9.15649	5.85779	2.73591	1.30902	.39105	.57876	.30460
200.0 /	.71724	19.58864	9.47973	1.96976	1.01070	1.21092	.76032	.67270	.26480
.0 /	.00000	2.23411	.09796	.50499	.32276	.22449	.15854	.11080	.07492
-200.0 /	4.80986	6.00057	6.53752	2.32495	.60020	.10242	.00340	.01265	.00350
-400.0 /	4.07129	9.94799	1.29573	2.17407	2.55888	1.27223	.48513	.21711	.04122
-600.0 /	3.17410	6.90573	2.32979	.59008	1.66965	1.06957	1.35741	.57672	.17589
-800.0 /	2.47149	4.40760	3.16556	.02903	.31914	1.46126	.52405	.82013	.33462
-1000.0 /	1.95317	3.36099	3.45173	1.19723	.42971	.21629	.70602	.30004	.62977
-1250.0 /	1.50979	2.22100	2.02463	1.61413	.56476	.27519	.14752	.47697	.31534
-1500.0 /	1.19636	1.43846	1.39329	1.10727	.80430	.35560	.15793	.10812	.32429
-2000.0 /	.80511	.71417	1.09334	.97663	.72593	.60102	.24998	.15264	.06628
-3000.0 /	.44829	.33716	.57389	.92389	.46296	.45793	.39972	.30410	.16650

FIGURE 3-5. (Continued)

"H"-DAY
10 DAYS
SGROUPS 2

ooo -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ooo

o 10-DAY AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) o

o FROM SOURCES: 2, -11,
o FOR THE RECEPTOR GRID o

o MAXIMUM VALUE EQUALS 19.55864 AND OCCURRED AT (200.0, 200.0) o

Y-AXIS (METERS) /	X-AXIS (METERS) 3000.0
3000.0 /	.36402
2000.0 /	.39912
1500.0 /	.21502
1250.0 /	.19483
1000.0 /	.08015
800.0 /	.19504
600.0 /	.13382
400.0 /	.21362
200.0 /	.05773
.0 /	.03962
-200.0 /	.00487
-400.0 /	.00221
-600.0 /	.01790
-800.0 /	.05999
-1000.0 /	.10807
-1250.0 /	.18160
-1500.0 /	.33362
-2000.0 /	.09057
-3000.0 /	.03319

FIGURE 3-5. (Continued)

"N"-DAY
10 DAYS
$GROUPS 2

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* 10-DAY AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *

* FROM SOURCES: 2, -11,
* FOR THE DISCRETE RECEPTOR POINTS *

- RNG -	- DIR -	CON.	- RNG -	- DIR -	CON.	- RNG -	- DIR -	CON.
555.0	317.0	.64430	620.0	318.0	.32151	685.0	320.0	.17095
735.0	322.0	.22230	800.0	326.0	.76855	860.0	331.0	1.36164
900.0	336.0	.70925	920.0	341.0	.11470	940.0	346.0	.00646
940.0	351.0	.00022	935.0	356.0	.00001	910.0	1.0	.00291
950.0	6.0	.10125	1015.0	11.0	.94620	1655.0	16.0	1.71317
1075.0	21.0	1.01459	1075.0	26.0	1.38512	1045.0	31.0	1.50867
995.0	36.0	1.71214	910.0	41.0	3.52849	859.0	43.0	4.66730
755.0	45.0	6.19663	620.0	47.0	9.21069	525.0	49.0	13.27004
460.0	51.0	17.12016	355.0	56.0	20.77974	355.0	66.0	10.67536
355.0	76.0	4.82090	355.0	86.0	2.93970	350.0	96.0	.45671
345.0	106.0	5.86118	335.0	116.0	9.52768	325.0	126.0	6.97453
380.0	136.0	3.38442	420.0	141.0	4.46995	490.0	146.0	6.35272
480.0	151.0	8.18763	505.0	156.0	8.91923	535.0	161.0	8.48276
575.0	166.0	7.71952	620.0	171.0	5.07146	665.0	176.0	4.33245
705.0	181.0	2.33030	730.0	186.0	.59311	745.0	191.0	.08491
755.0	196.0	.00687	795.0	201.0	.00018	745.0	206.0	.00000
730.0	211.0	.00000	765.0	216.0	.00000	690.0	221.0	.00000
690.0	226.0	.00000	690.0	231.0	.00000	680.0	236.0	.00000
665.0	241.0	.00000	645.0	246.0	.00009	615.0	251.0	.00423
575.0	256.0	.00683	530.0	261.0	.67749	475.0	266.0	2.36500
410.0	271.0	5.16094	365.0	276.0	11.20536	365.0	286.0	10.16617
410.0	296.0	12.96254						

FIGURE 3-5. (Continued)

values for the discrete receptors (if any) are printed with a heading similar to that printed for the receptor grid.

The program may also print tables of the highest and second highest average concentration or total deposition values calculated at each receptor point throughout the duration of the problem run. If ISW(17) equals "1", a table of the highest and a table of the second highest calculated values are printed for all user-defined combinations of source groups and time periods. Figure 3-6 is an illustration of a highest calculated average concentration or total deposition table. The second highest table is not shown but is similar in format. The calculated values are first printed for the receptor grid points (if any). The heading indicates the time period and sources which represent the calculated values. The heading information is listed in a cryptic format in the upper right-hand corner of the page. The maximum value found among the receptor grid values for a given table is printed. The calculated values for the discrete receptors (if any) are then printed beginning on a new page. Beside each calculated value for all receptors, the day and the time period interval* are enclosed in parentheses and indicate when the corresponding highest (or second highest) calculated value occurred.

The final category of printed output that may be produced are tables of the maximum 50 calculated average concentration or total deposition values found for the problem run. If ISW(18) equals "1", a table of the 50 maximum values is produced for all user-defined combinations of source groups and time periods. As shown in Figure 3-7, each table consists of a heading and the maximum 50 calculated values. The heading specifies the time period and sources that represent the maximum 50 values. The heading information is also listed in a cryptic format in the upper right-hand corner of the page. For each of the maximum 50 calculated values, the order (rank), the calculated value itself, the

*See Table 3-6 for the hours which define a particular time period interval.

HIGH
24-HR
SGROUP# 1

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* HIGHEST 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* FROM SOURCES: 1,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 29257.33984 AND OCCURRED AT (.0, -200.0) *

Y-AXIS (METERS) /	X-AXIS (METERS) -3000.0	-2000.0	-1500.0	-1250.0	-1000.0
3000.0 /	7.01088 (187, 1)	78.74459 (305, 1)	18.80492 (305, 1)	2.66758 (205, 1)	.22506 (187, 1)
2000.0 /	262.92981 (187, 1)	16.39869 (187, 1)	73.02420 (305, 1)	153.63390 (305, 1)	38.32606 (305, 1)
1500.0 /	286.99170 (305, 1)	240.66068 (187, 1)	29.79066 (187, 1)	31.76900 (187, 1)	236.79732 (305, 1)
1250.0 /	326.64682 (305, 1)	455.56999 (187, 1)	134.89673 (187, 1)	43.37550 (187, 1)	70.12573 (305, 1)
1000.0 /	373.36642 (305, 1)	564.73594 (305, 1)	802.14337 (187, 1)	283.60898 (187, 1)	68.49780 (187, 1)
800.0 /	393.87098 (262, 1)	675.95557 (305, 1)	1070.54029 (205, 1)	1044.73756 (187, 1)	425.15841 (187, 1)
600.0 /	385.86480 (262, 1)	618.38744 (305, 1)	1002.33798 (305, 1)	1233.12947 (305, 1)	1061.97388 (205, 1)
400.0 /	269.97479 (262, 1)	746.60953 (262, 1)	1190.02315 (262, 1)	1454.61662 (305, 1)	2083.11252 (305, 1)
200.0 /	225.80037 (262, 1)	968.32584 (262, 1)	861.27768 (262, 1)	1330.66579 (262, 1)	2264.69687 (262, 1)
.0 /	247.39113 (262, 1)	477.78599 (262, 1)	759.00874 (262, 1)	1018.25744 (262, 1)	1444.61826 (262, 1)
-200.0 /	194.09293 (262, 1)	244.51450 (262, 1)	209.60483 (262, 1)	140.95262 (262, 1)	67.56431 (262, 1)
-400.0 /	61.43138 (262, 1)	16.28438 (262, 1)	1.66692 (262, 1)	.15093 (262, 1)	.00295 (187, 1)
-600.0 /	6.82830 (262, 1)	.12364 (262, 1)	.00073 (187, 1)	.00063 (187, 1)	.00000 (187, 1)
-800.0 /	.26891 (262, 1)	.00026 (187, 1)	.00000 (187, 1)	.00000 (187, 1)	.00000 (187, 1)
-1000.0 /	.00396 (262, 1)	.00000 (187, 1)	.00000 (187, 1)	.00000 (187, 1)	.00000 (337, 1)
-1250.0 /	.00002 (187, 1)	.00000 (187, 1)	.00000 (187, 1)	.00000 (337, 1)	.00000 (337, 1)
-1500.0 /	.00000 (187, 1)	.00000 (187, 1)	.00000 (337, 1)	.00000 (337, 1)	.00000 (337, 1)
-2000.0 /	.00000 (187, 1)	.00000 (337, 1)	.00000 (337, 1)	.00000 (337, 1)	.00021 (337, 1)
-3000.0 /	.00000 (337, 1)	.00000 (337, 1)	.00009 (337, 1)	.01987 (337, 1)	1.52175 (337, 1)

FIGURE 3-6. Example listing of a highest average concentration output table (ISW(17) option).

HIGH
24-HR
SGROUPS 1

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* HIGHEST 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* FROM SOURCES: 1,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 29257.33984 AND OCCURRED AT (.0, -200.0) *

Y-AXIS (METERS) /	X-AXIS (METERS) -800.0	-600.0	-400.0	-200.0	.0
3000.0 /	.02187 (187, 1)	.00103 (187, 1)	.00002 (187, 1)	.00140 (289, 1)	.39458 (289, 1)
2000.0 /	3.64513 (205, 1)	.23969 (187, 1)	.00400 (187, 1)	.00018 (289, 1)	1.03276 (289, 1)
1500.0 /	118.39290 (305, 1)	6.96493 (205, 1)	.17495 (187, 1)	.00037 (187, 1)	2.02372 (289, 1)
1250.0 /	329.60170 (305, 1)	53.73400 (205, 1)	1.90340 (187, 1)	.00314 (187, 1)	3.07055 (289, 1)
1000.0 /	103.86832 (305, 1)	427.40199 (305, 1)	15.03959 (187, 1)	.04380 (187, 1)	5.07164 (289, 1)
800.0 /	107.80086 (187, 1)	331.47763 (305, 1)	188.70660 (305, 1)	.97678 (187, 1)	8.50962 (289, 1)
600.0 /	1164.95976 (187, 1)	192.61037 (187, 1)	999.93413 (305, 1)	12.40346 (187, 1)	16.37711 (289, 1)
400.0 /	2986.00357 (305, 1)	3429.66122 (187, 1)	431.43683 (187, 1)	996.97519 (305, 1)	40.20404 (289, 1)
200.0 /	3417.10876 (262, 1)	5034.02111 (305, 1)	8261.22119 (305, 1)	1618.61168 (187, 1)	159.62980 (289, 1)
0 /	2113.19528 (262, 1)	3410.60469 (262, 1)	6411.06494 (262, 1)	14624.32703 (262, 1)	.00000 (0, 0)
-200.0 /	16.72914 (262, 1)	.65443 (262, 1)	.00080 (187, 1)	.00000 (337, 1)	29257.33984 (337, 1)
-400.0 /	.00006 (187, 1)	.00000 (187, 1)	.00000 (337, 1)	.08076 (337, 1)	12556.48901 (337, 1)
-600.0 /	.00000 (187, 1)	.00000 (337, 1)	.00000 (337, 1)	41.96467 (337, 1)	6761.63867 (337, 1)
-800.0 /	.00000 (337, 1)	.00000 (337, 1)	.00620 (337, 1)	250.86494 (337, 1)	4217.97260 (337, 1)
-1000.0 /	.00000 (337, 1)	.00000 (337, 1)	.71882 (337, 1)	442.10267 (337, 1)	2898.65292 (337, 1)
-1250.0 /	.00000 (337, 1)	.00420 (337, 1)	13.46043 (337, 1)	557.08878 (337, 1)	2017.04434 (337, 1)
-1500.0 /	.00006 (337, 1)	.24976 (337, 1)	54.82798 (337, 1)	580.01745 (337, 1)	1501.84814 (337, 1)
-2000.0 /	.12187 (337, 1)	12.00114 (337, 1)	160.56051 (337, 1)	549.62419 (337, 1)	949.64354 (337, 1)
-3000.0 /	20.03640 (337, 1)	98.79222 (337, 1)	227.32941 (337, 1)	396.21806 (337, 1)	513.20028 (337, 1)

FIGURE 3-6. (Continued)

HIGH
24-HR
SGROUP# 1

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* HIGHEST 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* FROM SOURCES: 1,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 29257.33904 AND OCCURRED AT (.0, -200.0) *

Y-AXIS (METERS) /	X-AXIS (METERS) 200.0	400.0	600.0	800.0	1000.0
3000.0 /	12.09791 (289, 1)	95.99378 (289, 1)	208.16702 (289, 1)	210.70117 (289, 1)	123.79415 (289, 1)
2000.0 /	72.26886 (289, 1)	408.23549 (289, 1)	279.99170 (289, 1)	395.55615 (289, 1)	586.41706 (289, 1)
1500.0 /	309.13699 (289, 1)	640.51051 (289, 1)	631.27656 (289, 1)	900.32335 (289, 1)	579.07925 (312, 1)
1250.0 /	692.94864 (289, 1)	535.10152 (285, 1)	1212.21210 (289, 1)	760.05359 (289, 1)	1535.92755 (312, 1)
1000.0 /	1264.42076 (289, 1)	1213.19186 (289, 1)	1356.18510 (289, 1)	2180.26080 (312, 1)	1233.37479 (312, 1)
800.0 /	1862.76083 (289, 1)	2495.05020 (289, 1)	2630.63773 (312, 1)	1791.38394 (312, 1)	1324.06496 (299, 1)
600.0 /	1880.63634 (289, 1)	2678.74228 (312, 1)	2905.20343 (312, 1)	1902.53619 (299, 1)	1912.80093 (299, 1)
400.0 /	7380.99609 (289, 1)	5631.48242 (312, 1)	3601.52902 (299, 1)	1782.01617 (299, 1)	754.60027 (299, 1)
200.0 /	13594.94873 (312, 1)	5105.16809 (299, 1)	534.33291 (299, 1)	1363.01515 (312, 1)	392.20446 (312, 1)
.0 /	728.76321 (229, 1)	491.65845 (229, 1)	293.93680 (229, 1)	192.29752 (229, 1)	135.66249 (229, 1)
-200.0 /	3096.53659 (229, 1)	7997.71472 (229, 1)	2584.90671 (229, 1)	833.65382 (229, 1)	250.04896 (229, 1)
-400.0 /	7259.68079 (51, 1)	1015.86870 (229, 1)	1761.94778 (229, 1)	2744.46030 (229, 1)	1336.52791 (229, 1)
-600.0 /	4195.57330 (51, 1)	1210.95793 (51, 1)	491.51054 (229, 1)	925.43362 (229, 1)	1236.53349 (229, 1)
-800.0 /	1835.72150 (337, 1)	2395.10950 (51, 1)	309.70553 (51, 1)	292.65739 (229, 1)	803.61901 (229, 1)
-1000.0 /	1727.78735 (337, 1)	2078.45715 (51, 1)	773.98990 (51, 1)	162.50557 (51, 1)	196.84149 (229, 1)
-1250.0 /	2639.88640 (337, 1)	1196.73647 (51, 1)	1293.01970 (51, 1)	406.83203 (51, 1)	109.67669 (51, 1)
-1500.0 /	1821.19019 (337, 1)	654.31646 (337, 1)	1084.91153 (51, 1)	675.81919 (51, 1)	256.72969 (51, 1)
-2000.0 /	1091.00719 (337, 1)	524.65175 (337, 1)	507.92515 (51, 1)	680.26542 (51, 1)	539.92422 (51, 1)
-3000.0 /	479.52023 (337, 1)	611.11151 (337, 1)	265.07733 (337, 1)	212.32002 (337, 1)	300.43372 (51, 1)

FIGURE 3-6. (Continued)

HIGH
24-HR
SGROUP# 1

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* HIGHEST 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* FROM SOURCES: 1,
* FOR THE RECEPTOR GRID *

* MAXIMUM VALUE EQUALS 29237.33900 AND OCCURRED AT (.0, -200.0) *

Y-AXIS (METERS) /	X-AXIS (METERS) 1250.0	1500.0	2000.0	3000.0
3000.0 /	232.93274 (289, 1)	308.86749 (289, 1)	103.11969 (312, 1)	198.61736 (299, 1)
2000.0 /	388.30664 (289, 1)	613.38634 (312, 1)	380.83041 (299, 1)	260.78302 (299, 1)
1500.0 /	1157.59996 (312, 1)	617.60366 (312, 1)	418.99287 (299, 1)	197.32846 (299, 1)
1250.0 /	843.64931 (312, 1)	749.72033 (299, 1)	394.75001 (299, 1)	131.08338 (299, 1)
1000.0 /	910.70238 (299, 1)	816.41238 (299, 1)	390.22298 (299, 1)	34.40098 (299, 1)
800.0 /	1198.75235 (299, 1)	732.87447 (299, 1)	240.38709 (299, 1)	138.92283 (312, 1)
600.0 /	842.67531 (299, 1)	389.74961 (299, 1)	163.28487 (312, 1)	30.33080 (312, 1)
400.0 /	98.41490 (312, 1)	449.64993 (312, 1)	168.72939 (312, 1)	139.90004 (299, 1)
200.0 /	476.74028 (299, 1)	414.32555 (299, 1)	122.60000 (299, 1)	26.02315 (229, 1)
.0 /	96.84216 (229, 1)	73.09407 (229, 1)	46.51416 (229, 1)	24.81405 (229, 1)
-200.0 /	62.40043 (229, 1)	18.66026 (229, 1)	8.62507 (229, 1)	3.00900 (229, 1)
-400.0 /	694.99847 (229, 1)	346.06254 (229, 1)	72.33560 (229, 1)	4.20383 (229, 1)
-600.0 /	1293.53807 (229, 1)	673.32644 (229, 1)	284.09901 (229, 1)	34.60614 (229, 1)
-800.0 /	659.73797 (229, 1)	901.26665 (229, 1)	412.39845 (229, 1)	108.52377 (229, 1)
-1000.0 /	611.78599 (229, 1)	353.90938 (229, 1)	624.02987 (229, 1)	170.60395 (229, 1)
-1250.0 /	131.95607 (229, 1)	439.53657 (229, 1)	336.33190 (229, 1)	218.67608 (229, 1)
-1500.0 /	52.19541 (51, 1)	95.09326 (229, 1)	176.88272 (229, 1)	323.26402 (229, 1)
-2000.0 /	199.56817 (91, 1)	84.66453 (91, 1)	56.71505 (229, 1)	103.10001 (229, 1)
-3000.0 /	359.34361 (91, 1)	279.02787 (51, 1)	80.32958 (51, 1)	27.30494 (229, 1)

FIGURE 3-6. (Continued)

HIGH
24-HR
SGROUP0 1

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* HIGHEST 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *
* FROM SOURCES: 1,
* FOR THE DISCRETE RECEPTOR POINTS *

- RNG -	- DIR -	CON.	(DAY,PER.)	- RNG -	- DIR -	CON.	(DAY,PER.)
555.0	317.0	363.35759	(187, 1)	620.0	318.0	281.45566	(187, 1)
685.0	320.0	242.87609	(187, 1)	735.0	322.0	367.98349	(305, 1)
800.0	326.0	833.51421	(305, 1)	860.0	331.0	478.96017	(305, 1)
900.0	336.0	61.94616	(205, 1)	920.0	341.0	6.68790	(187, 1)
940.0	346.0	.39082	(187, 1)	940.0	351.0	.00820	(187, 1)
935.0	356.0	.04938	(289, 1)	910.0	1.0	15.25862	(289, 1)
990.0	6.0	310.12569	(289, 1)	1015.0	11.0	1252.37616	(289, 1)
1055.0	16.0	984.78966	(289, 1)	1075.0	21.0	1064.22385	(289, 1)
1075.0	26.0	1828.96118	(289, 1)	1045.0	31.0	1605.53326	(289, 1)
995.0	36.0	2312.04096	(312, 1)	910.0	41.0	3716.50061	(312, 1)
835.0	43.0	3334.30417	(312, 1)	755.0	45.0	3532.88397	(312, 1)
620.0	47.0	5498.56340	(299, 1)	525.0	49.0	6816.95062	(299, 1)
460.0	51.0	7187.11414	(299, 1)	355.0	56.0	9529.39441	(299, 1)
355.0	66.0	4968.47260	(299, 1)	355.0	76.0	3324.30042	(312, 1)
335.0	86.0	668.70051	(299, 1)	350.0	96.0	208.95413	(229, 1)
345.0	106.0	5091.62152	(229, 1)	335.0	116.0	11717.47192	(229, 1)
325.0	126.0	5328.33734	(229, 1)	380.0	136.0	1627.61234	(229, 1)
420.0	141.0	1051.16229	(51, 1)	450.0	146.0	2513.70938	(51, 1)
480.0	151.0	4777.69812	(51, 1)	505.0	156.0	7180.53339	(51, 1)
535.0	161.0	5699.72949	(51, 1)	575.0	166.0	3225.32541	(337, 1)
620.0	171.0	6371.78607	(337, 1)	665.0	176.0	5821.85095	(337, 1)
705.0	181.0	5090.61237	(337, 1)	730.0	186.0	2722.19958	(337, 1)
745.0	191.0	846.50612	(337, 1)	755.0	196.0	119.60146	(337, 1)
755.0	201.0	3.92454	(337, 1)	745.0	206.0	.02435	(337, 1)
730.0	211.0	.00004	(337, 1)	705.0	216.0	.00000	(337, 1)
690.0	221.0	.00000	(337, 1)	690.0	226.0	.00000	(187, 1)
690.0	231.0	.00000	(187, 1)	680.0	236.0	.00000	(187, 1)
665.0	241.0	.00001	(187, 1)	645.0	246.0	.00244	(187, 1)
615.0	251.0	.39407	(262, 1)	575.0	256.0	40.88502	(262, 1)
530.0	261.0	797.13342	(262, 1)	475.0	266.0	3713.44977	(262, 1)
410.0	271.0	6243.87268	(262, 1)	365.0	276.0	8224.08228	(262, 1)
365.0	286.0	10781.29871	(262, 1)	410.0	296.0	9458.34009	(305, 1)

FIGURE 3-6. (Continued)

MAX 50
24-HR
SGROUP0 3

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* 50 MAXIMUM 24-HOUR AVERAGE CONCENTRATION (MICROGRAMS/CUBIC METER) *

* FROM SOURCES: 12. -15.

RANK	CON.	PER.	DAY	X OR RANGE (METERS)	Y(METERS) OR DIRECTION (DEGREES)
1	365.60716	1	229	345.0	106.0
2	357.13231	1	337	200.0	-200.0
3	306.66805	1	312	355.0	65.0
4	291.32770	1	299	355.0	66.0
5	274.64339	1	337	200.0	-400.0
6	270.49908	1	51	325.0	126.0
7	261.61703	1	51	380.0	136.0
8	243.53323	1	337	305.0	156.0
9	238.94873	1	299	400.0	200.0
10	231.92527	1	205	-200.0	200.0
11	230.57980	1	337	400.0	151.0
12	227.51217	1	312	400.0	200.0
13	223.18093	1	299	355.0	76.0
14	221.24822	1	337	535.0	161.0
15	215.76077	1	51	420.0	141.0
16	214.17474	1	262	.0	.0
17	213.90416	1	312	335.0	56.0
18	205.91974	1	51	200.0	-200.0
19	193.70723	1	262	365.0	206.0
20	192.98119	1	337	450.0	146.0
21	189.49826	1	337	200.0	-600.0
22	184.51424	1	289	200.0	200.0
23	182.62673	1	229	600.0	-200.0
24	176.39334	1	289	355.0	56.0
25	176.15051	1	337	575.0	166.0
26	174.78666	1	312	600.0	400.0
27	170.18014	1	305	-200.0	200.0
28	160.01897	1	312	460.0	51.0
29	151.16765	1	229	400.0	-200.0
30	149.03143	1	262	-200.0	.0
31	146.40760	1	51	450.0	146.0
32	145.61457	1	337	420.0	141.0
33	143.40306	1	51	400.0	-600.0
34	139.19619	1	312	525.0	49.0
35	134.27904	1	229	335.0	116.0
36	133.93348	1	299	600.0	400.0
37	133.60077	1	337	200.0	-800.0
38	130.02702	1	312	800.0	600.0
39	129.24970	1	187	365.0	286.0
40	129.15974	1	289	460.0	51.0
41	128.57034	1	299	800.0	400.0
42	128.26113	1	187	410.0	296.0
43	126.49464	1	262	-600.0	200.0
44	125.83667	1	51	400.0	-400.0
45	124.67772	1	262	410.0	296.0
46	123.24991	1	262	365.0	276.0
47	122.15517	1	289	400.0	400.0
48	120.45645	1	305	410.0	296.0
49	118.68963	1	205	-600.0	400.0
50	117.97248	1	187	-200.0	200.0

FIGURE 3-7. Example listing of a maximum 50 average concentrations output table (ISW(18) option).

time period interval*, the day and the receptor location are listed. This information allows the user to identify when and where the calculated value occurred.

In general, the order in which the printed output is listed corresponds to the order that the five categories of print output have been mentioned in the preceding paragraphs. First, all input data parameters, excluding the hourly meteorological data, are optionally listed if ISW(6) equals "1". Tables of the average concentration or total deposition calculated for each time-period/source-group combination for each day ("daily") of meteorological data processed are then listed. Also printed for each day, if ISW(6) equals "2", are the hourly meteorology for that day. The number of tables of daily average concentration or total deposition values is governed by the number of source groups (specified in parameter NGROUP), time periods (specified in parameters ISW(7) through ISW(14)) and time period intervals (parameter IPERD). The order in which the daily tables of average concentration or total deposition are produced is best described by an example. Suppose we have five source groups, desire average concentrations for 1-, 3-, 12- and 24-hour time periods, and all time period intervals are to be printed. For a given day, the following set of tables are produced: (1) for Hour one, 5 tables of 1-hour averages for source groups 1 through 5 are printed; (2) for Hour two, 5 tables of 1-hour averages are printed for the 5 source groups; (3) for Hour three, a 1-hour average table followed by a 3-hour average table are printed for source group 1. Similarly, 1-hour and 3-hour average tables are alternately printed for the second through fifth source groups; (4) for Hour four, 5 tables of 1-hour averages for source groups 1 through 5 are printed; (5) for Hour five, the same format is printed as that for Hours one, two and four; (6) for Hour six, the same format is printed as that for Hour three. This format is continued for each hour of the day. For Hour twelve, 1-hour, 3-hour and 12-hour tables are printed for each of the five source groups. For Hour

*See Table 3-6 for the hours which define a particular time period interval.

twenty four, 1-hour, 3-hour, 12-hour and 24-hour tables are printed for each of the five source groups. This format is repeated for each day of meteorological data. Hence, if ISW(6) equals "2" and ISW(16) equals "1", a listing of the meteorological data and a set of daily tables would be alternately printed for each day of meteorological data processed by the program. After all hourly meteorological data have been processed by the program, the "N"-day tables, highest and second highest tables and the maximum 50 tables are alternately printed for each source group for each specified time interval. The number of tables is governed by the number of source groups (NGROUP) and time periods (ISW(7) through ISW(14)) specified. For each source group, the "N"-day, highest and second highest and the maximum 50 tables are listed in this order:

For source group 1:
  Print "N"-day table (only if ISW(15) = 1)
  For the 1-hour time period (only if ISW(7) = 1):
    Print highest and second highest tables (only if ISW(17) = 1)
    Print maximum 50 table (only if ISW(18) = 1)
  For the 2-hour time period (only if ISW(8) = 1):
    Print highest and second highest tables (only if ISW(17) = 1)
    Print maximum 50 table (only if ISW(18) = 1)
  For the 3-hour time period (only if ISW(9) = 1):
    Print highest and second highest tables (only if ISW(17) = 1)
    Print maximum 50 table (only if ISW(18) = 1)

.   .   .
.   .   .
.   .   .

  For the 24-hour time period (only if ISW(14) = 1)
    Print highest and second highest tables (only if ISW(17) = 1)
    Print maximum 50 table (only if ISW(18) = 1)

The order and number of tables printed according to the above format is repeated for all source groups.

b. <u>Tape Output</u>. The ISCST program is capable of generating an output tape file containing the calculated average concentration or total deposition values based on the selected time periods and source groups. If ISW(5) equals "1", this output tape file is generated. The user must assign an output file and associate the logical unit number specified in parameter ITAP to the output file (see Section 3.2.2.a). The output file is written with a FORTRAN unformatted (binary) WRITE statement and consists of constant length records whose lengths equal the total number of receptor points (NPNTS) plus 3 words. Words 4 through NPNTS + 3 contain the calculated average concentration or total deposition values for all receptors. The values calculated for the receptor grid (if any) are written first followed by the values calculated at the discrete receptors (if any). Starting with the first Y point (direction radial) of the Y-axis (radial) grid, the calculated values are written for the X-axis (ranges) in the same order that receptor locations were entered in parameter GRIDX (see Section 3.2.3.a). For each successive Y-axis (radial), the values are written for the X-axis (ranges). After the calculated values have been written for the receptor grid, the calculated values are written for the discrete points in the order the discrete points were entered in parameters XDIS and YDIS (see Section 3.2.3.a). Word 1 of each record contains the hour at which the corresponding values were calculated in words 4 to NPNTS + 3. Word 2 contains the Julian Day and word 3 contains the source group number. The content and number of records produced is governed by the number of source groups (specified in parameter NGROUP) and time periods (specified in parameters ISW(7) through ISW(14)). For each day of meteorological data processed by the program and for each hour, the program generates records of calculated values for all <u>applicable</u> time period intervals for all source groups. For Hour one, a 1-hour record of calculated values for source group 1, followed by a 1-hour record of calculated values for source group 2, up to a 1-hour record of calculated values for the last source group are written to the output file. For Hour two, a 1-hour and a 2-hour record are written to the output file for each source group. For Hour three, a 1-hour and 3-hour record are written to the output file for each source group. For Hour four, a 1-hour, 2-hour and 4-hour record of calculated values are written to the output file for each source group. This format is continued for each hour of the day. The applicable time period interval records that are written depend on parameters ISW(7) through ISW(14). For example, if there is one source group and only 24-hour average concentrations are calculated in a problem run, only one record per day of meteorological data processed is written to the output file. If ISW(15) equals "1", records of the "N"-day average concentration or total deposition values are additionally written to the output file for all source groups after the program has processed all "N" days of meteorological data. At the conclusion of the problem run, two end-of-file marks are written at the end of the output tape file.

3.2.5 Program Run Time, Page and Tape Output Estimates

This section provies the user with equations which estimate the amount of run time required and program output generated for a given problem run. The equations describing the amount of printed output data (in pages) and tape output data (in words) can be quite accurately estimated. The run time estimate is less accurate because of unknowns such as the nature of the hourly meteorology and wake effects. These unknowns may affect the run time estimate by several minutes for a large problem run.

a. Run Time. The amount of time a problem takes to execute is primarily governed by six factors. These factors are: (1) the number of hours in a day of meteorological data (NHOURS); (2) the number of days of meteorological data processed (NDAYS); (3) the number of sources (NSOURC); (4) the number of source groups (NGROUP); (5) the number of receptor points (NPNTS); and (6) the number of time periods (NAVG). Using these factors, the following equation estimates the run time in minutes:

$$\text{No. of Minutes} = C \cdot (\text{NDAYS} + 1) \cdot \Big(1 + \text{NHOURS} \cdot \big(1 + 0.8 \cdot \text{NSOURC} \cdot (1 + 0.6 \cdot \text{NPNTS} + 0.1 \cdot \text{NGROUP} \cdot \text{NAVG})\big)\Big) \quad (3\text{-}2)$$

where

$$C = 2.1 \cdot 10^{-5}$$

The constant, C, is derived from problem runs made on a UNIVAC 1108 computer and is different for other computer models.

b. Page Output. The number of pages of printer output produced by a problem run is primarily controlled by which categories of output are desired by the user. The content of these categories of program print output are discussed in Section 3.2.4.a. Input parameters ISW(6), ISW(15), ISW(16), ISW(17) and ISW(18), discussed in Section 3.2.3.a, control which categories of program print output are produced. Other factors which determine the amount of print output are the number of receptor points, number of source groups and the number of time periods for which average concentration or total deposition values are computed.

If ISW(6) equals "1", all input data are printed, producing about 5 pages of print output. For sources with gravitational settling categories (NVS greater than zero) or variational emission rates (QFLG greater than zero), add one third of a page per source. If ISW(6) equals "2", all meteorological data processed by the program are printed. Add one page for every day of meteorological data processed.

If ISW(15) equals "1", tables of the "N"-day average concentration or total deposition values are printed. The number of tables printed equals the number of source groups desired by the user (NGROUP). If parameter NGROUP is specified as "0", one table will be printed. The number of pages produced for each "N"-day table is given by the following equation:

$$\text{Number of Pages} = \left(\frac{\text{NXPNTS}}{9}\right) \cdot \left(\frac{\text{NYPNTS}}{38}\right) + \left(\frac{\text{NXWYPT}}{114}\right) \qquad (3\text{-}3)$$

where

NXPNTS = the number of X points on the X-axis grid or the number of grid ranges

NYPNTS = the number of Y points on the Y-axis grid or the number of grid direction radials

NXWYPT = the number of discrete receptor points

Round up any fractional number in each term to the nearest whole number.

If ISW(16) equals "1", tables of average concentration or total deposition for user-defined combinations of source groups and time periods for each day of meteorological data processed by the program are printed. The number of tables produced by this output category for each day is given by the following equation:

$$\begin{aligned}\text{No. of Tables} = \text{NGROUP} \cdot \Big[&(24/\text{IPERD}) \cdot \text{ISW}(7) \\ &+ (12/\text{IPERD}) \cdot \text{ISW}(8) + (8/\text{IPERD}) \cdot \text{ISW}(9) \\ &+ (6/\text{IPERD}) \cdot \text{ISW}(10) + (4/\text{IPERD}) \cdot \text{ISW}(11) \\ &+ (3/\text{IPERD}) \cdot \text{ISW}(12) + (2/\text{IPERD}) \cdot \text{ISW}(13) \\ &+ (1/\text{IPERD}) \cdot \text{ISW}(14)\Big]\end{aligned} \qquad (3\text{-}4)$$

where

NGROUP = number of source groups as specified by input parameter NGROUP. If NGROUP is specified as "0", assume a value of "1" for this equation

IPERD = "N"th time interval for all time periods as specified by input parameter IPERD. Note that if IPERD is set to "0", the term (j/IPERD) • ISW(i) equals (j) • ISW(i). If IPERD is set greater than "0", the term (j/IPERD) • ISW(i) equals (1) • ISW(i) if (j/IPERD) is greater than or equal to "1"; otherwise, it equals (0) • ISW(i) if (j/IPERD) is less than "1".

ISW(7)- ISW(14)	=	the corresponding 1-, 2-, 3-, 4-, 6-, 8-, 12- and 24-hour time periods as specified by input parameters ISW(7) through ISW(14). The "1" or "0" values specified by the user in these parameters are the numeric values used in the equation

The number of pages produced by each table is given in Equation (3-3). Hence, the total number of pages generated by this print output option (ISW(16)) equals the product of the number of days processed by the program for a problem run, the number of tables printed according to Equation (3-4) and the number of pages produced per table according to Equation (3-3).

If ISW(17) equals "1", tables of the highest and second highest average concentration or total deposition values found at each receptor are printed for all user-defined combinations of source groups and time periods. The number of tables printed equals twice the number of time periods specified (the number of input parameters ISW(7) through ISW(14) set to "1") multiplied by the number of source groups desired. If no source groups are specified (input parameter NGROUP equals "0"), assume one source group for the purpose of computing the number of tables printed by this option (ISW(17)). The number of pages each table produces is given by the following equation:

$$\text{No. of Pages} = \left(\frac{NXPNTS}{5}\right) \cdot \left(\frac{NYPNTS}{38}\right) + \left(\frac{NXWYPT}{76}\right) \qquad (3\text{-}5)$$

where NXPNTS, NYPNTS and NXWYPT are defined following Equation (3-3). Round up any fractional number in each term to the nearest whole number. Hence, the number of pages printed by this output category equals two times the product of the number of time periods, the number of source groups and the number of pages produced per table according to Equation (3-5).

If ISW(18) equals "1", tables of the maximum 50 average concentration or total deposition values calculated are printed for all user-defined combinations of source groups and time periods. Because each table printed produces only one page of output, the total number of pages printed by this output category equals the number of time periods specified (the number of input parameters (ISW(7) through ISW(14) set to "1") multiplied by the number of source groups specified. Again, if no source groups are specified (input parameter NGROUP equal to zero), assume one source group.

Thus, the total number of pages of output produced by the program equals the sum of the number of pages produced by each optional print output category desired by the user for a problem run.

c. <u>Tape Output</u>. Values of average concentration or total deposition are written by a FORTRAN unformatted WRITE statement to an output tape file only if parameter ISW(5) equals "1". Otherwise, the program does not generate an output tape file. It is not practical to discuss the physical amount (length of magnetic tape or number of tracks or sectors of mass storage) generated since this introduces factors which depend on the computer installation. Instead, the number of computer words generated by a problem run is discussed. The user may then equate this number to a physical amount for the particular storage device being used.

The output tape is written in records, where the length of each record equals the number of receptor points (NPNTS) plus 3 for a total of NPNTS + 3 computer words for a given problem run. For each day of meteorological data processed, the number of records written to the output tape file is governed by the number of source groups and time periods specified by the user. If we substitute the term "Tables" used in Equation (3-4) with the word, "Records" and set IPERD equal to "0", Equation (3-4) gives the number of records written to the output tape file for each day of meteorological data processed. All variables used to formulate Equation (3-4) maintain the same definition. Hence, the number of records equals the value computed from Equation (3-4) multiplied by the number of days of meteorological data processed by the program for a problem run. Also, if input parameter ISW(15) equals "1", additional records containing "N"-day average concentration or total deposition values are written to the output tape file depending on the number of source groups specified by input parameter NGROUP (If NGROUP equals "0", assume one source group). Hence, the total number of computer words written to the output tape file equals the number of records generated, multiplied by (NPNTS + 3) computer words per record for a problem run.

3.2.6 Program Diagnostic Messages

The ISCST program prints diagnostic messages when certain conditions occur during a problem run. The diagnostic messages consist of two types. The first type is a table format that informs the user of the conditions found, but does not terminate program execution. The second type is an error message which informs the user of the condition. The run is terminated after the error message is printed.

The diagnostic message in a table format informs the user when a receptor is located within 100 meters or three building heights (or three effective building widths) of a source. As shown in Figure 3-8, the table lists all source-receptor combinations for which this condition has occurred. The table lists the source number, receptor location and calculated distance between the corresponding source and receptor. A negative distance value implies that the receptor is located within the dimensions of a volume or area source.

Five types of diagnostic error messages may be printed by the program. If the allocated data storage is not sufficient for the data required by a problem run, an error message is printed (Figure 3-9(a)). An error message is printed if the station numbers or years read from

*** -- HYPOTHETICAL POTASH PROCESSING PLANT - CONCENTRATION -- ***

* SOURCE-RECEPTOR COMBINATIONS LESS THAN 100 METERS OR THREE BUILDING HEIGHTS IN DISTANCE. NO AVERAGE CONCENTRATION IS CALCULATED *

SOURCE NUMBER	- - RECEPTOR LOCATION - - X OR RANGE (METERS)	Y (METERS) OR DIRECTION (DEGREES)	DISTANCE BETWEEN (METERS)
1	.0	.0	-15.01
2	.0	.0	9.90
3	.0	.0	19.90
4	.0	.0	29.90
5	.0	.0	38.90
6	.0	.0	48.90
7	.0	.0	58.90
8	.0	.0	68.90
9	.0	.0	78.90
10	.0	.0	88.90
10	200.0	.0	90.90
11	.0	.0	98.90
11	200.0	.0	80.90
12	.0	.0	97.78
12	200.0	.0	55.78
13	200.0	.0	32.78
14	200.0	.0	9.78
15	200.0	.0	-13.22
16	200.0	.0	1.00

FIGURE 3-8. Example listing of a diagnostic message table printed when source-receptor distances are less than the maximum of 100 meters and three building heights or three building widths.

```
***ERROR*** CALCULATED STORAGE ALLOCATION LIMIT EQUALS nnnnnn
AND EXCEEDS THE MAXIMUM STORAGE ALLOCATION LIMIT OF mmmmmm
RUN TERMINATED.
```

(a)

```
***ERROR*** MET DATA REQUESTED DOES NOT MATCH MET DATA READ.
'REQUESTED/READ' VALUES ARE:
SURFACE STATION NO. = isisis/jsjsjs YEAR OF SURFACE DATA = iys/jys
UPPER AIR STATION NO. = iuiuiu/jujuju YEAR OF UPPER AIR DATA = iuy/juy
RUN TERMINATED.
```

(b)

```
***ERROR*** NUMBER OF SOURCES TO BE READ EQUALS ZERO.  RUN TERMINATED.
```

(c)

```
***ERROR*** PHYSICAL STACK HEIGHT OF SOURCE nnnnn
IS LOWER THAN THE TERRAIN ELEVATION FOR THE RECEPTOR
LOCATED AT (xxxxxxx.x,yyyyyyy.y).  RUN TERMINATED.
```

(d)

```
***ERROR*** SOURCE NUMBER nnnnn HAS NO GRAVITATIONAL SETTLING CATEGORIES
WITH WHICH TO CALCULATE DEPOSITION.  RUN TERMINATED.
```

(e)

FIGURE 3-9. (a) through (e) show the five types of error messages printed by the ISCST Program. The run is terminated after an error message is printed.

the meteorological data input tape do not match the corresponding station numbers or years specified by the user in parameters ISS, ISY, IUS, IUY (Figure 3-9(b)). If the number of input sources equals "0", an error message is printed (Figure 3-9(c)). If the physical stack height of any source is lower in elevation than the terrain elevation of any receptor, an error message is printed (Figure 3-9(d)). Finally, if there are no gravitational settling categories to calculate deposition for any source, an error message is printed as shown in Figure 3-9(e).

3.2.7 Program Modification for Computers Other than UNIVAC 1100 Series Computers

The ISCST program, which is written in FORTRAN IV, provides easy transport and adaptation for use on other computer models. The program design requires that: (1) At least four Hollerith characters can be stored in one computer word; (2) The computer word lengths of integer and real type variables are the same; and, (3) At least 132 characters per line can be printed on a page with 57 lines per page. The program requires about 65,000 words of executable storage, 21,500 of which consist of the program itself compiled on a UNIVAC 1108 Computer. The size of the compiled program will vary depending on the FORTRAN IV compiler and computer installation. The remaining 43,500 words consist of data storage used by the program for storing the input data values, intermediate values and output results of a given problem run.

If it is necessary to adjust the current allotment of 43,500 words of data storage, only two FORTRAN statements in the ISCST program need to be modified. Line 601 (see page A-17) in Appendix A) of the main program allocates the data storage in array QF. Also, the value assigned to the variable LIMIT in line 609 must agree with the value used in array QF.

The program assumes FORTRAN logical unit 5 for the card reader and logical unit 6 for the printer. These logical unit numbers may be modified on lines 616 and 617 in the main section of the program.

3.2 ISCLT

The following pages contain Chapter 4 (user's instructions) of the manual:

Bowers et al. (1978) Industrial Source Complex (ISC) Dispersion Model User's Guide. Volumes 1 and 2. EPA-450/4-79-0, 1(NTIS PB-80-133 044, 133 051).

CHAPTER 4

USER'S INSTRUCTIONS FOR THE ISC LONG-TERM (ISCLT) MODEL PROGRAM

4.1 SUMMARY OF PROGRAM OPTIONS, DATA REQUIREMENTS AND OUTPUT

4.1.1 Summary of ISCLT Program Options

The program options of the ISC Dispersion Model long-term computer program ISCLT consist of three general categories:

- Meteorological data input options
- Dispersion-model options
- Output options

Each category is discussed separately below.

a. Meteorological Data Input Options. Table 4-1 lists the meteorological data input options for the ISCLT computer program. All meteorological data may be input by card deck or by a magnetic tape inventory previously generated by ISCLT (see Section 4.1.1.c below). ISCLT accepts STAR summaries with six Pasquill stability categories (A through F) or five Pasquill stability categories (A through E with the E and F categories combined). Site-specific mixing heights and ambient air temperatures are ISCLT input requirements rather than options. Suggested procedures for developing these inputs are given in Section 2.2.1.2. The remaining meteorological data input options listed in Table 4-1 are identical to the ISCST meteorological data input options discussed in Section 3.1.1.a.

b. Dispersion Model Options. Table 4-2 lists the dispersion model options for the ISCLT computer program. In general, these options correspond to the ISCST dispersion-model options discussed

TABLE 4-1

METEOROLOGICAL DATA INPUT OPTIONS FOR ISCLT

Input of all meteorological data by card deck or by magnetic tape inventory previously generated by ISCLT
STAR summaries with five or six Pasquill stability categories
Site-specific mixing heights
Site-specific ambient air temperatures
Site-specific wind-profile exponents
Site-specific vertical potential temperature gradients
Rural Mode or Urban Mode 1 or 2
Entrainment coefficients other than the Briggs (1975) coefficients
Final or distance dependent plume rise
Wind system measurement height other than 10 meters

TABLE 4-2

DISPERSION-MODEL OPTIONS FOR ISCLT

Concentration or dry deposition calculations
Inclusion of the effects of gravitational settling and/or dry deposition in concentration calculations
Inclusion of terrain effects (concentration calculations only)
Cartesian or polar receptor system
Discrete receptors (Cartesian or polar system)
Stack, volume and area sources
Pollutant emission rates held constant or varied by season or by wind speed and stability
Time-dependent exponential decay of pollutants
Inclusion of building wake and stack-tip downwash effects
Time periods for which concentration or deposition calculations are to to be made (seasonal and/or annual)

in Section 3.1.1.b. Pollutant emission rates may be held constant or varied by season or by wind speed and stability in ISCLT calculations. The program uses seasonal STAR summaries to calculate seasonal and/or annual concentration or deposition values or an annual STAR summary to calculate annual concentration or deposition values. Additionally, monthly STAR summaries may be used to calculate monthly concentration or deposition values.

c. Output Options. Table 4-3 lists the ISCLT program output options. A more detailed discussion of the ISCLT output information is given in Section 4.1.3.

The ISCLT program has the capability to generate a master tape inventory containing all meteorological and source inputs and the results of all concentration or deposition calculations. This tape can then be used as input to future update runs. For example, assume that the user wishes to add a new source and modify an existing source at a previously modeled industrial source complex. Concentration or deposition calculations are made for these or modified sources alone and the results of these calculations in combination with select sources from the original tape inventory are used to generate an updated inventory. That is, it is not necessary to repeat the concentration or deposition calculations for the unaffected sources in the industrial source complex in order to obtain an updated estimate of the concentration or deposition values for the combined emissions. The optional master tape inventory is discussed in detail in Section 4.2.4.b.

The ISCLT user may elect to print one or more of the following tables:

- The program control parameters, meteorological input data and receptor data

- The source input data

TABLE 4-3

ISCLT OUTPUT OPTIONS

Master tape inventory of meteorological and source inputs and the results of the concentration or deposition calculations
Printout of program control parameters, meteorological data and receptor data
Printout of tables of source input data
Printout of seasonal and/or annual average concentrations or total seasonal and/or annual deposition values calculated at each receptor for each source or for the combined emissions from a select group of all sources
Printout of the contributions of the individual sources to the 10 highest concentration or deposition values calculated for the combined emissions from a select group of all sources or the contributions of the individual sources to the total concentration or deposition values calculated for the combined emissions from a select group of all sources at 10 user-specified receptors

- The seasonal and/or annual average concentration or total deposition values calculated at each receptor for each source or for the combined emissions from select source groups or all sources

- The contributions of the individual sources to the 10 receptors with highest concentration (or deposition) values obtained from the combined emissions of select groups of sources; or the contributions of each individual source, as well as the combined sources, to a select group of user specified receptor points; or the maximum 10 concentration (or deposition) values for each source and for the combined sources, determined independently of each other

4.1.2 Data Input Requirements

This section provides a description of all input data parameters required by the ISCLT program. The user should note that some input parameters are not read or are ignored by the program, depending on the values assigned to the control parameters (options) by the user.

a. Program Control Parameter Data. These data contain parameters which provide user-control over all program options.

Parameter Name	
ISW(1)	Concentration/Deposition Option -- Directs the program to calculate either average concentration or total deposition. A value of "1" indicates average concentration is to be calculated and a value of "2" indicates total deposition is to be calculated. If this parameter is not punched, the program defaults to "1" or concentration.

Parameter Name	
ISW(2)	Receptor Reference Grid System Option -- Specifies whether a right-handed rectangular Cartesian coordinate system or a polar system is to be input to the program to form the receptor reference grid system. A value of "1" indicates a Cartesian reference grid system is being input and a value of "2" indicates a polar reference grid system is being input. If this parameter is not punched, the program will default to a value of "1".
ISW(3)	Discrete Receptor Option -- Specifies whether a right-handed rectangular Cartesian reference system or polar reference system is used to reference the input discrete receptor points. A value of "1" indicates that the Cartesian reference system is used and a value of "2" indicates that a polar reference system is used. If this parameter is not punched, the program will default to a value of "1".
ISW(4)	Receptor Terrain Elevation Option -- Specifies whether the user desires to input the terrain elevations for each receptor point or to use the program as a flat terrain model. A value of "0" indicates terrain elevations are not to be input and a value of "1" indicates terrain elevations for each receptor point are to be input. Note that terrain elevations cannot be used with the deposition model. The default for this parameter is no terrain or "0".
ISW(5)	Input/Output Tape Option -- Specifies whether tape input and/or output is to be used. A value of "0" indicates no

Parameter Name	
ISW(5) (Cont.)	tape input or output. A value of "1" indicates an output tape or data file is to be produced on the output unit specified by ISW(15). A value of "2" indicates an input tape or data file is required on the input unit specified by ISW(14). A value of "3" indicates both input and output tape or data files are being used. Default for this parameter is no tapes or files. It is the user's responsibility to insure that the correct tapes or files are mounted on the correct units.
ISW(6)	Print Input Data Option -- Specifies what input data are to be printed. A value of "0" indicates no input data are to be printed. A value of "1" indicates only the control parameters, receptor points and meteorological data are to be printed. A value of "2" indicates only the source input data are to be printed and a value of "3" indicates all input data are to be printed. The default for this parameter is "0".
ISW(7)	Seasonal/Annual Print Option -- Specifies whether seasonal concentration (or deposition) values are to be printed, or annual values only, or both seasonal and annual values. An ISW(7) value of "1" indicates only seasonal output is to be printed, a value of "2" indicates only annual output is to be printed, and a value of "3" indicates both seasonal and annual output are to be printed. If this parameter is not punched or is "0", the program defaults to "3".
ISW(8)	Individual/Combined Sources Print Option -- Specifies whether output for individual sources or the combined

Parameter Name	
ISW(8) (Cont.)	sources (sum of sources) or both is to be printed. An ISW(8) value of "1" indicates output for individual sources only is to be printed, a value of "2" indicates output for the combined sources only is to be printed, and a value of "3" indicates output for both individual and combined sources is to be printed. The default for this parameter is "3". This parameter is used in conjunction with the parameter NGROUP below. If NGROUP equals "0", all sources input to the program are considered for output under ISW(8). However, if NGROUP is greater than "0", only those sources explicitly or implicitly defined under NGROUP are considered for output under ISW(8). Also, a single source defined under NGROUP is logically treated as combined source output when ISW(8) equals "2" or "3".
ISW(9)	Rural/Urban Option -- Specifies whether rural or urban modes of adjustment of stability categories are to be used (see Table 2-3). A value of "1" specifies Urban Mode 1 and the E and F stability categories are redefined as D. A value of "2" specifies Urban Mode 2 and stability categories A and B are redefined as A, C becomes B, D becomes C, and E and F become D. A value of "3" specifies the Rural Mode and does not redefine the stability categories. If this parameter is not punched or is "0", the program defaults to "3". If tape input is used, the program defaults to the value saved on tape. The parameter ISW(9) is only used for card input sources and/or tape input sources when ISW(12) equals "1". It should be noted that the use of Urban Mode 2 generally is not recommended for regulatory purposes.

Parameter Name	
ISW(10)	Maximum 10 Print Option — Specifies whether the maximum 10 values of concentration or deposition only are to be printed, or the results of the calculations for all receptors only, or both are to be printed. A value of "1" directs the program to calculate and print only the maximum 10 values and receptors according to ISW(11) or ISW(12) below. Values at receptors other than the maximum 10 are not printed if this option equals "1". A value of "0" directs the program to print the results of the calculations at all receptors; the maximum 10 values are not produced. A value of "2" directs the program to print the results of the calculations at all receptor locations as well as the maximum 10. The default for this parameter is "0". The ISCLT program will print less than 10 values in cases where there are less than 10 concentration (deposition) values greater than zero calculated.
ISW(11)	Maximum 10 Calculation Option 1 — This option directs the program to use one of two methods to calculate and print maximum 10 concentration (or deposition) values. If this option is used, option ISW(12) must equal "0". The program determines the maximum values and receptor locations from the set of all receptors input.
	Method 1: A value of "1" directs the program to calculate and print the maximum 10 values and respective receptors for each individual source and to calculate and print the maximum 10 values and respective receptors for the combined sources independently of each other. The output

Parameter Name	
	for individual sources and combined sources will in general show a different set of receptors.

Method 2: A value of "2" directs the program to first calculate and print the maximum 10 values and respective receptors for the combined sources (sum of sources) and then print the contribution at each receptor of each individual source to the combined sources maximum 10. This option can only be used if one or more of the following conditions is met:

ISW(11) (Cont.)

Condition a — The run uses an output tape or data file (user must specify NOFILE, if tape)

Condition b — The run uses an input tape or data file, but has no input data card sources (all are taken from tape) (user must specify NOFILE, if tape)

Condition c -- The total number of input sources is less than or equal to the minimum of I and J, where

$$\left.\begin{aligned} J &= 300 \\ &\text{and} \\ I &= \left[\frac{\left(E - (N_x + N_y + 2 \cdot N_{xy}) - K - L\right)}{\left(N_s \cdot (N_x \cdot N_y + N_{xy})\right)}\right] \end{aligned}\right\} \quad (4\text{-}1)$$

Parameter Name	
ISW(11) (Cont.)	E = the total amount of program data storage in BLANK COMMON. The design size is 40,000. N_x = number of points in the input X-axis of the receptor grid system (NXPNTS) N_y = number of points in the input Y-axis of the receptor grid system (NYPNTS) N_{xy} = number of discrete (arbitrarily placed) input receptors (NXWYPT) N_s = number of seasons in the input meteorological data (NSEASN)

$$K = N_s \cdot (N_x \cdot N_y + N_{xy})$$

$$L = \begin{cases} 0 \; ; & \text{if ISW(4) = "0"} \\ N_x \cdot N_y + N_{xy} ; & \text{if ISW(4) = "1"} \end{cases}$$

ISW(12)	Maximum 10 Calculation Option 2 — This option directs the program to calculate concentration or deposition at a special set of user supplied discrete (arbitrarily placed) receptor points. If this option is used, option ISW(11) must equal "0". A value of "1" directs the program to

Parameter Name	
ISW(12) (Cont.)	expect to read from 10 to 50 special receptors at which concentration or deposition is to be calculated. If this option is selected and 10 special receptors are input, both seasonal and annual concentration or deposition values for individual sources and combined sources are printed for the 10 user-specified receptors. If more than 10 special receptors are input, the program assumes the first 10 points are for season 1, the second 10 points are for season 2 and the last 10 points are for annual tables. This option requires the parameter NXWYPT given below to be a multiple of 10. All input tape or data file sources are recalculated with this option. Also, if an input tape is being used, the receptor grid system, discrete receptors and their elevations input from the tape are discarded and the user inputs the new special set of receptor points (with elevations if ISW(4) equals "1") via data card.
ISW(13)	Print Output Unit Option -- This option is provided to enable the user to print the program output on a unit other than print unit "6". If this value is not punched or a "0" is punched, all print output goes to unit "6". Otherwise, print output goes to the specified unit. Also, if this value is punched non-zero positive, two end-of-file marks are written at the end of the print file. If ISW(13) is a negative value, the end-of-file marks are not written.
ISW(14)	Optional Tape Input Unit Number — This option is provided to enable the user to assign the unit number from which tape or data file data are read under ISW(5). If ISW(14)

Parameter Name	
ISW(14) (Cont.)	is not punched or is "0", the program defaults to unit "2". If the input data are being read from a mass-storage file, ISW(14) must be set to a negative value. A positive value implies magnetic tape. Note that ISW(14) is the internal file name used by the program to reference the data file and must be equated with the external file name used to assign the file (see Section 4.2.2).
ISW(15)	Optional Tape Output Unit Number -- This option is provided to enable the user to assign the unit number to which tape or output file data are written under ISW(5). If ISW(15) is not punched or is "0", the program defaults to unit "3". If the output data are being written to a mass-storage file, ISW(15) must be set to a negative value. A positive value implies magnetic tape. Note that ISW(15) is the internal file name used by the program to reference the data file and must be equated with the external file name used to assign the file (see Section 4.2.2).
ISW(16)	Print Output Paging Option -- This option enables the user to minimize the number of print output pages. A value of "1" directs the program to minimize the output pages by not starting a new page with each type of output table. If this option is not punched or is "0", the program will start each unrelated output table on a new page. The user is cautioned not to exercise this option until familiar with the output format because the condensed listing may be confusing.

Parameter Name	
ISW(17)	Lines Per Page Option — This option is provided to enable the user to specify the number of print lines per page on the output printer. The correct number of lines per page is necessary for the program to maintain the output format. If this value is not punched or is "0", the program defaults to 57 print lines per page.
ISW(18)	Optional Format for Joint Frequency of Occurrence — This parameter is a switch used to inform the program whether it is to use a default format to read the joint frequency of occurrance of speed and direction (FREQ) or to input the format via data card. If this option is not punched or is "0", the program uses the default format given under FMT below. If this option is set to a value of "1", the array FMT below is read by the program.
ISW(19)	Option to Calculate Plume Rise as a Function of Downwind Distance — This option is applicable to all stack sources and if set equal to "0" or not punched, the downwind distance is not considered in calculating the plume rise. If ISW(19) is set equal to "1", the plume rise calculation is a function of downwind distance.
ISW(20)	Option to Add the Briggs (1973) Stack-Tip Downwash Correction to Stack Sources — This option is applicable to all stack sources and if set equal to "0" or not punched, no downwash correction is made. If ISW(20) is set equal to "1", the Briggs (1973) downwash correction is applied to the stack height for all stack sources.

Parameter Name	
NSOURC	Number of Data Card Input Sources — This parameter specifies the number of input card image sources. This includes card images that specify a new source being entered and card images that specify modifications or deletions to sources input from tape or data file. If this value is not punched or is "0", the program assumes all sources are input from tape or data file. Also, if a negative value is punched for this parameter, the program will continue to read source data card images until it encounters an end-of-file or a negative source identification number in the parameter NUMS below. There is no limit to the number of sources the program can process.
NGROUP	Number of Source Combination Groups — This parameter is used to select concentration (deposition) calculations for specific sources or source combinations to be printed under the parameter ISW(8) above. A source combination consists of one or more sources and is the sum of the concentrations (deposition) calculated for those sources. If the user desires only individual source output or only all sources combined or both, the parameter NGROUP is not punched or is set equal to "0" and ISW(8) is set according to which option the user desires. Also, if NGROUP is not punched or is set equal to "0", the parameters NOCOMB and IDSOR below are omitted from the input data. However, if NGROUP is set greater than zero, the program assumes the user desires to restrict the output of concentration tables to select individual sources or select combinations of sources or both, depending on ISW(8). The maximum value for NGROUP is 20. If more than 20 source combinations are desired they must be produced in multiple runs of ISCLT. This can be

Parameter Name

done by specifying an output tape or data file on the first execution. The user would then use this tape for input on subsequent runs to produce the remaining desired source combinations. Also, only a few of the data cards and values from the initial data deck are required on subsequent runs. The parameter NGROUP cannot be used or punched non-zero unless one or more of the following conditions is met:

NGROUP (Cont.)

Condiiton a — The run uses an output tape or data file (user must specify NOFILE, if tape)

Condition b — The run uses an input tape or data file, but has no input data card sources (all are taken from tape, NSOURC = "0") (user must specify NOFILE, if tape).

Condition c — The total number of input sources (NSOURC + input tape sources) is less than or equal to the minimum of I and J, where

$$\left.\begin{aligned} J &= 300 \\ &\text{and} \\ I &= \frac{\left(E - \left(N_x + N_y + 2N_{xy}\right) - K - L\right)}{\left(N_s\left(N_x \cdot N_y + N_{xy}\right)\right)} \end{aligned}\right\} \quad (4\text{-}2)$$

All of the variables in this equation except K are the same as those defined under ISW(11) above.

Parameter Name	
NGROUP (Cont.)	$K = \begin{cases} 0 & ; \text{ if ISW(8)=1 and ISW(11)} \neq 2 \\ N_s\left(N_x \cdot N_y + N_{xy}\right) & ; \text{ if ISW(8)} \neq 1 \text{ or ISW(11)=2} \end{cases}$
	X-Axis/Range Receptor Grid Size — This parameter specifies the number of east-west receptor grid locations for the Cartesian coordinate system X-axis, or the number of receptor grid ranges (rings) in the polar coordinate system, depending on which receptor grid system is chosen by the user under parameter ISW(2). This is the number of X-axis points to be input or the number of X-axis points to be automatically generated by the program. A value of "0" (not punched) directs the program to assume there is no regular receptor grid being used. The maximum value of this parameter is related to other parameter values and is given by the equation
NXPNTS	$E \geq \left[N_x + N_y + 2N_{xy}\right] + \left[(K \cdot N_s + I)\ (N_x \cdot N_y + N_{xy})\right] \quad (4\text{-}3)$
	where all variables in the above equation are the same as those defined under ISW(11) above except K and I, which are defined as
	$K = \begin{cases} 1 & ; \text{ if ISW(8)=1 and ISW(11)} \neq 2 \\ 2 & ; \text{ if ISW(8)} \neq 1 \text{ or ISW(11)=2} \end{cases}$

Parameter Name	
NXPNTS (Cont.)	$$I = \begin{cases} 0 \ ; & \text{if ISW(4)=0 (no terrain)} \\ 1 \ ; & \text{if ISW(4)=1} \end{cases}$$ This parameter is ignored by the program if tape or data file input is being used.
NYPNTS	Y-Axis/Azimuth Receptor Grid Size -- This parameter specifies the number of north-south receptor grid locations for the Cartesian coordinate system Y-axis, or the number of receptor azimuth bearings from the origin in the polar coordinate system, depending on which receptor grid system is chosen by the user under parameter ISW(2). This is the number of Y-axis points to be input or the number of Y-axis points to be automatically generated by the program. If the parameter NXPNTS is set non-zero, the parameter NYPNTS must also be non-zero. The maximum value of this parameter is given by the equation under NXPNTS above. The parameter NYPNTS is ignored by the program if tape or data file input is being used.
NXWYPT	Number of Discrete (Arbitrarily Placed) Receptors -- This parameter specifies the total number of discrete receptor points to be input to the program. A value of "0" (not punched) directs the program to assume no discrete receptors are being used. This parameter must be set to a multiple of 10 if option ISW(12) above is selected. Also, the maximum value of this parameter is limited by the equation given under NXPNTS above. This parameter is ignored by the program if input tape or data file is being used, except in the case where the ISW(12) option has been selected.

Parameter Name	
NSEASN	Number of Seasons — This parameter specifies the number of seasons or months in the input meteorological data. A value of "0" (not punched) defaults to "1". Also, if annual meteorological data are being used, a value of "1" should be specified. The maximum value of this parameter is "4". If monthly STAR summaries and seasonal average mixing heights and ambient air temperatures are used to calculate monthly concentration or deposition values for each month of the year, four separate program runs, each containing three "seasons" (months), are required. This parameter is ignored by the program if an input tape or data file is being used.
NSPEED	Number of Wind Speed Categories -- This parameter specifies the number of wind speed categories in the input joint frequency of occurrence of wind speed and direction (FREQ). A value of "0" (not punched) causes the program to default to "6" (maximum). This parameter is ignored by the program if an input tape or data file is being used.
NSTBLE	Number of Pasquill Stability Categories — This parameter specifies the number of Pasquill stability categories in the input joint frequency of occurrence of wind speed and direction (FREQ). A value of "0" (not punched) causes the program to default to "6" (maximum). This parameter is ignored by the program if an input tape or data file is being used.

Parameter Name	
NSCTOR	Number of Wind Direction Sector Categories — This parameter specifies the number of wind direction sector categories in the input joint frequency of occurrence of wind speed and direction (FREQ). A value of "0" (not punched) causes the program to assume the standard "16" (maximum) sectors are to be used (see Section 2.2.1.2). This parameter is ignored by the program if an input tape or data file is being used.
NOFILE	Tape Data Set File Number — This parameter specifies the output tape file number or, if only an input tape is being used, the input tape file number. This parameter is used by the ISCLT program to position the tape at the correct file if multiple passes through the data are required. This parameter must be input if the user is using Condition a or Condition b under ISW(11) and/or under NGROUP. This parameter does not apply to runs that use mass-storage (assumed one file) or runs that satisfy Condition c under ISW(11) and/or NGROUP. Also, the user must position input and output tapes at the correct files prior to executing the ISCLT program.
NOCOMB	Number of Sources Defining Combined Source Groups — This parameter is not read by the program if the parameter NGROUP above is zero or not punched. Otherwise, this parameter is an array of NGROUP values where each value gives the number of source identification numbers used to define a source combination. The source identification number is that number assigned to each source by the user under the source input parameter NUMS below. An example

Parameter Name	
NOCOMB (Cont.)	and a more detailed discussion of the use of this parameter is given under IDSORC below. A maximum of 20 values is provided for this array.
IDSOR	Combined Source Group Defining Sources — This parameter is not read by the program if the parameter NGROUP above is zero or not punched. Otherwise, this parameter is an array of source identification numbers that define each combined source group to be output. The values punched into the array NOCOMB above indicate how many source identification numbers are punched into this array successively for each combined source output. The source identification numbers can be punched in two ways. The first is to punch a positive value directing the program to include that specific source in the combined output. The second is to punch a negative value. When a negative value is punched, the program includes all sources with identification numbers less than or equal to it in absolute value. Also, if the negative value is preceded by a positive value in the same defining group, that source is also included with those defined by the negative number, but no sources with a lesser source identification number are included. For example, assume NGROUP above is set equal to 4 and the array NOCOMB contains the values 3, 2, 1, 0. Also, assume the entire set of input sources is defined by the source identification numbers 5, 72, 123, 223, 901, 902, 1201, 1202, 1205, 1206 and 1207. To this point we have a total of 11 input sources and we desire to see 4 combinations of sources taken from these 11. Also, the array NOCOMB indicates that the first 3

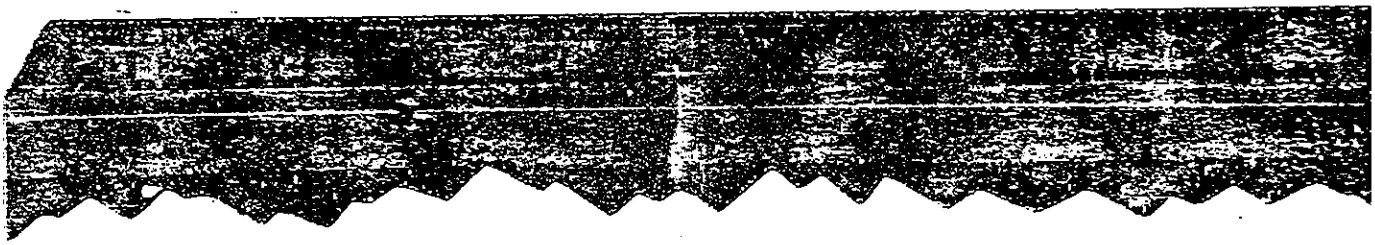
Parameter Name

IDSOR (Cont.)

values in the array IDSORC define the first source combination, the next 2 values (4th and 5th) in IDSORC define the second combination, the 6th value in IDSORC defines the third combination and the last combination has no defining (0) sources so the program assumes all 11 sources are used. Similarly, let the array IDSORC be set equal to the values 5, 72, -223, 1201, -1207, -902. The program will first produce combined source output for source 5, and all sources from 72 through 223. The second combined source output will include sources 1201 through 1207. The third will include source numbers 1 through 902 and the last will include all sources input. Note that the source identification numbers in each defining group are in ascending order of absolute value. Also, if ISW(8) equals "2" (combined output only) and there are groups with only one positive source number (individual sources), the program logically treats these individual sources as combined sources.

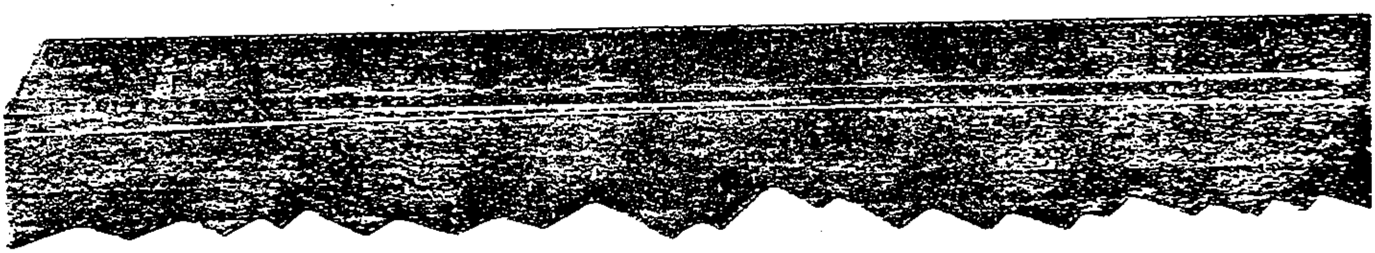
FMT

Optional Format for Joint Frequency of Occurrence — This parameter is an array which is read by the program only if ISW(18) is set to a value of "1". The array FMT is used to specify the format of the joint frequency of occurrence of wind speed and direction data (FREQ, STAR summary, $f_{i,j,k,\ell}$ in Table 2-4). The format punched, if used, must include leading and ending parentheses. If ISW(18) is not punched or is set to a value of "0", the parameter FMT is omitted from the input deck and the program uses the default format "(6F10.0)". This default format specifies that there are 6 real values per card occupying 10 columns each, including the decimal point (period), and the first value is punched in columns one through ten. If the user has received the STAR data from an outside source, the deck must also be checked for the proper order as well as format and, if the order is not correct, the data must be repunched. The correct order of the STAR data is given under FREQ below. An example of a STAR deck punched in a format not compatible with the default format for FMT is



FMT
(Cont.)

This example shows the stability and direction categories punched in columns 1 through 17 and the frequency of occurrence data occupying columns 20 through 73. To input these data the user would set ISW(18) equal to "1" and punch the format (FMT) as shown on the following example input data card



This format directs the ISCLT program to skip the first 19 columns on each frequency of occurrence card read and

Parameter Name	
FMT (Cont.)	to read six equally-spaced real values from the card. Each value occupies 9 columns including the decimal point (period). The first value begins in column 20. The program interprets the leading blank character of each value as zero.

b. Receptor Data. These data consist of the (X,Y) or (range, azimuth) locations of all receptor points as well as the elevations of the receptors above mean sea level.

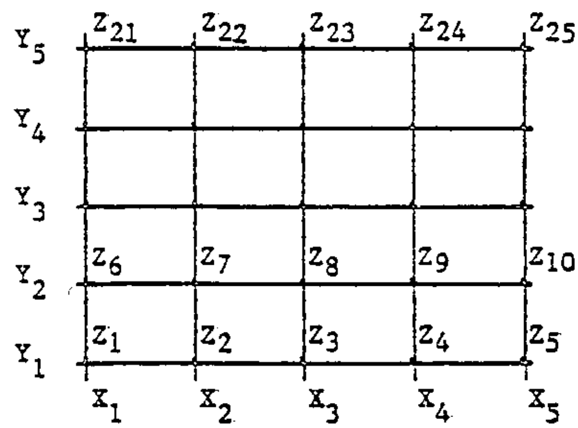
Parameter Name	
X	Receptor Grid System X-Axis or Range — This parameter is read by the program only if the parameters NXPNTS and NYPNTS are non-zero and only if an input tape or data file is not being used. This parameter is an array of values in ascending order that defines the X-axis or ranges (rings) (depending on ISW(2)) of the receptor grid system in meters. If only the first 2 values on the input card are punched and the parameter NXPNTS is greater than 2, the program assumes the X-axis (range) is to be generated automatically and assumes the first value punched is the starting coordinate and the second value punched is an increment used to generate the remaining NXPNTS evenly-spaced points. If all receptor points are being input, NXPNTS values must be punched. The origin of the grid system is defined by the user and can be anywhere.

Parameter Name	
Y	Receptor Grid System Y-Axis or Azimuth — This parameter is read by the program only if the parameters NXPNTS and NYPNTS are non-zero and only if an input tape or data file is not being used. This parameter is an array of values in ascending order that defines the Y-axis or azimuth bearings (depending on ISW(2)) of the receptor grid system in meters or degrees. If only the first 2 values on the input card are punched (third and fourth values are zero) and the parameter NYPNTS is greater than 2, the program assumes the first value punched is the starting coordinate and the second value punched is the increment used to generate the remaining NYPNTS evenly-spaced (rectangular or angular) points. If all receptor points are being input, NYPNTS values must be punched. If polar coordinates are being used, Y is measured clockwise from zero degrees (north).
X (Discrete)	Discrete (Arbitrarily Placed) Receptor X or Range — This parameter is not read by the program if the parameter NXWYPT is zero or if the program is using an input tape or data file with the ISW(12) option set to zero. This parameter is an array defining all of the discrete receptor X points. The values are either east-west distances or radial distances in meters, depending on the type of reference system specified by ISW(3). NXWYPT points are read by the program. The origin of these points is the same as the origin of the regular (non-discrete) grid system if one is used. Otherwise, the origin is defined by the user and can be located anywhere.

Parameter Name	
Y (Discrete)	Discrete (Arbitrarily Placed) Receptor Y or Azimuth — This parameter is not read by the program if the parameter NXWYPT is zero or if the program is using an input tape or data file with the ISW(12) option set to zero. This parameter is an array defining all of the discrete receptor Y points in meters or degrees. The values are either north-south distances or azimuth bearings (angular distances) measured clockwise from zero degrees (north) depending on the type of reference system specified by ISW(3). NXWYPT points are read by the program.
Z	Elevation of Grid System Receptors — This parameter is not read by the program if the parameter ISW(4) is zero or if an input tape is being used or if NXPNTS or NYPNTS equals zero. This parameter is an array specifying the terrain elevation in feet above mean sea level at each receptor of the Cartesian or polar grid system. There are NXPNTS • NYPNTS values read into this array. The program starts the input of values with the first Y coordinate specified and reads the elevations for each X coordinate at that Y in the same order as the X coordinates were input. A new data card is started for each Y value and the NXPNTS elevations for that Y are read. The program will expect NYPNTS groups of data cards with NXPNTS elevation values punched in each group. For example, assume we have a 5 by 5 Cartesian or polar receptor array:

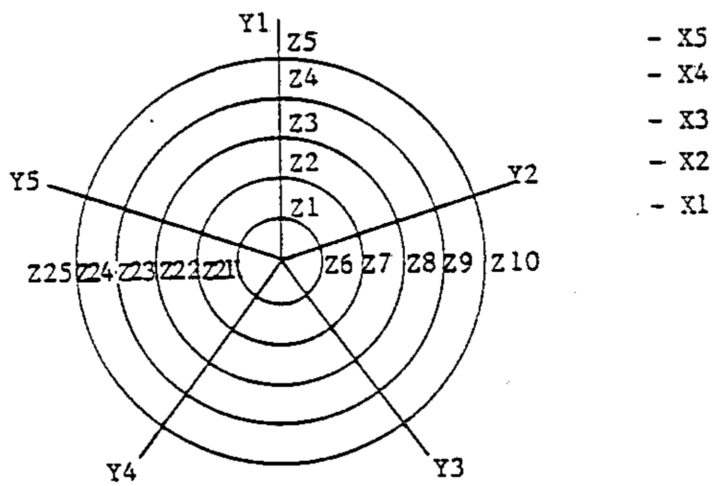
Parameter
Name

Rectangular



Z
(Cont.)

Polar



(4-27)

Parameter Name	
Z (Cont.)	The values Z_1 through Z_5 are read from the first card group, the values Z_6 through Z_{10} from the second card group and Z_{21} through Z_{25} from the last card group.
Z (Discrete)	Elevation of the Discrete (Arbitrarily Placed) Receptors -- This parameter is not read by the program if the parameter ISW(4) is zero or if the parameter NXWYPT equals zero or if an input tape is being used with the ISW(12) option equal to zero. This parameter, which is an array specifying the terrain elevation in feet at each of the NXWYPT discrete receptors, is input in the same order as the discrete receptors.

c. Identification Labels and Model Constants. These data consist of parameters pertaining to heading and identification labels and program constants. These data except for TITLE are not read by the program if an input tape or data file is being used.

Parameter Name	
TITLE	Page Heading Label -- This parameter is an array that allows up to 80 characters of title information to be printed as the first line of each output page.
UNITS	Concentration/Deposition and Source Units Label -- This parameter is an array used for the optional input of two units labels. The first 40 characters of this array are provided for an optional output units label for concentration or deposition. This label is defaulted to "micrograms per cubic meter" for concentration and "grams per

Parameter Name	
UNITS (Cont.)	square meter" for deposition, if the parameter TK below is not punched or is "0". The second 40 characters of this array are provided for an optional source input units label. This label is defaulted to "grams per second" for concentration or "grams" for deposition for stacks and volume sources and to "grams per second per square meter" or "grams per square meter" for area sources, if the parameter TK below is not punched or is "0".
ROTATE	Wind Direction Correction Angle -- This parameter is used to correct for any difference between north as defined by the X, Y reference grid system and north as defined by the weather station at which the wind direction data were recorded. The value of ROTATE (degrees) is subtracted from each wind-direction sector angle (THETA). This parameter is positive if the positive Y axis of the reference grid system points to the right of north as defined by the weather station. Most weather stations record direction relative to true north and the center of most grid systems are relative to true north. However, some weather stations record direction relative to magnetic north and the ends of some UTM (Universal Transverse Mercator) zones are not oriented towards true north. The user is cautioned to check the wind data as errors in the wind direction distribution will lead to erroneous program results. The default value of ROTATE is zero.
TK	Model Units Conversion Factor -- This parameter is provided to give the user flexibility in the source input units used and the concentration or deposition output units desired. This parameter is a direct multiplier of

Parameter Name	
TK (Cont.)	the concentration or deposition equation. If this parameter is not punched or is set to a value of "0", the program defaults to "1 x 10^6" micrograms per gram for concentration and to "1" for deposition. This default assumes the user desires concentration in micrograms per cubic meter or deposition in grams per square meter and the input source units are grams per second or total grams for stack and volume sources and grams per second per square meter or grams per square meter for area sources, depending on whether the program is to calculate concentration or deposition. Also, if the default value for this parameter is selected, the program defaults the units labels in the array UNITS above. If the user chooses to input this parameter for other units, he must also input the units labels in UNITS above. This parameter corresponds to K in Equations (2-46), (2-53), (2-54) and (2-55).
ZR	Weather Station Recording Height -- This parameter is the height above ground level in meters at which the meteorological data were recorded. If this parameter is not punched or has a value of "0", the program defaults to "10" meters. This parameter corresponds to Z_1 in Equation (2-10).
BETA1	Adiabatic/Unstable Entrainment Coefficient -- This parameter, which is used in plume rise calculations, is the air entrainment coefficient for an adiabatic or unstable atmosphere. If this value is not punched or is "0", the program uses "0.6" as the default value. This parameter corresponds to β_1 in Equation (2-4).

Parameter Name	
BETA2	Stable Entrainment Coefficient -- This parameter, which is used in the plume rise calculations, is the air entrainment coefficient for a stable atmosphere. If this value is not punched or is "0", the program uses "0.6" as the default value. This parameter corresponds to β_2 in Equation (2-7).
G	Acceleration Due to Gravity -- This parameter, which is used in the plume rise calculations, is the acceleration due to gravity. If this parameter is not punched or has a value of "0", the program uses "9.8" meters per second squared as the default value. This parameter corresponds to g in Equation (2-2).
DECAY	Decay Coefficient -- This parameter is the coefficient (seconds^{-1}) of time-dependent pollutant removal by physical or chemical processes (Equations (2-13), (2-14)). The default for this parameter is "0".

d. Meteorological Data. These data are the meteorological input parameters classified according to one or more of the categories of wind speed, Pasquill stability, wind direction and season or annual. These parameters are not read by the program if an input tape or data file is being used.

Parameter Name	
FREQ	Joint Frequency of Occurrence -- This parameter array consists of the seasonal or annual joint frequency of

Parameter Name	
FREQ (Cont.)	occurrence of wind-speed and wind-direction categories classified according to the Pasquill stability categories (STAR summary, $f_{i,j,k,\ell}$ in Table 2-4). This parameter has no default and must be input in the correct order. The program begins by reading the joint frequency table for season 1 (winter) and stability category 1 (Pasquill A stability). The first data card contains the joint frequencies of wind speed categories 1 through 6 (1 through NSPEED) for the first wind direction category (north). The second data card contains the joint frequencies of wind speed categories 1 through 6 for the second wind direction category (north-northeast). The program continues in this manner until the joint frequencies of the last direction category (north-northwest) for stability category 1, season 1 have been read. The program then repeats this same read sequence for stability category 2 (Pasquill B stability) and season 1. When all of the stability category values for season 1 have been read, the program repeats the read sequence for season 2, season 3, etc., until all of the joint frequency values have been read. There are a total of NSPEED*NSCTOR*NSTBLE*NSEASN values read in this data card group and a total of NSCTOR*NSTBLE*NSEASN data cards. If the total sum of the joint frequency of occurrences for any season (or annual) does not add up to 1, the program will automatically normalize the joint frequency distribution by dividing each joint frequency by the total sum. Also, the program assumes stability categories 1 through 6 are Pasquill stabilities A through F. Seasons 1 through 4 are normally winter, spring, summer and fall. See the parameter FMT above for the format of these data.

Parameter Name	
TA	Average Ambient Air Temperature -- This parameter array consists of the average ambient air temperatures ($T_{a;k,\ell}$ in Table 2-4), classified according to season (or annual) and stability category, in degrees Kelvin. One data card is read for each season (1 to NSEASN) with the temperature values for stability categories 1 through NSTBLE punched across the card. When the program has completed reading these data cards, it will scan all of the values in the order of input and, if any value is not punched or is zero, the program will default to the last non-zero value of TA it encountered.
HM	Mixing Heights -- This parameter array consists of the median mixing layer height in meters ($H_{m;i,k,\ell}$ in Table 2-4) classified according to wind speed, stability and season (or annual). The program begins reading the mixing layer heights for season 1. The program reads the mixing layer height values for each wind speed category (1 to NSPEED) from each card. There are NSTBLE (1 through NSTBLE) cards read for each season. The program scans each value input in the order of input and, for each season, if a zero or non-punched value is found, the program defaults to the last non-zero value encountered within the values for that season. The ISCLT program automatically uses a mixing height value of 10000 meters for the E and F stability categories when the program is run in the Rural Mode.
DPDZ	Potential Temperature Gradient — This parameter array consists of the vertical gradients of potential temperature

Parameter Name	
DPDZ (Cont.)	$\left(\frac{\partial\theta}{\partial z}_{i,k}\right.$ in Table 2-4$\left.\right)$ classified according to wind speed and stability category in units of degrees Kelvin per meter. There are NSTBLE (1 through NSTBLE) data cards read with the values for wind speed categories 1 through NSPEED read from each card. If the first value on a data card is not punched or is zero for cards 1 through 4 (Pasquill stability A through D), the potential temperature gradients are set equal to zero by the program for these stability categories. If the first value on cards 5 or 6 (E and F) is zero or not punched the program defaults to a value of 0.02 for card 5 (E stability) and 0.035 for card 6 (F stability). Also, if the second through last value on any card is zero or not punched, the program defaults to the last non-zero value found in a scan of the data card.
UBAR	Wind Speed -- This parameter array consists of the median wind speeds in meters per second ($\bar{u}_1$ in Table 2-4) for the wind-speed categories used in the calculation of the joint frequency of occurrence of wind speed and direction (STAR summary). There are NSPEED values read from this card and if any value is not punched or is zero, the program defaults to the following set of values: 0.75, 2.5, 4.3, 6.8, 9.5 and 12.5 meters per second.
THETA	Wind Direction -- This parameter array consists of the median wind direction angles in degrees for the wind-direction categories used in the calculation of the joint frequency of occurrence of wind speed and direction (STAR summary). There are NSCTOR values read from 1 to 2 data

Parameter Name	
THETA (Cont.)	cards and if the first two values of this array are not punched or are zero, the program defaults to the following standard set of values: 0, 22.5, 45, 67.5, 90, . . ., 337.5 degrees (N, NNE, NE, . . ., NNW). The wind direction is that angle from which the wind is blowing, measured clockwise from zero degrees (north).
P	Wind Speed Power Law Exponent -- This parameter array consists of the wind speed power law exponents (p in Equation (2-10)) classified according to wind speed and stability category. There are NSPEED (1 through NSPEED) values read per data card for stability categories 1 through NSTBLE. If the first value on any data card in this set is not punched or is zero, the program defaults to the value from the following set of values: A = 0.1, B = 0.15, C = 0.2, D = 0.25, E = 0.3, F = 0.3 depending on the stability category A through F. Also, if any of the second through last value on a card is not punched or is zero, the value is defaulted to the previous non-zero value on the data card.

e. Source Data. These data consist of all necessary information required for each source. These data are divided into three groups: (1) parameters that are required for all source types, (2) parameters that are required for stack type sources, and (3) parameters that are required for volume sources and area sources. The order of input of these parameters is given at the end of this section.

Parameter Name	
NUMS	Source Identification Number -- This parameter is the source identification number and is a 1- to 5-digit integer. If this number is negative, the program assumes NUMS is only a flag to terminate the card source input data. Also, if NUMS is not punched or is zero, the program will default NUMS to the relative sequence number of the source input. This number cannot be defaulted if source data are also being input from tape or data file. Sources must be input in ascending order of the source identification number.
DISP	Source Disposition -- This parameter is a flag that tells the program what to do with the source. If this parameter is not punched or has a value of "0", the program assumes this is a new source for which concentration or deposition is to be calculated. Also, if the program is using an input tape or data file, this new source will be merged into the old sources from tape or will replace a tape source with the same source identification number. If the parameter DISP has a value of "1", the program assumes that the tape input source having the same source identification number is to be deleted from the source inventory. The program removes the source as well as the concentration or deposition arrays for the source. If the parameter DISP has a value of "2", the program assumes the source strengths to be read from data card for this source are to be used to rescale the concentration or deposition values of the tape input source with the same source identification number. The new source strengths input from card replace the old values taken

Parameter Name	
DISP (Cont.)	from the input tape and the concentration or deposition arrays taken from tape are multiplied by the ratio of the new and old source strengths. The DISP option equal to "2" can only be used if QFLG equals zero and the tape input source has QFLG equal to zero.
TYPE	Source Type -- This parameter is a flag that tells the program what type of source is being input. If this parameter is not punched or is "0", the program assumes a stack source. If this parameter has a value of "1", the program assumes a volume source. Similarly, if this parameter has a value of "2", an area source is assumed.
QFLG	Source Emissions Option -- This parameter is a flag that tells the program how the input source emissions are varied. If this value is not punched or is "0", the program assumes the source emissions vary by season (or annual) and only the NSEASN values are read by the program. If this parameter has a value of "1", the program assumes the source emissions vary by stability category and season. If this parameter has a value of "2", the program assumes the source emissions vary by wind speed category and season. If this parameter has a value of "3", the program assumes the source emissions vary by wind speed category, stability category and season. The order of input of the source strengths under each of these options is discussed under the parameter Q below.
DX	Source X Coordinate -- This parameter gives the Cartesian X (east-west) coordinate in meters of the source center

Parameter Name	
DX (Cont.)	for stack and volume sources and the southwest corner for area sources (X in Table 2-6) relative to the origin of the reference grid system being used.
DY	Source Y Coordinate -- This parameter gives the Cartesian Y (north-south) coordinate in meters of the source center for stack and volume sources and the southwest corner for area sources (Y in Table 2-6) relative to the origin of the reference grid system being used.
H	Height of Emission -- This parameter gives the height above ground in meters of the pollutant emission. For volume sources, this is the height to the center of the source.
ZS	Source Elevation -- This parameter gives the terrain elevation in meters above mean sea level at the source location and is not used by the program unless receptor terrain elevations (ISW(4)) are being used.
Q	Source Emission -- This parameter array gives the emission rate of the source for each category specified by QFLG above. If QFLG above is "0", NSEASN values are read from one data card. If QFLG is "1", NSEASN data cards are read with the source emission values for stability categories 1 through NSTBLE read from each card. If QFLG is "2", NSEASN data cards are read with the source emission values for wind speed categories 1 through NSPEED read from each card. If QFLG is "3", NSPEED (1 through

Parameter
Name

NSPEED) source emission values are read from each data card and there are NSTBLE (1 through NSTBLE) data cards read for each season. There are no default values provided for the parameter Q and the program assumes "0" is a valid source emission. The input units of source emission are:

Q (Cont.)

Source Type	Concentration	Deposition
stack or volume	mass per unit time (g/sec)*	total mass (g)*
area	mass per unit time per unit area (g/(sec·m^2))*	total mass per unit area (g/m^2)*

*Default units

NVS

Number of Particulate Size Categories -- This parameter gives the number of particulate size categories in the particulate distribution used in calculating ground-level deposition or concentration with deposition occurring. If ground-level deposition (ISW(1) = "2") is being calculated, this parameter must be punched and has a maximum value of 20. Also, if the program is calculating concentration and this value is punched greater than zero, concentration with deposition occurring is calculated. If the parameter NVS is greater than zero, the program reads NVS values for each of the parameter variables VS, FRQ and GAMMA below.

Parameter Name	
VS	Settling Velocity -- This parameter array is read only if NVS above is greater than zero. This parameter is the settling velocity in meters per second for each particulate size category (1 through NVS). No default values are provided for this parameter.
FRQ	Mass Fraction of Particles -- This parameter array is read only if NVS above is greater than zero. This parameter is the mass fraction of particulates contained in each particulate size category (1 through NVS). No default values are provided for this parameter.
GAMMA	Surface Reflection Coefficient -- This parameter array is read only if NVS above is greater than zero. This parameter is the surface reflection coefficient for each particulate size category (1 through NVS). A value of "0" indicates no surface reflection (total retention). A value of "1" indicates complete reflection from the surface. The reflection coefficient range is from 0 to 1 and no default values are provided.

Stack Source Parameters	
TS	Stack Gas Exit Temperature -- This parameter gives the stack gas exit temperature (T_s in Table 2-6) in degrees Kelvin. If this parameter is zero, the exit temperature is set equal to the ambient air temperature. If this parameter is negative, its absolute value is added to the ambient air temperature to form the stack gas exit temperature. For example, if the stack gas exit temperature is 15 degrees Celsius above the ambient temperature, enter TS as -15 (the minus sign is used by the program only as a flag).

Stack Source Parameters

VEL — Stack Gas Exit Velocity -- This parameter gives the stack gas exit velocity in meters per second. No plume rise is calculated if VEL is equal to zero.

D — Stack Diameter -- This parameter gives the inner stack diameter in meters and no default is provided.

HB — Building Height -- This parameter gives the height above ground level in meters of the building adjacent to the stack. *This parameter and BW below control the wake effects option. If HB and BW are punched non-zero, wake effects for the respective source are considered.* However, if HB and BW are not punched or both equal "0", wake effects for the respective source are not considered (see Section 2.4.1.1.d).

BW — Building Width -- This parameter gives the width in meters of the building adjacent to the stack. If the building is not square, input the diameter of a circular building of equal horizontal area. If HB is not punched or is zero, this value should not be punched.

WAKE — Supersquat Building Wake Effects Equation Option -- This option is used to control the equations used in the calculation of the lateral virtual distance (Equations (2-31) and (2-33)) when the effective building width to height ratio (BW/HB) is greater than 5. If this parameter is not punched or has a value of "0" and the width to height ratio is greater than 5, the program will use Equation (2-31) to calculate the lateral virtual distance producing the upper bound of the concentration or deposition for the source. If this parameter has a value of "1", the

Stack Source Parameters

WAKE (Cont.)

program uses Equation (2-33) producing the lower bound of the concentration or deposition for the source. The appropriate value for this parameter depends on building shape and stack placement with respect to the building (see Section 2.4.1.1.d).

Volume Source Parameters

SIGYO

Standard Deviation of the Crosswind Distribution -- This parameter gives the standard deviation of the crosswind distribution of the volume source (σ_{yo} in Table 2-6) in meters. See Section 2.4.2.3 to determine the correct value for this parameter. No default value is provided.

SIGZO

Standard Deviation of the Vertical Distribution -- This parameter gives the standard deviation of the vertical distribution of the volume source (σ_{zo} in Table 2-6) in meters. See Section 2.4.2.3 to determine the correct value for this parameter. No default value is provided for this parameter.

Area Source Parameters

XO

Width of Area Source -- This parameter gives the width of the area source (x_o in Table 2-6) in meters. This parameter should be the length of one side of the approximately square area source. No default is provided for this parameter.

f. Source Data Input Order. There are from one to four data input card groups of one or more cards each required to input the source data. The data cards and parameters required depend on the source type (TYPE) and on the parameters DISP, QFLG, NVS and the concentration/deposition option parameter ISW(1). Card Group 17 is always included in the input deck for each source input (1 to NSOURC). Card Groups 17a through 17c are included only if NVS on Card Group 17 is non-zero. Card Group 17d is included only if DISP on Card Group 17 equals "0" or "2". The order of input of these source cards is Card Group 17 followed by those used from 17a through 17d for each successive source input. DO NOT stack all of 17 together, all of 17a together, etc. or the program will terminate in error.

Source Input
Card Group 17

Required Source Parameters for Card Group 17 -- The parameters read from the first data card for each source and their order are:

Stack Sources -- NUMS, DISP, TYPE, QFLG, DX, DY, H, ZS, TS, VEL, D, HB, BW, WAKE, NVS

Volume Sources -- NUMS, DISP, TYPE, QFLG, DX, DY, H, ZS, SIGYO, SIGZO, NVS

Area Sources -- NUMS, DISP, TYPE, QFLG, DX, DY, H, ZS, XO, NVS

If the parameter DISP on this card is set to value of "0", all parameters on this card are expected to have the correct value and the program may read Card Groups 17a, 17b and 17c (depending on NVS) and will read Card Group 17d. If DISP is set to a value of "1", only the parameters NUMS and DISP are referenced (required) on this card, the program assumes it is to delete an incoming tape or data file source and only this data card is read for this

Source Input Card Group 17 (Cont.)

source. If DISP is set to a value of "2", only the parameters NUMS, DISP and QFLG are referenced (required) on this card because the program assumes it is to read the source strengths from Card Group 17d and to rescale the concentration or deposition of an incoming tape or data file source. Parameters not referenced on this first data card are set from tape or data file source data by the program.

Source Input Card Groups 17a, 17b and 17c

Source Particulate Distribution Data -- This card group consists of three sets of one or more data cards each and is read by the program only if DISP is set to "0" and the parameter NVS is set to a value greater than zero for concentration calculations with deposition occuring or for deposition calculations. The first data card(s) contains the values of the parameter array VS, the second contains the values of the parameter array FRQ and the third contains the values of the parameter array GAMMA. A total of NVS values are read from each set of cards.

Source Input Card Group 17d

Source emissions -- the last input card group for a source contains the source emission values for the source. This card group consists of one or more data cards and is read only if the parameter DISP is not equal to "1". The number of cards required and the order of values input depends on the parameters QFLG and is given under the source strength parameter Q above.

4.1.3 Output Information

The ISCLT program generates five categories of program output. Each category is optional to the user. That is, the user controls what output other than warning and error messages the program generates for a given run. In the following paragraphs, each category of output is related to the specific input parameter that controls the output category. All program output are printed except for magnetic tape or data file output.

a. Input Parameters Output. The ISCLT program will print all of the input data except for source data if the parameter ISW(6) is set equal to a value of "1" or "3". An example of this output is shown in Figure 4-2 of Section 4.2.4 and in the example problems given in Appendix D.

b. Source Parameters Output. The ISCLT program will print the input card and tape source data if the parameter ISW(6) is set to a value of "2" or "3". An example of the printed source data is shown in Figure 4-3 of Section 4.2.4 and in the example problems given in Appendix D.

c. Seasonal/Annual Concentration or Deposition. The parameter ISW(1) specifies whether the program is to calculate concentration or deposition and the parameter NSEASN specifies if seasonal or annual input meteorological data is being used. The option ISW(7) is used to specify whether seasonal output or annual output or both is to be generated. If the input meteorological data are seasonal (winter, spring, summer, fall), the program can be directed to produce tables of seasonal as well as annual concentration or deposition by setting the parameter ISW(7) equal to "0" or "3". Also, only seasonal tables are produced if ISW(7) equals "1". If the parameter NSEASN is set equal to a value of "1" and only annual output is selected (ISW(7)="2"), the program labels the output concentration or deposition as annual calculations. However, if seasonal output is selected with NSEASN equal to "1", the output tables are labeled seasonal. Also, all seasonal output is labeled season 1, season 2, etc., requiring the user to keep track of the actual meteorological season. Example seasonal and annual output tables are shown in Figures 4-4 and 4-5 in Section 4.2.4 as well as Appendix D.

d. Concentration or Deposition Printed for the Maximum 10 and/or All Receptor Points. The ISCLT program is cabable of printing the concentration or deposition calculations for each receptor point input to the program or printing only the maximum 10 of those receptors or both. The parameter ISW(10) is used to determine which calculations are to be printed. If ISW(10) is set equal to "1", only the maximum 10 values and receptors determined by ISW(11) or ISW(12) are printed. If ISW(10) is set equal to "0", the results of calculations at all receptors are printed and the maximum 10 are not printed. If ISW(10) is set equal to "2", the program prints the results of calculations at all receptors in addition to the maximum 10. Examples of output tables giving the calculations at all points and the maximum 10 are given in Figures 4-4 through 4-10 of Section 4.2.4 and in Appendix D.

e. Magnetic Tape or Data File Output. The ISCLT program will write all input data and all concentration (deposition) calculations to magnetic tape or data file. These data are written to the logical unit number specified by the parameter ISW(15). This tape or data file must be assigned to the run prior to the execution of the ISCLT program, positioned to the correct file and must be equated to the logical unit number given in ISW(15). ISW(15) must be a positive value for magnetic tape or a negative value for mass storage. If seasonal meteorological input data are used, the program saves only seasonal concentration (deposition) on the output file and if input is annual, only annual calculations are saved. This output file can be read back into the ISCLT program to print tables not output in the original run and/or to modify the source inventory for corrections or updates in the source emissions. The instructions on how to assign the output magnetic tape or file are given in Section 4.2.2 and approximations as to the length of magnetic tape required are given in Section 4.2.5.c. A more detailed description of the contents and format of the output tape file is given in Section 4.2.4.

4.2 USER'S INSTRUCTIONS FOR THE ISCLT PROGRAM

4.2.1 Program Description

The ISC long-term (ISCLT) program is designed to calculate ground-level average concentration or total deposition values produced by emissions from multiple stack, volume and area sources. The ground-level concentration or total deposition values can be calculated on a seasonal (monthly) or annual basis or both for an unlimited number of sources. The program is capable of producing the seasonal and/or annual results for each individual source input as well as for the combined (summed) seasonal and/or annual results from multiple groups of user-selected sources. The program calculations of concentration or deposition are performed for an input set of receptor coordinates defining a fixed receptor grid system and/or for discrete (arbitrarily placed) receptor points. The receptor grid system may be a right-handed Cartesian coordinate system or a polar coordinate system. In either case, zero degrees (north) is defined as the positive Y axis and ninety degrees (east) is defined as the positive X axis and all points are relative to a user-defined hypothetical origin (normally (X=0, Y=0), although the Universal Transverse Mercator (UTM) coordinates may be used as the Cartesian coordinate system).

Capabilities of the ISCLT program include:

- The capability to calculate either ground-level average concentration or total deposition
- The capability to process an unlimited number of sources
- The capability to model stacks, volume sources and area sources in the same execution
- The capability to specify source locations anywhere within or outside of the receptor grid system or discrete receptor points
- The capability to produce either seasonal or annual results or both
- The capability to display concentration or deposition from individual sources
- The capability to display combined (summed) concentration or deposition from multiple user-related subsets of the sources or from all sources
- The capability of saving the results of all calculations, the source data and the meteorological data on a master source/concentration (deposition) inventory magnetic tape or data file

- The capability of updating (adding to, modifying or deleting from) a master source/concentration (deposition) inventory magnetic tape or data file

- The capability to specify a regular receptor array or a set of discrete (arbitrarily placed) points or both

- The capability to specify a right-handed Cartesian coordinate system or a polar coordinate system for the regular receptor array or for the discrete (arbitrarily placed) receptors

- The capability to specify terrain elevations for each receptor and source for concentration calculations

- The capability to specify either an urban or a rural mode

- The capability of displaying the maximum 10 concentration or deposition values and their locations for each individual source and for the combined (summed) sources

- The capability of displaying the 10 values of concentration or deposition from each source that contributes to the maximum 10 for the combined (summed) sources

- The capability of letting the program determine the maximum 10 locations or letting the user specify a select group of 10 locations on a seasonal or annual basis

- The capability of using either seasonal or annual meteorological data

- The capability of specifying the number of wind speed, Pasquill stability and wind direction categories in the meteorological data

- The capability to vary source emissions by season, by Pasquill stability category and season, by wind speed category and season or by wind speed category, Pasquill stability category and season (season is defined as winter, spring, summer and fall or annual only)

The ISCLT computer program is written in FORTRAN, is designed for use on a UNIVAC 1110 computer and is compatible with both the UNIVAC FORTRAN V and ASCII compilers. However, the program is also designed to execute on most medium to large scale computers with minimal or no modifications. Program modifications necessary for computers other than the UNIVAC 1100 series computers are given below in Section 4.2.7. The program requires approximately 65,000 words (UNIVAC 1110) of executable core for instruction and data storage. The program design assumes a minimum of 32 bits per variable word and a minimum of four character bytes per computer word. The program also requires from two to four input/output devices, depending on whether the tape input/output options are used. Input card image data is referenced as logical unit 5 and print output, which requires 132-character print columns, is referenced as logical unit 6. The optional tape or data file input is referenced as logical unit 2 and the output is referenced as logical unit 3. The user has the option of either using the default logical unit numbers given here or specifying alternate logical unit numbers. The computer program consists of a main program (ISCLT) and 15 subroutines (MODEL, OUTPT, HEADNG, MXIMUM, CHECKR, SUMMER, TITLR, DISTR, FUNCT, VERTC1, VERTC2, VERTC3, SIGMAZ, VIRTZ and VIRTY). The FORTRAN source code for each of these routines is given in Appendix B and a logic flow description of the ISCLT program is given in Appendix I.

4.2.2 Control Language and Data Deck Setup

a. Control Language Requirements. The following illustrates the required ECL control statement runsteam for a typical run on a UNIVAC 1110 Operating System:

1.	@RUN,priority jobid,account,userid, time,pages	
2.	@PASSWD user-password	May be necessary with batch runs, depending on system
3.	@ASG,A prog-file.	
4.	@ASG,T input-tape-file.,16N,reel-number @USE nn,input-tape-file.	Optional, required only if ISW(5)=2 or 3 and data is on tape
	@MOVE input-tape-file.,ℓ	Optional, required only if data is the ℓth file on tape, ℓ>1
	or	
	@ASG,A input-file. @USE nn,input-file.	Optional, required only if ISW(5)=2 or 3 and data is on mass storage file
5.	@ASG,TF/W output-tape-file.,16N,reel-number @USE mm,output-tape-file.	Optional, required only if ISW(5)=1 or 3 and data is output to tape
	@MOVE output-tape-file.,ℓ	Optional, required only if data output file ℓ is greater than 1
	or	

```
@ASG,CP  output-file.
@USE mm, output-file.
```

} Optional, required only if ISW(5)=1 or 3 and data is output to a mass storage file to be catalogued and saved at the end of the run

or

```
@ASG,T output file.
@USE mm,output-file.
```

} Optional, required only if ISW(5)=1 or 3 and data is output to a temporary mass storage file to be deleted at the end of the run

6. @XQT prog-file.ISCLT

7. card-input-data

8. @FIN

where

priority	=	job run priority
jobid	=	six-character user supplied job identification. May also specify core usage requirements, check with your system consultant
account	=	account number, assign by installation accounting
userid	=	six-character user identification code
time	=	execution time required

pages	=	maximum number of output pages
user-password	=	password, assigned by installation accounting
prog-file	=	is the name of the program file. This illustration assumes the user (installation) has assembled and collected (linked) the long-term program into this file and called the absolute program ISCLT.
input-tape-file	=	a user supplied file name used to reference the optional source/concentration (deposition) inventory input tape. This tape was created by a previous run of the ISCLT program.
reel-number	=	the physical tape reel-number assigned by the installation tape librarian. Each tape reel-number is unique.
nn	=	the FORTRAN logical unit number with which the ISCLT program is to reference (read) the input tape. This number is defined under the ISW(14) parameter input option and is always positive here.
ℓ	=	the number of file-marks to space over on the input tape to position the tape at the desired input data set. The MOVE card is only required if $\ell > 1$.

input-file = the name of a catalogued file containing the input source/concentration (deposition) inventory. This assignment assumes the file was created by a previous run of the ISCLT program.

output-tape-file = a user supplied file name used to reference the optional source/concentration (deposition) inventory output tape.

mm = the FORTRAN logical unit number with which the ISCLT program is to reference (write) the output tape. This number is defined under the ISW(15) parameter input option and is always positive here.

output-file = the name of a catalogued or temporary file to which the output source/concentration (deposition) inventory is to be written.

card-input-data = that card deck consisting of all necessary data cards defined in Section 4.1.2 above and shown in Figure 4-1, Section 4.2.2.b.

The JCL control statement runstream for a typical run on an IBM 360 Operating System is given below:

```
1.        //jobid  JOB(account),'name',Time=time
```

```
2.        //JOBLIB  DD  DSNAME=prog-file,DISP=(OLD,PASS)

3.        //STEP1  EXEC  PGM=ISCLT

4.        //FT05F001  DD  DDNAME=SYSIN

5.        //FT06F001  DD  SYSOUT=A

6.        //FTnnF001  DD DSN=input-tape-file,UNIT=TAPE,VOL=SER=reel-number,
                                                  DCB=RECFM=V,DISP=OLD

7.        //FTmmF001  DD  DSN=output-tape-file,UNIT=TAPE,VOL=SER=reel-number,
                                            DCB=RECFM=V,DISP=(NEW,KEEP)

8.        //GO.SYSIN  DD  *

9.        card-input-data

10.       /*
```

where the lower case names and letters are defined the same as under the UNIVAC ECL definitions. This illustration assumes the user has assembled the ISCLT program into an absolute deck located in a catalogued library "prog-file" and that the absolute deck is called ISCLT. Also, cards 6 and 7 are optional input and output tapes.

The control statement runstream for a typical run on a CDC 6500 Operating System is given by:

```
1.        job-card(s)

2.        REQUEST,TAPEnn,VRN=reel-number,HY - Optional input tape

3.        REQUEST,TAPEmm,VRN=reel-number,RW,HY - Optional output tape
```

4. ATTACH,ISCLT,prog-file [,options]

5. ZRO.

6. ISCLT.

7. 7 } 8 } 9 } Card Column One

8. card-input-data

9. 6 } 7 } 8 } 9 } Card Column One

where

job-card(s) = job card or cards that consist of the job name, account, password, etc. depending on the installation.

The remaining lower case names and letters are defined the same as under the UNIVAC ECL definitions. The illustration assumes the user has assembled the ISCLT program into an absolute deck located in a catalogued file "prog-file" and that the absolute deck, which is called ISCLT, is used as the LGO (load and go) file.

b. Data Deck Setup. The card input data required by the ISCLT program depends on the program options desired by the user. The card input deck may be partitioned into five major groups of card data. Figure 4-1 illustrates the input deck setup. The five major input deck groups are:

1. Title Card (1 data card)

2. Program Option and Control Cards (2 to 5 data cards)

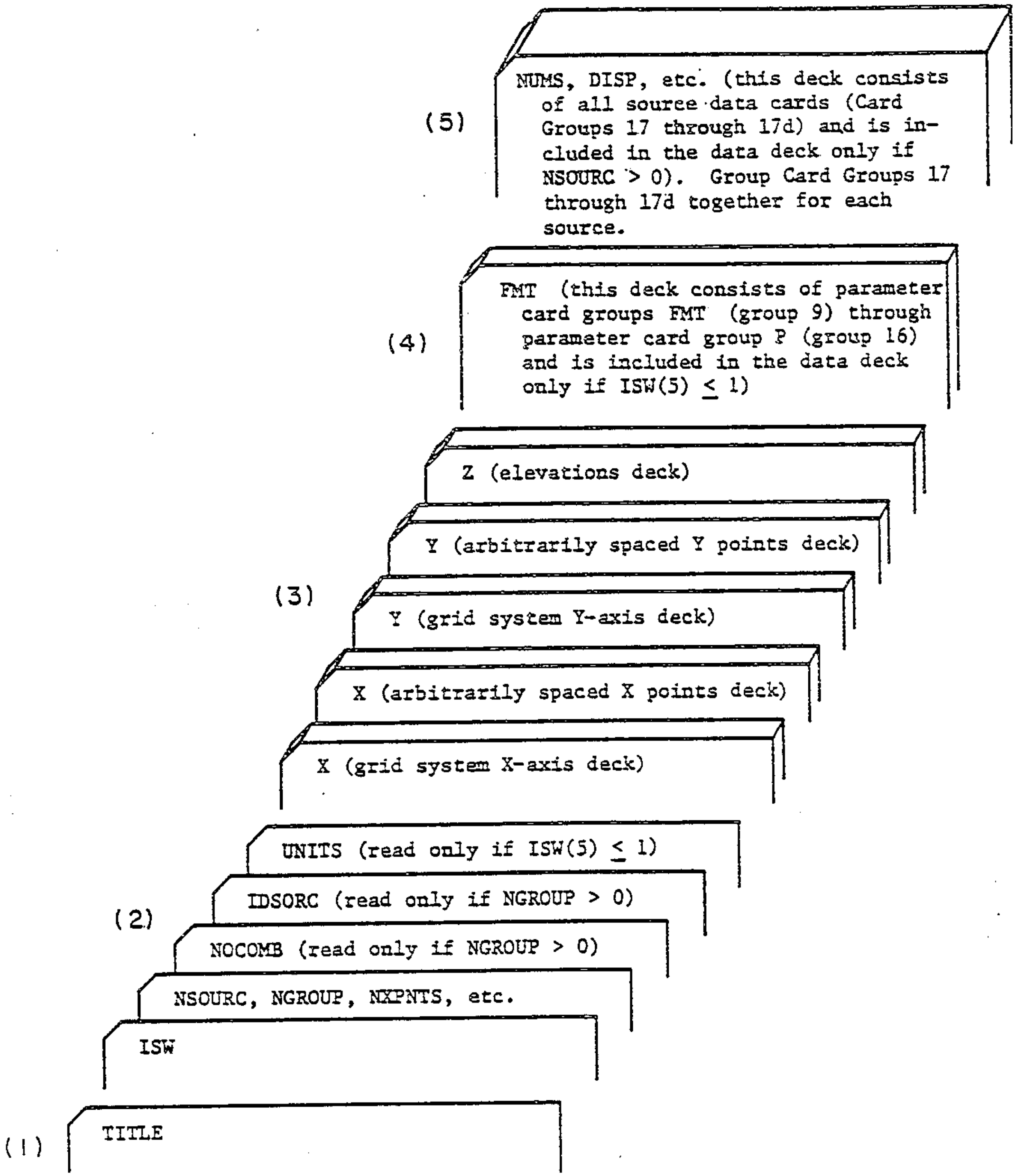


FIGURE 4-1. Input data deck setup for the ISCLT program.

3. Receptor Data Cards (the number of data cards included in this group depends on the parameters ISW(4), ISW(5), ISW(12), NXPNTS, NYPNTS and NXWYPT)

4. Meteorological Data Cards (this card deck is included in the input deck only if ISW(5) is less than or equal to "1")

5. Source Data Cards (this card deck is included in the input deck only if NSOURC is greater than zero)

4.2.3 Input Data Description

Section 4.1.2 provides a summary description of all input data parameter requirements for the ISCLT program. This section provides the user with the FORTRAN format and order in which the program requires the input data parameters. The input parameter names used in this section are the same as those introduced in Section 4.1.2. Two forms of input data may be input to the program. One form is card image input data (80 characters per record) in which all required input data may be entered. The other form is magnetic tape or mass storage on which some of the required input data was stored as part of a previous run of the ISCLT program. Both forms of input are discussed below.

a. Card Input Requirements. The ISCLT program reads all card image input data in a fixed-field format with the use of a FORTRAN "A", "I" or "F" editing code (format). Each parameter value must be punched in a fixed-field on the data card defined by the start and end card columns specified for the variable. Table 4-4 identifies each variable by name and respective card group. Also, Table 4-4 specifies the card columns (fixed-field) for the parameter value and the editing code ("A", "I" or "F") used to interpret the parameter value. Parameters using an "A" editing code are alpha-numeric data items used primarily for

TABLE 4-4

ISCLT PROGRAM CARD INPUT PARAMETERS,
FORMAT AND DESCRIPTION

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
1	TITLE	1 - 80	20A4	80 character page heading label
2	ISW(1)*	2	I1	blank, 0 or 1 = calculate concentration 2 = calculate deposition
	ISW(2)*	4	I1	blank, 0 or 1 = Cartesian coordinate receptor grid system 2 = Polar coordinate receptor grid system
	ISW(3)*	6	I1	blank, 0 or 1 = Cartesian discrete (arbitrarily placed) receptors 2 = Polar discrete receptors
	ISW(4)*	8	I1	blank or 0 = no terrain elevation data 1 = terrain elevation data
	ISW(5)	10	I1	blank or 0 = no input or output tape 1 = output tape only 2 = input tape only 3 = both input and output tapes

*These parameters are set automatically by the program and cannot be changed if tape input ISW(5) = 2 or 3) is being used.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
2 (Cont.)	ISW(6)	12	I1	blank or 0 = input data are not printed 1 = print all but source input data 2 = print source input data only 3 = print all input data
	ISW(7)	14	I1	1 = print seasonal (monthly) calculations only 2 = print annual calculations only blank, 0 or 3 = print both seasonal and annual calculations
	ISW(8)	16	I1	1 = print only concentration (deposition) from individual sources 2 = print only concentration (deposition) from combined sources blank, 0 or 3 = print concentration (deposition) from both individual and combined sources
	ISW(9)	18	I1	1 = Urban Mode 1 2 = Urban Mode 2 blank, 0 or 3 = Rural Mode if ISW(5) = 0 or 1 blank or 0 = Value from input tape if ISW(5) = 2 or 3
	ISW(10)	20	I1	blank or 0 = maximum 10 concentration (deposition) values are not calculated 1 = maximum 10 concentration (deposition) values are calculated according to ISW (11) or ISW(12) and only these calculations are printed

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
2 (Cont.)	ISW(10) (Cont.)			2 = maximum 10 concentration (deposition) values are calculated according to ISW(11) or ISW(12) and these as well as the concentration (deposition) values at all other receptors are printed
	ISW(11)	22	I1	blank or 0 = see ISW(12) if ISW(10) > 0 1 = program determines maximum 10 of each individual source and source combination independently of each other 2 = program determines maximum 10 of combined sources and prints those as well as the contributions of each individual source to those receptors
	ISW(12)	24	I1	blank or 0 = see ISW(11) if ISW(10) > 0 1 = user specifies maximum 10 or special 10 receptors
	ISW(13)	25 - 26	I2	blank or 0 = print output goes to FORTRAN logical unit 6 (printer) n > 0 = print output goes to FORTRAN logical unit n followed by two end-of-file marks n < 0 = print output goes to FORTRAN logical unit n with no end-of-file marks
	ISW(14)	27 - 28	I2	blank or 0 = tape input data is read from FORTRAN logical unit 2 n > 0 = input data is read from magnetic tape on FORTRAN logical unit n n < 0 = input data is read from mass-storage on FORTRAN logical unit n

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
2 (Cont.)	ISW(15)	29 - 30	I2	blank or 0 = tape output data is written to FORTRAN logical unit 3 (magnetic tape) n > 0 = output data is written to magnetic tape on FORTRAN logical unit n n < 0 = output data is written to mass storage on FORTRAN logical unit n
	ISW(16)	32	I1	blank or 0 = each new output table starts on a new page 1 = program minimizes number of output pages by not starting a new page even though successive tables are not related.
	ISW(17)	33 - 34	I2	blank or 0 = the program prints 57 lines per page before ejecting to a new page n > 0 = the program prints n lines per page before ejecting to a new page
	ISW(18)	35 - 36	I2	blank or 0 = the program reads Card Group 9a using a 6F10.0 format 1 = the program reads Card Group 9 which specifies the format the program is to use to read Card Group 9a
	ISW(19)	38	I1	blank or 0 = plume rise is independent of downwind distances 1 = plume rise is dependent on downwind distance
	ISW(20)	40	I1	blank or 0 = no stack-tip downwash correction is made at the stack height 1 = the Briggs (1973) downwash correction is applied to the stack height

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
3	NSOURC	1 - 4	I4	Number of card image input sources to be read under Card Group 17 to 17d below. If negative the program will continue to read Card Group 17 to 17d until a negative source ID-number is read from Card Group 17.
	NGROUP	5 - 8	I4	Number of different source combinations used to print concentration (deposition) calculations (the maximum is 20). If set to zero Card Groups 4 and 4a are omitted from the input card deck.
	NXPNTS*	9 - 12	I4	Number of receptors in the X-axis of the receptor grid system. (The number of rings in polar coordinates.)
	NYPNTS*	13 - 16	I4	Number of receptors in the Y-axis of the receptor grid system. (The number of radials in polar coordinates.)
	NXWYPT	17 - 20	I4	Number of discrete (arbitrarily placed) receptor points. This parameter is not used if ISW(5) = 2 or 3 unless ISW(12) is non-zero.
	NSEASN*	21 - 24	I4	Number of seasons (months) in the input meteorological data. The maximum for this parameter is 4 and if blank or 0 the default is 1.

*These parameters are set automatically by the program and cannot be changed if tape input (ISW(5) = 2 or 3) is being used.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
3 (Cont.)	NSPEED*	25 - 28	I4	Number of wind speed categories in the joint frequency of occurrence of wind speed and direction. The maximum is 6 and 6 is the default value if blank or 0.
	NSTBLE*	29 - 32	I4	Number of Pasquill stability categories in the joint frequency of occurrence of wind speed and direction. The maximum is 6 and the default is 6 if blank or 0.
	NSCTOR*	33 - 36	I4	Number of wind direction sector categories in the joint frequency of occurrence of wind speed and direction. The maximum is 16 and the default is 16 if blank or 0.
	NOFILE	37 - 40	I4	Output file number of output tape or if no output tape, then input file number of input tape. Applicable to magnetic tape only, when Condition a or Condition b is being used under ISW(11) or NGROUP.

*These parameters are set automatically by the program and cannot be changed if tape input (ISW(5) = 2 or 3) is being used.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
4	NOCOMB	1 - 4 5 - 8 ⋮ 77 - 80	20I4	Array used to specify the number of source ID-numbers you are using to define each source combination. There are NGROUP values read here. This data card is omitted from the input card deck if NGROUP = 0.
4a	IDSORC	1 - 6 7 - 12 ⋮ 73 - 78 (for each card)	13I6	Array used to specify the source ID-numbers to use in forming the combined source output and individual source output. There is a maximum of 200 values that can be input here. This data card group is omitted from the input card deck if NGROUP = 0.
5**	UNITS	1 - 40	10A4	40 characters giving the concentration (deposition) print output units. This label is automatically filled if the parameter TK on Card Group 13 is defaulted. If this label is punched, start in column 1.
		41 - 80	10A4	40 characters giving the source strength input units. This label is automatically filled if the parameter TK on Card Group 13 is defaulted. If this label is punched, start in column 41. This card group is omitted from the input deck if tape input (ISW(5) = 2 or 3) is being used.

**These card groups are omitted from the input card deck if tape input (ISW(5) = 2 or 3) is being used. The information for these parameters is taken from the input tape.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
6**	X	1 - 10 11 - 20 . . . 71 - 80 (for each card)	8F10.0	Array of NXPNTS receptor points in meters in ascending order defining the X-axis of the receptor grid system or the distances to the rings in polar coordinates. If only two values are punched and NXPNTS is greater than 2, the program assumes the first is the start of the axis and the second is the increment it uses to generate the remaining points. This card group is omitted from the input data deck if NXPNTS = 0.
6a	X	1 - 10 11 - 20 . . . 71 - 80 (for each card)	8F10.0	Array of NXWYPT discrete receptor points in meters. This card group is omitted from the input data deck if NXWYPT = 0 or if an input tape is being used and ISW(12) = 0.
7**	Y	1 - 10 11 - 20 . . . 71 - 80 (for each card)	8F10.0	Array of NYPNTS receptor points in meters or degrees, depending on ISW(2), in ascending order defining the Y-axis of the receptor grid system or the radials in polar coordinates. If only two values are punched and NYPNTS is greater than 2, the program assumes the first is the start of the axis and the second is the increment used to generate the remaining points. This card group is omitted from the input data deck if NYPNTS = 0.

**These card groups are omitted from the input card deck if tape input (ISW(5) = 2 or 3) is being used. The information for these parameters is taken from the input tape.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
7a	Y	1 - 10 11 - 20 ⋮ 71 - 80 (for each card)	8F10.0	Array of NXWYPT discrete receptor points in meters or degrees depending on ISW(3). This card group is omitted from the input data deck if NXWYPT = 0 or if an input tape is being used and ISW(12) = 0.
8**	Z	1 - 10 11 - 20 ⋮ 71 - 80 (for each card)	8F10.0	Array of terrain elevations in feet for each receptor of the NXPNTS by NYPNTS grid system. This card group is omitted from the input data deck if either ISW(4) = 0 or an input tape is being used. See the text for the order of values input to this card group.
8a	Z	1 - 10 11 - 20 ⋮ 71 - 80 (for each card)	8F10.0	Array of terrain elevations in feet for each discrete receptor. This card group is omitted from the input card deck if ISW(4) = 0 or NXWYPT = 0 or an input tape is being used and ISW(12) = 0.

** These card groups are omitted from the input card deck if tape input (ISW(5) = 2 or 3) is being used. The information for these parameters is taken from the input tape.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
9**	FMT	1 - 80	20A4	Array specifying the format used to read Card Group 9a (not read if ISW(18)=0, default format is 6F10.0)
9a**	FREQ	1 - 10*** 11 - 20 ⋮ 51 - 60 (for each card)	FMT	Array giving the joint frequency of occurrence of the wind speed and direction for each stability category and each season expressed as a percentage or as a fraction. See the text for the order of input values.
10**	TA	1 - 10 11 - 20 ⋮ 51 - 60 (for each card)	6F10.0	Array of ambient air temperatures in degrees Kelvin as a function of stability category and season. See the text for the order of input values.
11**	HM	1 - 10 11 - 20 ⋮ 51 - 60 (for each card)	6F10.0	Array of mixing layer heights in meters as a function of wind speed and stability category and season. See the text for the order of input values.

**These card groups are omitted from the input card deck if tape input (ISW(5) = 2 or 3) is being used. The information for these parameters is taken from the input tape.

***These are the default card columns used for this array and are not applicable if FMT on Card Group 9 is input.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
12**	DPDZ	1 - 10 11 - 20 ⋮ 51 - 60 (for each card)	6F10.0	Array of the vertical gradient of potential temperature in degrees Kelvin per meter as a function of wind speed and stability category. See the text for the order of input values.
13**	ROTATE	1 - 10	F10.0	Wind direction correction parameter used to correct for any difference in north as defined by the reference receptor grid system and north as defined by the weather station at which the weather data were recorded. The value of ROTATE is subtracted from each wind direction category.
	TK	11 - 20	F10.0	Model units conversion factor used to produce the desired output concentration (deposition) units from the input source strength units. The concentration default for TK is 1 x 10^6 micrograms per gram assuming output in micrograms per cubic meter and input source units in grams per second for stack and volume sources and grams per second per square meter for area sources. The deposition default for TK is 1 assuming output in grams per square meter and input source units in total grams for stack and volume sources and grams per square meter for area sources.

**These card groups are omitted from the input card deck if tape input (ISW(5) = 2 or 3) is being used. The information for these parameters is taken from the input tape.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
13 ** (Cont.)	TK (Cont.)			If the default is chosen, the parameter UNITS above on Card Group 5 is automatically set.
	ZR	21 - 30	F10.0	Height in meters above ground at airport or weather station at which the wind speed was measured. The default value is 10.0 meters.
	BETA1	31 - 40	F10.0	Air entrainment coefficient for an adiabatic or unstable atmosphere. The default is 0.6.
	BETA2	41 - 50	F10.0	Air entrainment coefficient for a stable atmosphere. The default is 0.6.
	G	51 - 60	F10.0	Acceleration due to gravity in meters per second squared. The default is 9.8 m/sec^2.
	DECAY	61 - 70	F10.0	Coefficient ($seconds^{-1}$) of time dependent pollutant removal by physical or chemical processes. Default is zero or no decay.
14 **	UBAR	1 - 10 11 - 20 ⋮ 51 - 60	6F10.0	Array containing the median value of each wind speed category in meters per second. The default values are 0.75, 2.5, 4.3, 6.8, 9.5 and 12.5 m/sec for the standard STAR summary wind-speed categories.

** These card groups are omitted from the input card deck if tape input (ISW(5) = 2 or 3) is being used. The information for these parameters is taken from the input tape.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
15 **	THETA	1 - 10 11 - 20 ⋮ 71 - 80 (for each card)	8F10.0	Array of wind direction sector angles in degrees beginning with the first direction category used in the joint frequency of occurrence of wind speed and direction (normally zero degrees north). NSCTOR values are read and, if the first two values are zero this array is defaulted to the standard direction angles 0.0, 22.5, 45.0, . . ., 337.5 degrees.
16 **	P	1 - 10 11 - 20 ⋮ 51 - 60 (for each card)	6F10.0	Array of wind speed power law exponents as a function of wind speed and stability categories. See the text for the order of values and default values.
17	NUMS	1 - 5	I5	Source identification number. Input all sources in ascending order of the identification number. If the number is negative, source input is terminated. If this number is zero, the program defaults the relative position of this source in the source input deck. Card Groups 17 through 17d are omitted from the input data deck if NSOURC equals zero. Remember to group Card Groups 17 through 17d together as a set for each input source.

** These card groups are omitted from the input card deck if tape input (ISW(5) = 2 or 3) is being used. The information for these parameters is taken from the input tape.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
17 (Cont.)	DISP	6	I1	Source disposition. blank or 0 = new input source or replace old source if it has same ID-number 1 = delete incoming tape source with same ID-number (next card group read is 17) 2 = rescale concentration (deposition) values for this source using input source strengths (next card group read is 17d) (only if QFLG = 0)
	TYPE	7	I1	Source type. blank or 0 = stack 1 = volume 2 = area
	QFLG	8	I1	Source emissions variation flag. blank or 0 = source emission varies with season (month) only 1 = source emission varies with stability category and season 2 = source emission varies with wind speed category and season 3 = source emission varies with wind speed and stability category and season
	DX	9 - 18	F10.0	Cartesian X-coordinate of the source in meters. (source center for building and stack sources and southwest corner for area sources)
	DY	19 - 28	F10.0	Cartesian Y-coordinate of the source in meters. (source center for building and stack sources and southwest corner for area sources)
	H	29 - 35	F7.0	Height above the ground of the emission in meters

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
17 (Cont.)	ZS	36 - 42	F7.0	Elevation in meters above mean sea level at the source location.
	TS or SIGYO or XO	43 - 49	F7.0	This field depends on the source type -- if TYPE = 0, TS = stack gas exit temperature in degrees Kelvin TYPE = 1, SIGYO = standard deviation of the cross-wind source distribution in meters TYPE = 2, XO = width of the area source in meters
	VEL or SIGZO	50 - 56	F7.0	This field depends on the source type -- if TYPE = 0, VEL = stack gas exit velocity in meters per second TYPE = 1, SIGZO = standard deviation of the vertical source distribution in meters TYPE = 2, this field is left blank
	D	57 - 63	F7.0	This field depends on the source type -- if TYPE = 0, D = inner stack diameter in meters TYPE = 1 or 2, this field is left blank
	HB	64 - 70	F7.0	This field depends on the source type -- if TYPE = 0, HB = 0, Wake effects are not considered for this source HB > 0, height above ground in meters of the building adjacent to the stack for the consideration of wake effects for this source TYPE = 1 or 2, this field is left blank

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
17 (Cont.)	BW	71 - 77	F7.0	This field depends on the source type -- if TYPE = 0, BW = 0, wake effects are not considered for this source; BW > 0, width of the building in meters adjacent to the stack for the consideration of wake effects for this source. TYPE = 1 or 2, this field is left blank
	WAKE	78	I1	This field depends on the source type -- if TYPE = 0, WAKE is a super squat building wake effects equation option. If the building width to height ratio is greater than 5 and WAKE is blank, or 0, the program uses the equation of lateral virtual distance (Equation (2-31)) that will produce the upper bound of concentration or deposition. If WAKE is 1, the equation of lateral virtual distance (Equation (2-33)) that will produce the lower bound of the concentration or deposition calculation is used (see Section 2.4.1.1.d). TYPE 1 or 2, this field is left blank
	NVS	79 - 80	I2	Number of particulate size categories in the particulate distribution for deposition or concentration with depletion due to dry deposition. The maximum value of this parameter is 20.

TABLE 4-4 (Continued)

Card Group	Parameter Name	Card Columns	FORTRAN Edit Code (Format)	Description
17a	VS	1 - 10 11 - 20 ⋮ 71 - 80 (for each card)	8F10.0	Array of settling velocities in meters per second for each particulate size category. This card group is omitted from the input data deck if NVS = 0.
17b	FRQ	1 - 10 11 - 20 ⋮ 71 - 80 (for each card)	8F10.0	Array of mass fraction of the particulate distribution for each category. The sum of the fractions in this array should total 1 (100% of the distribution). This card group is omitted from the input data deck if NVS = 0.
17c	GAMMA	1 - 10 11 - 20 ⋮ 71 - 80 (for each card)	8F10.0	Array of surface reflection coefficients (fraction, 0 to 1) for each particulate size category. A value of 0 is no reflection; a value of 1 is complete reflection. This card group is omitted from the data deck if NVS = 0.
17d	Q	1 - 10 11 - 20 ⋮ 51 - 60 (for each card)	6F10.0	Array of source emissions in units indicated by the parameters UNITS and TK above. The number of values input in this card group is determined by QFLG on Card Group 17 and the order of input is given in the text. This card group is omitted from the input data deck if DISP on Card Group 17 equals "1".

labeling purposes. These data items can be punched anywhere in the specified data columns and can consist of any character information. If not punched, these data items are interpreted as blanks. Parameters using an "I" editing code are integer (whole number) data items. These data items must be numeric punches only and must be punched (right justified) so the units digit of the number is in the right most column of the field. If the punch field for the variable is not punched (left blank), it is interpreted as zero. Parameters using an "F" editing code are real number data items. These data items can be punched like integer ("I") data items (right justified) if they are whole numbers. However, they must be punched with a decimal point (".") if they contain a fractional part.

Card Group 1 in Table 4-4 gives the print output page heading and is always included in the input data deck. Any information to identify the output listing or data case may be punched into this card. If the card is left blank, the heading will consist of only the output page number or the heading will be taken from the input tape or data file, if used.

Card Group 2 gives the values of the program option array ISW. This card is always included in the input data deck. However, the values of ISW(1) through ISW(4) are automatically set by the program if you are using an input (source/concentration or deposition inventory) tape. The options on this card that determine whether or not some card groups are included in the input data deck are: ISW(4), ISW(5), ISW(12) and ISW(18). If ISW(4) is left blank or punched zero, Card Groups 8 and 8a are omitted from the input data deck. If ISW(5) is equal to "2" or "3" (indicating an input data tape), Card Groups 5, 6, 7, 8 and 9 through 16 are omitted from the input data deck. Also, Card Groups 6a 7a, and 8a are omitted if the ISW(12) option is not used or equals blank or zero. If ISW(18) is left blank or punched zero, Card Group 9 is omitted from the input card deck. The ISW(10) option on this card must be set to "1" or "2" if either the ISW(11) or ISW(12) option is chosen. Also, if the ISW(11) option equals "2", one or more of the following conditions must be met:

Condition a — The run uses an output tape or data file. This tape or file may be a permanent catalogued file or may be temporary, lasting only for the duration of the run. If this condition is selected and the output medium is tape, the parameter NOFILE on Card Group 3 must be input.

Condition b — The run uses an input tape or catalogued data file, but has no input data card sources (NSOURC equals zero). If this condition is selected and the input medium is tape, the parameter NOFILE on Card Group 3 must be input.

Condition c — The total number of non-deleted input sources from data card and tape (data file) is less than or equal to the minimum of I and J, where:

$$\left.\begin{aligned} J &= 300 \\ &\text{and} \\ I &= \left[\frac{E - (NXPNTS+NYPNTS+2*NXWYPT) - K - L}{NSEASN*(NXPNTS*NYPNTS+NXWYPT)}\right] \end{aligned}\right\} \qquad (4\text{-}4)$$

E = the total amount of program data storage in BLANK COMMON. The program design size is 40,000.

NGROUP cannot be set to a non-zero value unless one or more of the following conditions is met:

Condition a — The run uses an output tape or data file. This tape or file may be a permanent catalogued file or may be temporary, lasting only for the duration of the run. If this condition is selected and the output medium is tape, the parameter NOFILE on this card group must be input.

Condition b — The run uses an input tape or data file, but no input card sources (NSOURC equals zero). If this condition is selected and the input medium is tape, the parameter NOFILE on this card group must be input.

Condition c — The total number of input card and tape sources is less than or equal to the minimum of I and J where:

$$\left.\begin{aligned} J &= 300 \\ &\text{and} \\ I &= \frac{E - (NXPNTS+NYPNTS+2*NXWYPT) - K - L}{NSEASN*(NXPNTS*NYPNTS+NXWYPT)} \end{aligned}\right\} \quad (4\text{-}5)$$

E = the total amount of program data storage in BLANK COMMON. The program design size is 40,000.

$$K = \begin{cases} 0 \; ; & \text{if } ISW(8)=1 \text{ and } ISW(11) \neq 2 \\ NSEASN*(NXPNTS*NYPNTS+NXWYPT) \; ; & \text{if } ISW(8) \neq 1 \text{ or } ISW(11)=2 \end{cases}$$

$$L = \begin{cases} 0 & ; \text{ if ISW(4) = 0} \\ \text{NXPNTS*NYPNTS+NXWYPT}; & \text{if ISW(4) = 1} \end{cases}$$

The parameters NXPNTS, NYPNTS and NXWYPT define the size of the program receptor point arrays. The maximum values of these parameters are limited by the core-use equation (4-3) given under NXPNTS in Section 4.1.2. If an input tape is being used, these parameters are normally ignored by the program because these values are taken from the input tape. However, if the ISW(12) option is selected, the parameter NXWYPT must be set to a multiple of 10 as outlined in Section 4.1.2. When ISW(12) is choosen and an input tape is being used, the original receptor points from the incoming tape are destroyed and replaced by a new set of discrete (arbitrarily placed) points indicated by NXWYPT. This necessitates a new set of calculations for the special points and requires ISW(9) to be set correctly. An output tape produced under these conditions contains only the calculations for the discrete receptors. The parameters NSEASN, NSPEED, NSTBLE and NSCTOR specify the number of seasons (NSEASN), the number of wind speed categories (NSPEED), the number of stability categories (NSTBLE) and the number of wind direction categories (NSCTOR) in the input meteorological data. These parameters are set automatically by the program when an input tape is being used. The parameter NOFILE must be specified if the user is using input and/or output tape and is applying Condition a or Condition b given under ISW(11) and/or NGROUP. This parameter is the output file number of the file to be written to tape (ISW(5) = "1" or "3") or the input tape file number, if no output file is geing generated (ISW(5) = "2"). The program uses this parameter to correctly position the tape if additional passes through the tape data are required.

Card Groups 4 and 4a always occur together and are included in the input card deck only if NGROUP is greater than zero. Card Group 4 is the array NOCOMB used to specify the number of source ID-numbers used to define each source combination. Each value in NOCOMB specifies the number of source ID-numbers to be read from Card Group 4a (IDSORC) in consecutive order for each source combination. A positive source ID-number punched into the array IDSORC indicates to include that source in the combination. A negative source ID-number indicates to include that source as well as all source ID-numbers less in absolute value, up to and including the previous positive source ID-number punched if it is part of the same set of ID-numbers defining a combination. If the negative value is the first ID-number of a group of ID-numbers, it as well as all sources less in absolute values of ID-number are included in the source combination. See the example given under NOCOMB and IDSORC in Section 4.1.2 and the example problems in Appendix D. The data values are read from Card Group 4 using 4 card columns per value with a maximum of 20 values and from Card Group 4a using 6 card columns per value, 13 values per card with a maximum of 200 values or 16 data cards.

Card Group 5 is an array (UNITS) used to specify the labels printed for concentration or deposition output units and for the input source strength units. This card group is omitted from the input card deck if tape or data file input is used.

Card Groups 6 through 8a specify the X, Y and Z coordinates of all receptor points. Card Groups 6, 7 and 8 are omitted from the input card deck if the parameters NXPNTS and NYPNTS equal zero or if an input tape is being used. Also, Card Group 8 is omitted if ISW(4) equals "0" or no terrain elevations are being used. Card Groups 6a, 7a and 8a are also omitted from the input card deck if the parameter NXWYPT is zero or if an input tape is being used with ISW(12) equal to "0". Card Group 8a is also omitted if ISW(4) equals "0". Each of these card groups uses a 10 column field for each receptor value and 8 values per data card. The number of data cards required for each card group is defined by the values of the parameters NXPNTS, NYPNTS and NXWYPT. Values input on Card Groups 6 and 7 are always in ascending order (west to east, south to north, 0 to 360 degrees). The terrain elevations for the grid system on Card Group 8 begin in the southwest corner of the grid system or at 0 degrees for polar coordinates. The first data card(s) contain the elevations for each receptor on the X axis (1 to NXPNTS) for the first Y receptor coordinate. A new data card is started for the elevations for each successive Y receptor coordinate. A total of NYPNTS groups of data cards containing NXPNTS values each is required for Card Group 8. The elevations for the discrete receptors in Card Group 8a are punched across the card for as many cards as required to satisfy NXWYPT elevation values. See the discussion given for parameter Z in Section 4.1.2.b for examples of the order of input for receptor elevations in Cartesian and polar systems.

Card Groups 9 through 16 specify the meteorological data and model constants and are included in the input data deck only if an input tape or data file is not being used. Card Group 9 is input only if ISW(18) equals "1" and specifies the format (FMT) which the program uses to read the card data in Card Group 9a. If Card Group 9 is omitted from the input deck (ISW(18) equals "0"), the program assumes the format is (6F10.0) or there are 6 values per card occupying 10 columns each including the decimal point (period). Card Group 9a is the set of data cards giving the joint frequency of occurrence of the wind speed and wind direction (FREQ) by season and Pasquill stability category. The values for each wind speed category (1 to NSPEED) are punched across the card and are read using the format given in Card Group 9 or the default format used when Card Group 9 is omitted. The first card is for direction category 1 (normally north), the second card for direction category 2 (normally north-northeast), down to the last direction category (normally north-northwest). Starting with season 1 (normally winter), the card group contains a set of these (NSCTOR) cards for each stability category, 1 through NSTBLE. The program requires NSCTOR*NSTBLE*NSEASN data cards in this card group. This data deck is normally produced by the STAR program of the National Climatic Center (NCC). Card Group 10 is the average ambient air temperature (TA). NSTBLE values are read from each data card in this group and there is one data card for each season, 1 through NSEASN. Card Group 11 is the median mixing layer height (HM) for each speed and stability category and season. The program requires NSPEED values per data card and one data card for each stability category, 1 to NSTBLE. A group of these cards is required for each season (1 to NSEASN) for a total of NSTBLE*NSEASN data cards in Card Group 11. Card Group 12 is the vertical gradient of potential temperature (DPDZ) for each wind speed and stability category. NSPEED values are punched across the card and NSTBLE cards (1 to NSTBLE) are punched for this group. Card Group 13 contains meteorological and model constants; a detailed description of these parameters (ROTATE, TK, ZR, BETA1, BETA2, G and DECAY) is given in Section 4.1.2 above. Card Group 14 is the median wind speed for each wind speed category (UBAR) and there are NSPEED values read from this card group. Card Group 15 is the median wind direction for each wind direction category (THETA). There are 8 values read from each data card in this group up to a maximum of NSCTOR (normally 16) values. Card Group 16, the last of the meteorological input card groups, provides the wind speed power law exponents (P) for each wind speed and stability category. There are NSPEED values read per data card and NSTBLE (1 to NSTBLE) cards read in this group.

The last card groups in the input data deck, Card Groups 17 through 17d, consist of source related information. Card Groups 17 through 17d are always input as a set of cards for each individual source and each of these sets (17 through 17d) are input in ascending order of the source ID-number (NUMS). Card Group 17 provides the source

ID-number (NUMS), the source type (TYPE) the source disposition (DISP), etc. This data card is included in the input card deck for each card input source, 1 to NSOURC. As shown in Table 4-4, some of the card columns (43 through 78) on this card may or may not contain parameter values, depending on the source type. The last parameter (NVS) on this card determines whether Card Groups 17a through 17c are read or not. These card groups are not included in the input card deck if NVS equals zero. The last card group, Card Group 17d, contains the source emissions (Q). This card group is not included in the input deck if the parameter DISP on Card Group 17 equals "1". The number of cards and values in this card group depends on the parameter QFLG on Card Group 17. If QFLG equals blank or zero, the source emissions are a function of season only and one data card is read with NSEASN values punched across it. If QFLG is equal to "1", the program assumes the source emissions are a function of stability category and season. In this case, NSEASN data cards (1 through NSEASN) are required with NSTBLE values per card. If QFLG is equal to "2", the program assumes the source emissions are a function of wind speed and season. There are NSEASN data cards read with NSPEED values per card. If QFLG is equal to "3", the program assumes the source emissions are a function of wind speed, stability and season. In this last case, the program reads NSTBLE data cards containing NSPEED values for each season (1 to NSEASN) for a total of NSTBLE*NSEASN data cards. The program continues to read sets of data Card Groups 17 through 17d until a negative source ID-number is encountered or until it has read these cards NSOURC times.

b. <u>Tape Input Requirements</u>. The ISCLT program accepts an input source/concentration (deposition) inventory tape (catalogued data file) previously created by the ISCLT program. This tape is a binary tape written using the FORTRAN I/O routines and created as an output tape on a previous run of the ISCLT program. This tape contains all of the program options that affect how the model concentration or deposition calculations were performed (except ISW(9)), all of the receptor and elevation data, all of the meteorological data, all of the source input data and the results of the seasonal (annual) concentration or deposition calculations at each receptor point. The program reads the data from the FORTRAN logical unit number specified by ISW(14). The tape data are read only if option ISW(5) equals "2" or "3". *The input tape requires the user to omit specified data card groups from the input deck and makes the input of some parameter values unnecessary.* The omitted Card Groups and unnecessary parameters are indicated by a * or ** in the Card Group and Parameter Name columns of Table 4-4. The format and exact contents of the input tape are discussed in Section 4.2.4.b below.

4.2.4 Program Output Data Description

The ISCLT program generates several categories of printed output and an optional output source/concentration or deposition inventory tape or data file. The following paragraphs describe the format and content of both forms of program output.

a. Printed Output. The ISCLT program generates 11 categories of printed output, 8 of which are tables of average ground-level concentration or total ground-level deposition. All program printed output is optional except warning and error messages. The printed output categories are:

- Input Source Data
- Input Data Other than Source Data
- Seasonal Concentration (Deposition) from Individual Sources

- Seasonal Concentration (Deposition) from Combined Sources
- Annual Concentration (Deposition) from Individual Sources
- Annual Concentration (Deposition) from Combined Sources
- Seasonal Maximum 10 Concentration (Deposition) Values from Individual Sources
- Seasonal Maximum 10 Concentration (Deposition) Values from Combined Sources
- Annual Maximum 10 Concentration (Deposition) Values from Individual Sources
- Annual Maximum 10 Concentration (Deposition) Values from Combined Sources
- Warning and Error Messages

The first line of each page of output contains the run title (TITLE) and page number followed by the major heading of the type or category of output table.

The first category of printed output is the input card data except for the source data. This output is optional and is selected by the option parameter ISW(6). Figure 4-2 shows an example of the printed input data. The example output shown in this section is output generated from an example problem given in Section 2.6. The second category of printed output is the source input data. Figure 4-3 shows an example of the source input data table. This example shows each input source listed down the page. However, if the user is printing tables for individual sources, the source input data may be printed prior to each concentration or deposition output table for each source. The third through tenth categories of output tables are concentration or deposition tables. Figures 4-4 through 4-10 show an example of each type of output table. These tables are defined by their respective headings and are all optional, depending on the parameters ISW(7), ISW(8), ISW(10) and ISW(11) or ISW(12). Also, the ISCLT program has an option (ISW(16)) of compressing the output tables by minimizing the number of new pages started by new tables. This option will save on the paper output, but the user should become familiar

```
**** ISCLT *************            HYPOTHETICAL POTASH PROCESSING PLANT                    ******** PAGE     1 ****
                                         - ISCLT INPUT DATA -
        NUMBER OF SOURCES =  16
        NUMBER OF X AXIS GRID SYSTEM POINTS =   19
        NUMBER OF Y AXIS GRID SYSTEM POINTS =   19
        NUMBER OF SPECIAL POINTS =    1
        NUMBER OF SEASONS =   4
        NUMBER OF WIND SPEED CLASSES =   6
        NUMBER OF STABILITY CLASSES =   6
        NUMBER OF WIND DIRECTION CLASSES =  16
        FILE NUMBER OF DATA FILE USED FOR REPORTS =   1
        THE PROGRAM IS RUN IN RURAL MODE
        CONCENTRATION (DEPOSITION) UNITS CONVERSION FACTOR =  .10000000+07
        ACCELERATION OF GRAVITY (METERS/SEC**2) =  9.800
        HEIGHT OF MEASUREMENT OF WIND SPEED (METERS) =  10.000
        ENTRAINMENT PARAMETER FOR UNSTABLE CONDITIONS =  .600
        ENTRAINMENT PARAMETER FOR STABLE CONDITIONS =  .600
        CORRECTION ANGLE FOR GRID SYSTEM VERSUS DIRECTION DATA NORTH (DEGREES) =     .000
        DECAY COEFFICIENT =  .00000000
        PROGRAM OPTION SWITCHES = 1, 1, 2, 0, 0, 3, 3, 3, 3, 2, 2, 0, 0, 0, 0, 0, 0, 0, 1, 0,
        SOURCES USED TO FORM SOURCE COMBINATION  1 ARE -     1,
        SOURCES USED TO FORM SOURCE COMBINATION  2 ARE -     2,  -11,
        SOURCES USED TO FORM SOURCE COMBINATION  3 ARE -    12,  -15,
        SOURCES USED TO FORM SOURCE COMBINATION  4 ARE -    16,
        SOURCES USED TO FORM SOURCE COMBINATION  5 ARE -   -16,
      DISTANCE X AXIS GRID SYSTEM POINTS (METERS )=   -3000.00,   -2000.00,   -1500.00,   -1250 00,   -1000.00,    -800.00,
           -600.00,    -400.00,    -200.00,         .00,     200.00,     400.00,     600.00,     800.00,    1000.00,    1250.00,
           1500.00,    2000.00,    3000.00,
         RANGE X SPECIAL DISCRETE POINTS (METERS )=    2100.00,
      DISTANCE Y AXIS GRID SYSTEM POINTS (METERS )=   -3000.00,   -2000.00,   -1500.00,   -1250 00,   -1000.00,    -800.00,
           -600.00,    -400.00,    -200.00,         .00,     200.00,     400.00,     600.00,     800.00,    1000.00,    1250.00,
           1500.00,    2000.00,    3000.00,
AZIMUTH BEARING Y SPECIAL DISCRETE POINTS (DEGREES)=       14.00,
                        - AMBIENT AIR TEMPERATURE (DEGREES KELVIN) -

                   STABILITY   STABILITY   STABILITY   STABILITY   STABILITY   STABILITY
                   CATEGORY 1  CATEGORY 2  CATEGORY 3  CATEGORY 4  CATEGORY 5  CATEGORY 6
        SEASON  1   287.2000    287.2000    283.2000    280.8000    279.1000    279.1000
        SEASON  2   287.2000    287.2000    283.2000    280.8000    279.1000    279.1000
        SEASON  3   287.2000    287.2000    283.2000    280.8000    279.1000    279.1000
        SEASON  4   287.2000    287.2000    283.2000    280.8000    279.1000    279.1000
```

FIGURE 4-2. Example listing of input data for the calculation of seasonal and annual ground-level particulate concentration from a hypothetical potash processing plant.

- ISCLT INPUT DATA (CONT.) -

- MIXING LAYER HEIGHT (METERS) -

SEASON 1

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04
STABILITY CATEGORY 2	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04
STABILITY CATEGORY 3	.960000+03	.102500+04	.123500+04	.129500+04	.129500+04	.129500+04
STABILITY CATEGORY 4	.320000+03	.500000+03	.840000+03	.840000+03	.840000+03	.840000+03
STABILITY CATEGORY 5	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05
STABILITY CATEGORY 6	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05

SEASON 2

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04
STABILITY CATEGORY 2	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04
STABILITY CATEGORY 3	.960000+03	.102500+04	.123500+04	.129500+04	.129500+04	.129500+04
STABILITY CATEGORY 4	.320000+03	.500000+03	.840000+03	.840000+03	.840000+03	.840000+03
STABILITY CATEGORY 5	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05
STABILITY CATEGORY 6	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05

SEASON 3

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04
STABILITY CATEGORY 2	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04
STABILITY CATEGORY 3	.960000+03	.102500+04	.123500+04	.129500+04	.129500+04	.129500+04
STABILITY CATEGORY 4	.320000+03	.500000+03	.840000+03	.840000+03	.840000+03	.840000+03
STABILITY CATEGORY 5	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05
STABILITY CATEGORY 6	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05

SEASON 4

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04
STABILITY CATEGORY 2	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04	.173000+04
STABILITY CATEGORY 3	.960000+03	.102500+04	.123500+04	.129500+04	.129500+04	.129500+04
STABILITY CATEGORY 4	.320000+03	.500000+03	.840000+03	.840000+03	.840000+03	.840000+03
STABILITY CATEGORY 5	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05
STABILITY CATEGORY 6	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05	.100000+05

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -
SEASON 1
STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
22.500	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
45.000	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
67.500	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
90.000	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
112.500	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
135.000	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
157.500	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
180.000	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
202.500	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
225.000	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
247.500	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
270.000	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
292.500	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
315.000	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000
337.500	.00002890	.00000000	.00000000	.00000000	.00000000	.00000000

SEASON 1
STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00113880	.00000000	.00011580	.00000000	.00000000	.00000000
22.500	.00073830	.00011580	.00000000	.00000000	.00000000	.00000000
45.000	.00042700	.00000000	.00000000	.00000000	.00000000	.00000000
67.500	.00110280	.00046300	.00011580	.00000000	.00000000	.00000000
90.000	.00160960	.00081030	.00000000	.00000000	.00000000	.00000000
112.500	.00160960	.00081030	.00034730	.00000000	.00000000	.00000000
135.000	.00167220	.00046300	.00011580	.00000000	.00000000	.00000000
157.500	.00235730	.00034730	.00023150	.00000000	.00000000	.00000000
180.000	.00419840	.00092600	.00023150	.00000000	.00000000	.00000000
202.500	.00243710	.00069450	.00000000	.00000000	.00000000	.00000000
225.000	.00102300	.00011580	.00000000	.00000000	.00000000	.00000000
247.500	.00144070	.00069450	.00011580	.00000000	.00000000	.00000000
270.000	.00283750	.00057880	.00023150	.00000000	.00000000	.00000000
292.500	.00145010	.00011580	.00000000	.00000000	.00000000	.00000000
315.000	.00085410	.00000000	.00034730	.00000000	.00000000	.00000000
337.500	.00045360	.00011580	.00011580	.00000000	.00000000	.00000000

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -
SEASON 1
STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00060080	.00081030	.00046300	.00000000	.00000000	.00000000
22.500	.00053100	.00046300	.00034730	.00011580	.00000000	.00000000
45.000	.00029100	.00057880	.00081030	.00000000	.00000000	.00000000
67.500	.00079130	.00231510	.00069450	.00000000	.00000000	.00000000
90.000	.00086780	.00335690	.00416710	.00000000	.00000000	.00000000
112.500	.00160630	.00978770	.00474590	.00000000	.00000000	.00000000
135.000	.00054600	.00405140	.00474590	.00023150	.00000000	.00000000
157.500	.00071280	.00463020	.00439870	.00000000	.00000000	.00000000
180.000	.00144130	.00439870	.00358840	.00000000	.00000000	.00000000
202.500	.00143430	.00416710	.00138900	.00000000	.00000000	.00000000
225.000	.00079130	.00231510	.00092600	.00011580	.00000000	.00000000
247.500	.00086780	.00335690	.00150480	.00000000	.00000000	.00000000
270.000	.00151660	.00370410	.00358840	.00011580	.00000000	.00000000
292.500	.00076580	.00196780	.00173630	.00011580	.00000000	.00000000
315.000	.00031650	.00092600	.00081030	.00000000	.00000000	.00000000
337.500	.00093480	.00115750	.00092600	.00000000	.00000000	.00000000

SEASON 1
STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00090470	.00196780	.00902880	.01180650	.01319600	.01076510
22.500	.00077370	.00347260	.00937610	.01080090	.00790700	.00463020
45.000	.00050260	.00162060	.00601920	.00381990	.00162060	.00046300
67.500	.00062450	.00474590	.00787130	.00347260	.00034730	.00000000
90.000	.00187340	.00949180	.01331170	.00601920	.00092600	.00000000
112.500	.00129770	.00694520	.01794191	.00972330	.00138900	.00023150
135.000	.00071280	.00428290	.00868160	.00636650	.00023150	.00000000
157.500	.00060540	.00393560	.00578770	.00428290	.00023150	.00000000
180.000	.00126620	.00335690	.00497740	.00185210	.00023150	.00000000
202.500	.00020330	.00358840	.00243080	.00104180	.00057880	.00034730
225.000	.00074330	.00150480	.00277810	.00300960	.00115750	.00081030
247.500	.00046000	.00266230	.00694520	.00729250	.00208360	.00196780
270.000	.00196480	.00590330	.01122820	.02419261	.01319600	.00995400
292.500	.00135250	.00289390	.00717600	.01921521	.01852071	.01204870
315.000	.00044170	.00243080	.00532470	.01041790	.00532470	.00266230
337.500	.00070060	.00254660	.00625070	.00613560	.00277010	.00208360

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 1

STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00000000	.00555620	.00636650	.00000000	.00000000	.00000000
22.500	.00000000	.00428290	.00497740	.00000000	.00000000	.00000000
45.000	.00000000	.00069450	.00555620	.00000000	.00000000	.00000000
67.500	.00000000	.00544040	.00636650	.00000000	.00000000	.00000000
90.000	.00000000	.00706100	.00694520	.00000000	.00000000	.00000000
112.500	.00000000	.00428290	.00416710	.00000000	.00000000	.00000000
135.000	.00000000	.00289390	.00324110	.00000000	.00000000	.00000000
157.500	.00000000	.00393560	.00231510	.00000000	.00000000	.00000000
180.000	.00000000	.00370410	.00231510	.00000000	.00000000	.00000000
202.500	.00000000	.00254660	.00115750	.00000000	.00000000	.00000000
225.000	.00000000	.00150480	.00300960	.00000000	.00000000	.00000000
247.500	.00000000	.00486170	.00798700	.00000000	.00000000	.00000000
270.000	.00000000	.00833430	.01458500	.00000000	.00000000	.00000000
292.500	.00000000	.00729250	.00729250	.00000000	.00000000	.00000000
315.000	.00000000	.00532470	.00625070	.00000000	.00000000	.00000000
337.500	.00000000	.00775550	.00914460	.00000000	.00000000	.00000000

SEASON 1

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00941660	.01076510	.00000000	.00000000	.00000000	.00000000
22.500	.00495710	.00567200	.00000000	.00000000	.00000000	.00000000
45.000	.00361460	.00486170	.00000000	.00000000	.00000000	.00000000
67.500	.00221280	.00451440	.00000000	.00000000	.00000000	.00000000
90.000	.00599280	.00625070	.00000000	.00000000	.00000000	.00000000
112.500	.00420740	.00486170	.00000000	.00000000	.00000000	.00000000
135.000	.00423100	.00451440	.00000000	.00000000	.00000000	.00000000
157.500	.00559820	.00381990	.00000000	.00000000	.00000000	.00000000
180.000	.00586130	.00544040	.00000000	.00000000	.00000000	.00000000
202.500	.00614800	.00567200	.00000000	.00000000	.00000000	.00000000
225.000	.00551710	.00497740	.00000000	.00000000	.00000000	.00000000
247.500	.00850630	.01261720	.00000000	.00000000	.00000000	.00000000
270.000	.01735381	.02690771	.00000000	.00000000	.00000000	.00000000
292.500	.01135430	.01690011	.00000000	.00000000	.00000000	.00000000
315.000	.00917300	.01423780	.00000000	.00000000	.00000000	.00000000
337.500	.00977360	.01296450	.00000000	.00000000	.00000000	.00000000

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 2

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
22.500	.00010080	.00011320	.00000000	.00000000	.00000000	.00000000
45.000	.00006760	.00022640	.00000000	.00000000	.00000000	.00000000
67.500	.00013520	.00045290	.00000000	.00000000	.00000000	.00000000
90.000	.00046300	.00056610	.00000000	.00000000	.00000000	.00000000
112.500	.00041740	.00090580	.00000000	.00000000	.00000000	.00000000
135.000	.00050870	.00022640	.00000000	.00000000	.00000000	.00000000
157.500	.00039540	.00033970	.00000000	.00000000	.00000000	.00000000
180.000	.00053060	.00079260	.00000000	.00000000	.00000000	.00000000
202.500	.00061010	.00056610	.00000000	.00000000	.00000000	.00000000
225.000	.00028220	.00045290	.00000000	.00000000	.00000000	.00000000
247.500	.00010080	.00011320	.00000000	.00000000	.00000000	.00000000
270.000	.00036160	.00022640	.00000000	.00000000	.00000000	.00000000
292.500	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000
315.000	.00006760	.00022640	.00000000	.00000000	.00000000	.00000000
337.500	.00021460	.00022640	.00000000	.00000000	.00000000	.00000000

SEASON 2

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00038450	.00101900	.00090580	.00000000	.00000000	.00000000
22.500	.00135500	.00135870	.00079260	.00000000	.00000000	.00000000
45.000	.00008100	.00090580	.00033970	.00000000	.00000000	.00000000
67.500	.00117920	.00215130	.00090580	.00000000	.00000000	.00000000
90.000	.00197820	.00410930	.00249090	.00000000	.00000000	.00000000
112.500	.00171310	.00260420	.00362320	.00000000	.00000000	.00000000
135.000	.00160090	.00362320	.00339670	.00000000	.00000000	.00000000
157.500	.00230050	.00317030	.00317030	.00000000	.00000000	.00000000
180.000	.00296500	.00418930	.00226450	.00000000	.00000000	.00000000
202.500	.00201040	.00317030	.00079260	.00000000	.00000000	.00000000
225.000	.00107790	.00101900	.00067930	.00000000	.00000000	.00000000
247.500	.00137340	.00294380	.00101900	.00000000	.00000000	.00000000
270.000	.00245320	.00260420	.00169840	.00000000	.00000000	.00000000
292.500	.00148850	.00147190	.00067930	.00000000	.00000000	.00000000
315.000	.00107790	.00101900	.00033970	.00000000	.00000000	.00000000
337.500	.00094450	.00090580	.00033970	.00000000	.00000000	.00000000

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -
SEASON 2
STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
000	00032330	.00135870	.00181160	.00022640	.00000000	.00000000
22 500	.00041580	.00090580	.00192480	.00011320	.00011320	.00011320
45 000	.00005540	.00090580	.00135870	.00045290	.00000000	.00000000
67 500	.00058440	.00169840	.00124550	.00079260	.00000000	.00000000
90 000	.00062590	.00237770	.00724641	.00045290	.00011320	.00000000
112 500	.00058880	.00373640	.00735961	.00192480	.00022640	.00000000
135 000	.00031390	.00317030	.00668031	.00271740	.00011320	.00000000
157 500	.00057490	.00351000	.00679351	.00192480	.00033970	.00000000
180 000	.00071580	.00384960	.00622741	.00033970	.00011320	.00000000
202 500	.00032080	.00328350	.00362320	.00033970	.00000000	.00033970
225 000	.00028870	.00079260	.00249090	.00033970	.00022640	.00045290
247 500	.00034160	.00362320	.00362320	.00090580	.00011320	.00090580
270 000	.00097690	.00418930	.00656701	.00215130	.00079260	.00079260
292 500	.00067680	.00124550	.00384960	.00079260	.00045290	.00067930
315 000	.00005540	.00090580	.00135870	.00033970	.00000000	.00011320
337 500	.00016170	.00067930	.00158510	.00011320	.00022640	.00000000

SEASON 2
STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
000	.00099940	.00362320	.00690671	.01766302	.01222831	.01607792
22 500	.00093640	.00283060	.00939761	.01698372	.00928441	.00747281
45 000	.00010780	.00147190	.00769931	.00713321	.00237770	.00090580
67 500	.00101930	.00396290	.01154891	.00860511	.00169840	.00033970
90 000	.00135510	.00464221	.01936142	.02015402	.00362320	.00033970
112 500	.00096410	.00486871	.01664402	.01732342	.00464221	.00090580
135 000	.00066300	.00407610	.00894471	.01234151	.00317030	.00011320
157 500	.00131750	.00305710	.00713321	.00917121	.00283060	.00056610
180 000	.00079280	.00418930	.00520831	.00735961	.00283060	.00158510
202 500	.00091150	.00249090	.00283060	.00520831	.00317030	.00135870
225 000	.00045570	.00124550	.00192480	.00577451	.00407610	.00373640
247 500	00030110	.00079260	.00475541	.00871831	.00668031	.00509511
270 000	.00122910	.00351000	.00724641	.01460602	.01132251	.00871831
292 500	.00018780	.00090580	.00464221	.01347371	.00985051	.00611411
315 000	.00024590	.00169840	.00396290	.00634061	.00260420	.00339670
337 500	.00054690	.00249090	.00713321	.00600091	.00294380	.00249090

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -
SEASON 2
STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00000000	.00430250	.00939761	.00000000	.00000000	.00000000
22.500	.00000000	.00181160	.00701991	.00000000	.00000000	.00000000
45.000	.00000000	.00090580	.00603381	.00000000	.00000000	.00000000
67.500	.00000000	.00203800	.00724641	.00000000	.00000000	.00000000
90.000	.00000000	.00305710	.00928441	.00000000	.00000000	.00000000
112.500	.00000000	.00113220	.00362320	.00000000	.00000000	.00000000
135.000	.00000000	.00101900	.00203800	.00000000	.00000000	.00000000
157.500	.00000000	.00124550	.00135870	.00000000	.00000000	.00000000
180.000	.00000000	.00169840	.00135870	.00000000	.00000000	.00000000
202.500	.00000000	.00192480	.00158510	.00000000	.00000000	.00000000
225.000	.00000000	.00169840	.00169840	.00000000	.00000000	.00000000
247.500	.00000000	.00294380	.00452900	.00000000	.00000000	.00000000
270.000	.00000000	.00520831	.00996381	.00000000	.00000000	.00000000
292.500	.00000000	.00260420	.00668031	.00000000	.00000000	.00000000
315.000	.00000000	.00158510	.00724641	.00000000	.00000000	.00000000
337.500	.00000000	.00269090	.00815221	.00000000	.00000000	.00000000

SEASON 2
STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00533241	.00905801	.00000000	.00000000	.00000000	.00000000
22.500	.00273120	.00509511	.00000000	.00000000	.00000000	.00000000
45.000	.00159130	.00396290	.00000000	.00000000	.00000000	.00000000
67.500	.00215740	.00339670	.00000000	.00000000	.00000000	.00000000
90.000	.00337540	.00520831	.00000000	.00000000	.00000000	.00000000
112.500	.00165640	.00452900	.00000000	.00000000	.00000000	.00000000
135.000	.00291100	.00226450	.00000000	.00000000	.00000000	.00000000
157.500	.00217580	.00135870	.00000000	.00000000	.00000000	.00000000
180.000	.00574011	.00271740	.00000000	.00000000	.00000000	.00000000
202.500	.00302810	.00328350	.00000000	.00000000	.00000000	.00000000
225.000	.00114380	.00226450	.00000000	.00000000	.00000000	.00000000
247.500	.00394000	.00792571	.00000000	.00000000	.00000000	.00000000
270.000	.00629641	.01415312	.00000000	.00000000	.00000000	.00000000
292.500	.00583731	.00905801	.00000000	.00000000	.00000000	.00000000
315.000	.00446180	.00917121	.00000000	.00000000	.00000000	.00000000
337.500	.00529291	.01166211	.00000000	.00000000	.00000000	.00000000

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 3

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00050000	.00034010	.00000000	.00000000	.00000000	.00000000
22.500	.00024870	.00068010	.00000000	.00000000	.00000000	.00000000
45.000	.00022940	.00056680	.00000000	.00000000	.00000000	.00000000
67.500	.00022940	.00056680	.00000000	.00000000	.00000000	.00000000
90.000	.00037480	.00181360	.00000000	.00000000	.00000000	.00000000
112.500	.00085690	.00113350	.00000000	.00000000	.00000000	.00000000
135.000	.00085690	.00113350	.00000000	.00000000	.00000000	.00000000
157.500	.00194310	.00283380	.00000000	.00000000	.00000000	.00000000
180.000	.00177170	.00260710	.00000000	.00000000	.00000000	.00000000
202.500	.00133230	.00158690	.00000000	.00000000	.00000000	.00000000
225.000	.00022940	.00056680	.00000000	.00000000	.00000000	.00000000
247.500	.00017410	.00102020	.00000000	.00000000	.00000000	.00000000
270.000	.00066620	.00079350	.00000000	.00000000	.00000000	.00000000
292.500	.00024870	.00068010	.00000000	.00000000	.00000000	.00000000
315.000	.00013200	.00011340	.00000000	.00000000	.00000000	.00000000
337.500	.00077950	.00068010	.00000000	.00000000	.00000000	.00000000

SEASON 3

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00078840	.00102020	.00113350	.00000000	.00000000	.00000000
22.500	.00093220	.00170030	.00113350	.00000000	.00000000	.00000000
45.000	.00078840	.00102020	.00045340	.00000000	.00000000	.00000000
67.500	.00037610	.00147360	.00192700	.00000000	.00000000	.00000000
90.000	.00181790	.00204040	.00351390	.00000000	.00000000	.00000000
112.500	.00169100	.00510090	.00566760	.00000000	.00000000	.00000000
135.000	.00196940	.00442080	.00861400	.00000000	.00000000	.00000000
157.500	.00280320	.00804810	.01224210	.00000000	.00000000	.00000000
180.000	.00544640	.00600770	.00714120	.00000000	.00000000	.00000000
202.500	.00333900	.00510090	.00215370	.00000000	.00000000	.00000000
225.000	.00134070	.00147360	.00147360	.00000000	.00000000	.00000000
247.500	.00213120	.00317390	.00113350	.00000000	.00000000	.00000000
270.000	.00192610	.00374060	.00158690	.00000000	.00000000	.00000000
292.500	.00169730	.00204040	.00192700	.00000000	.00000000	.00000000
315.000	.00088730	.00068010	.00079350	.00000000	.00000000	.00000000
337.500	.00093060	.00136020	.00079350	.00000000	.00000000	.00000000

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -
SEASON 3
STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00016630	.00090680	.00204040	.00034010	.00011340	.00000000
22.500	.00027970	.00079350	.00215370	.00124690	.00045340	.00000000
45.000	.00027380	.00068010	.00113350	.00124690	.00011340	.00000000
67.500	.00039890	.00079350	.00238040	.00068010	.00022670	.00000000
90.000	.00041660	.00113350	.00476080	.00170030	.00022670	.00000000
112.500	.00043190	.00181360	.00960830	.00612110	.00034010	.00000000
135.000	.00046960	.00215370	.01008800	.00872820	.00056680	.00000000
157.500	.00020410	.00317390	.01212880	.00736790	.00045340	.00000000
180.000	.00099960	.00317390	.00600770	.00170030	.00034010	.00011340
202.500	.00024290	.00238040	.00204040	.00068010	.00045340	.00000000
225.000	.00030330	.00124690	.00147360	.00124690	.00011340	.00011340
247.500	.00064770	.00328720	.00249380	.00102020	.00056680	.00045340
270.000	.00098190	.00283380	.00702790	.00192700	.00034010	.00056680
292.500	.00082730	.00215370	.00464750	.00102020	.00056680	.00022670
315.000	.00030330	.00124690	.00215370	.00034010	.00022670	.00000000
337.500	.00043430	.00147360	.00102020	.00034010	.00000000	.00000000

SEASON 3
STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00068600	.00147360	.00725460	.01258220	.01156200	.00510090
22.500	.00019280	.00124690	.00793470	.01416910	.00850150	.00408070
45.000	.00010600	.00181360	.00521420	.00589440	.00272050	.00034010
67.500	.00066540	.00317390	.00668780	.00782140	.00170030	.00034010
90.000	.00093180	.00362730	.01201540	.01326230	.00249380	.00056680
112.500	.00088550	.00283380	.01178870	.02652460	.00578100	.00068010
135.000	.00047250	.00192700	.00793470	.01722970	.00238040	.00045340
157.500	.00056600	.00147360	.00600770	.00918160	.00124690	.00034010
180.000	.00049240	.00226710	.00442080	.00589440	.00136020	.00056680
202.500	.00021930	.00170030	.00215370	.00328720	.00068010	.00000000
225.000	.00016630	.00079350	.00283380	.00351390	.00192700	.00011340
247.500	.00027970	.00068010	.00566760	.00340060	.00079350	.00068010
270.000	.00041220	.00294720	.00963500	.01020180	.00260710	.00158690
292.500	.00045270	.00158690	.01167540	.01054180	.00555430	.00317390
315.000	.00016630	.00079350	.00691450	.00838810	.00238040	.00034010
337.500	.00089950	.00102020	.00691450	.00589440	.00328720	.00090680

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -
SEASON 3
STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00000000	.00668780	.00929490	.00000000	.00000000	.00000000
22.500	.00000000	.00374060	.00805490	.00000000	.00000000	.00000000
45.000	.00000000	.00294720	.00374460	.00000000	.00000000	.00000000
67.500	.00000000	.00272050	.00714120	.00000000	.00000000	.00000000
90.000	.00000000	.00510090	.01156200	.00000000	.00000000	.00000000
112.500	.00000000	.00317390	.00509440	.00000000	.00000000	.00000000
135.000	.00000000	.00136020	.00147360	.00000000	.00000000	.00000000
157.500	.00000000	.00181360	.00113350	.00000000	.00000000	.00000000
180.000	.00000000	.00192700	.00136020	.00000000	.00000000	.00000000
202.500	.00000000	.00136020	.00102020	.00000000	.00000000	.00000000
225.000	.00000000	.00158690	.00170030	.00000000	.00000000	.00000000
247.500	.00000000	.00294720	.00396740	.00000000	.00000000	.00000000
270.000	.00000000	.00708130	.00952170	.00000000	.00000000	.00000000
292.500	.00000000	.00600770	.00657450	.00000000	.00000000	.00000000
315.000	.00000000	.00442080	.00600770	.00000000	.00000000	.00000000
337.500	.00000000	.00646110	.00918160	.00000000	.00000000	.00000000

SEASON 3
STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00727720	.00084150	.00000000	.00000000	.00000000	.00000000
22.500	.00325950	.00612110	.00000000	.00000000	.00000000	.00000000
45.000	.00203440	.00430740	.00000000	.00000000	.00000000	.00000000
67.500	.00273330	.00374060	.00000000	.00000000	.00000000	.00000000
90.000	.00425940	.00657450	.00000000	.00000000	.00000000	.00000000
112.500	.00316720	.00396740	.00000000	.00000000	.00000000	.00000000
135.000	.00230090	.00192700	.00000000	.00000000	.00000000	.00000000
157.500	.00284890	.00124690	.00000000	.00000000	.00000000	.00000000
180.000	.00299970	.00136020	.00000000	.00000000	.00000000	.00000000
202.500	.00518800	.00260710	.00000000	.00000000	.00000000	.00000000
225.000	.00203540	.00204040	.00000000	.00000000	.00000000	.00000000
247.500	.00597770	.00578100	.00000000	.00000000	.00000000	.00000000
270.000	.00893320	.01405380	.00000000	.00000000	.00000000	.00000000
292.500	.00527660	.00872820	.00000000	.00000000	.00000000	.00000000
315.000	.00509040	.00600770	.00000000	.00000000	.00000000	.00000000
337.500	.00653700	.01314890	.00000000	.00000000	.00000000	.00000000

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 4

STABILITY CATEGORY 1

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
22.500	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
45.000	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
67.500	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
90.000	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
112.500	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
135.000	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
157.500	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
180.000	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
202.500	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
225.000	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
247.500	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
270.000	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
292.500	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
315.000	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000
337.500	.00012160	.00000000	.00000000	.00000000	.00000000	.00000000

SEASON 4

STABILITY CATEGORY 2

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00047580	.00103020	.00011450	.00000000	.00000000	.00000000
22.500	.00111440	.00114470	.00000000	.00000000	.00000000	.00000000
45.000	.00045380	.00080130	.00000000	.00000000	.00000000	.00000000
67.500	.00105510	.00103150	.00045790	.00000000	.00000000	.00000000
90.000	.00215440	.00412090	.00068680	.00000000	.00000000	.00000000
112.500	.00175990	.00263280	.00137360	.00000000	.00000000	.00000000
135.000	.00253090	.00412090	.00148810	.00000000	.00000000	.00000000
157.500	.00280390	.00434980	.00125920	.00000000	.00000000	.00000000
180.000	.00582300	.00572340	.00171700	.00000000	.00000000	.00000000
202.500	.00270460	.00331960	.00125920	.00000000	.00000000	.00000000
225.000	.00217360	.00171700	.00034340	.00000000	.00000000	.00000000
247.500	.00166060	.00160260	.00057230	.00000000	.00000000	.00000000
270.000	.00290460	.00148810	.00091580	.00000000	.00000000	.00000000
292.500	.00073790	.00114470	.00045790	.00000000	.00000000	.00000000
315.000	.00085230	.00103020	.00034340	.00000000	.00000000	.00000000
337.500	.00055720	.00057230	.00022890	.00000000	.00000000	.00000000

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 4

STABILITY CATEGORY 3

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00068200	.00068680	.00068680	.00000000	.00000000	.00000000
22.500	.00158310	.00103020	.00160260	.00045790	.00000000	.00000000
45.000	.00044310	.00080130	.00045790	.00000000	.00000000	.00000000
67.500	.00033860	.00103020	.00194600	.00022890	.00000000	.00000000
90.000	.00087670	.00434980	.00721150	.00068680	.00000000	.00000000
112.500	.00070240	.00377750	.00629580	.00034340	.00000000	.00000000
135.000	.00099600	.00286170	.00869960	.00091580	.00000000	.00000000
157.500	.00087200	.00572340	.00904300	.00103020	.00000000	.00000000
180.000	.00154800	.00492220	.00457800	.00045790	.00000000	.00000000
202.500	.00112560	.00434980	.00274730	.00000000	.00000000	.00000000
225.000	.00106060	.00217490	.00320510	.00011450	.00000000	.00000000
247.500	.00144930	.00515110	.00309190	.00011450	.00000000	.00000000
270.000	.00221610	.00606810	.00663920	.00022890	.00000000	.00000000
292.500	.00114040	.00309070	.00331960	.00011450	.00000000	.00000000
315.000	.00072190	.00114470	.00103020	.00000000	.00000000	.00000000
337.500	.00107530	.00091580	.00022890	.00000000	.00000000	.00000000

SEASON 4

STABILITY CATEGORY 4

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00122790	.00331960	.00847070	.01259161	.00812730	.00915750
22.500	.00086760	.00343410	.00801410	.01179031	.00652470	.00400640
45.000	.00087240	.00183150	.00744050	.00526560	.00148810	.00045790
67.500	.00166640	.00446030	.00835620	.00469320	.00080130	.00011450
90.000	.00399570	.00709710	.01480101	.01030221	.00060680	.00000000
112.500	.00221840	.00675370	.02014651	.01991761	.00103020	.00011450
135.000	.00102430	.00389190	.01076011	.01186141	.00103020	.00022890
157.500	.00137130	.00526560	.00744050	.00538000	.00045790	.00011450
180.000	.00149420	.00526560	.00412090	.00286170	.00057230	.00034340
202.500	.00090140	.00389190	.00114470	.00412090	.00080130	.00022890
225.000	.00063500	.00194600	.00148810	.00148810	.00080130	.00034340
247.500	.00121100	.00309070	.00286170	.00412090	.00183150	.00057230
270.000	.00130750	.00606680	.00807070	.01053111	.00457880	.00286170
292.500	.00081700	.00274730	.00610130	.01350731	.00869960	.00434980
315.000	.00130020	.00263280	.00423530	.00526560	.00148810	.00137360
337.500	.00080860	.00263280	.00583790	.00434980	.00148810	.00091580

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- FREQUENCY OF OCCURRENCE OF WIND SPEED, DIRECTION AND STABILITY -

SEASON 4

STABILITY CATEGORY 5

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00000000	.00446430	.01293501	.00000000	.00000000	.00000000
22.500	.00000000	.00320510	.00972991	.00000000	.00000000	.00000000
45.000	.00000000	.00251830	.00709710	.00000000	.00000000	.00000000
67.500	.00000000	.00331960	.00961390	.00000000	.00000000	.00000000
90.000	.00000000	.00469320	.01098901	.00000000	.00000000	.00000000
112.500	.00000000	.00244380	.00881410	.00000000	.00000000	.00000000
135.000	.00000000	.00183150	.00423530	.00000000	.00000000	.00000000
157.500	.00000000	.00251830	.00251830	.00000000	.00000000	.00000000
180.000	.00000000	.00251030	.00125920	.00000000	.00000000	.00000000
202.500	.00000000	.00148810	.00148810	.00000000	.00000000	.00000000
225.000	.00000000	.00183150	.00160260	.00000000	.00000000	.00000000
247.500	.00000000	.00297620	.00572340	.00000000	.00000000	.00000000
270.000	.00000000	.00572340	.01064961	.00000000	.00000000	.00000000
292.500	.00000000	.00412090	.00755490	.00000000	.00000000	.00000000
315.000	.00000000	.00297620	.00572340	.00000000	.00000000	.00000000
337.500	.00000000	.00423530	.00950090	.00000000	.00000000	.00000000

SEASON 4

STABILITY CATEGORY 6

DIRECTION (DEGREES)	WIND SPEED CATEGORY 1 (.7500MPS)	WIND SPEED CATEGORY 2 (2.5000MPS)	WIND SPEED CATEGORY 3 (4.3000MPS)	WIND SPEED CATEGORY 4 (6.8000MPS)	WIND SPEED CATEGORY 5 (9.5000MPS)	WIND SPEED CATEGORY 6 (12.5000MPS)
.000	.00330460	.01030221	.00000000	.00000000	.00000000	.00000000
22.500	.00397630	.00549450	.00000000	.00000000	.00000000	.00000000
45.000	.00260210	.00412090	.00000000	.00000000	.00000000	.00000000
67.500	.00427810	.00812730	.00000000	.00000000	.00000000	.00000000
90.000	.00547310	.01293501	.00000000	.00000000	.00000000	.00000000
112.500	.00317500	.00629500	.00000000	.00000000	.00000000	.00000000
135.000	.00336980	.00263280	.00000000	.00000000	.00000000	.00000000
157.500	.00371230	.00309070	.00000000	.00000000	.00000000	.00000000
180.000	.00413140	.00320510	.00000000	.00000000	.00000000	.00000000
202.500	.00512000	.00513110	.00000000	.00000000	.00000000	.00000000
225.000	.00327240	.00446630	.00000000	.00000000	.00000000	.00000000
247.500	.00524600	.01106141	.00000000	.00000000	.00000000	.00000000
270.000	.01490371	.02770151	.00000000	.00000000	.00000000	.00000000
292.500	.00732070	.01362181	.00000000	.00000000	.00000000	.00000000
315.000	.00644840	.00993881	.00000000	.00000000	.00000000	.00000000
337.500	.00890250	.01350731	.00000000	.00000000	.00000000	.00000000

FIGURE 4-2. (Continued)

- ISCLT INPUT DATA (CONT.) -

- VERTICAL POTENTIAL TEMPERATURE GRADIENT (DEGREES KELVIN/METER) -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.000000	.000000	.000000	.000000	.000000	.000000
STABILITY CATEGORY 2	.000000	.000000	.000000	.000000	.000000	.000000
STABILITY CATEGORY 3	.000000	.000000	.000000	.000000	.000000	.000000
STABILITY CATEGORY 4	.000000	.000000	.000000	.000000	.000000	.000000
STABILITY CATEGORY 5	.200000-01	.200000-01	.200000-01	.200000-01	.200000-01	.200000-01
STABILITY CATEGORY 6	.350000-01	.350000-01	.350000-01	.350000-01	.350000-01	.350000-01

- WIND PROFILE POWER LAW EXPONENTS -

	WIND SPEED CATEGORY 1	WIND SPEED CATEGORY 2	WIND SPEED CATEGORY 3	WIND SPEED CATEGORY 4	WIND SPEED CATEGORY 5	WIND SPEED CATEGORY 6
STABILITY CATEGORY 1	.100000+00	.100000+00	.100000+00	.100000+00	.100000+00	.100000+00
STABILITY CATEGORY 2	.150000+00	.150000+00	.150000+00	.150000+00	.150000+00	.150000+00
STABILITY CATEGORY 3	.200000+00	.200000+00	.200000+00	.200000+00	.200000+00	.200000+00
STABILITY CATEGORY 4	.250000+00	.250000+00	.250000+00	.250000+00	.250000+00	.250000+00
STABILITY CATEGORY 5	.300000+00	.300000+00	.300000+00	.300000+00	.300000+00	.300000+00
STABILITY CATEGORY 6	.300000+00	.300000+00	.300000+00	.300000+00	.300000+00	.300000+00

FIGURE 4-2. (Continued)

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**** ISCLT *************          HYPOTHETICAL POTASH PROCESSING PLANT                    ******** PAGE     16 ****

                                       - SOURCE INPUT DATA -

C T SOURCE SOURCE      X            Y       EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE  HEIGHT  ELEV- /                 - SOURCE DETAILS DEPENDING ON TYPE -
R P                  (M)          (M)        (M)    ATION /
D E                                                  (M)  /
------------------------------------------------------------------------------------------------------------------------
X        1  AREA      -13.30      -13.30   10.00     .00 WIDTH OF AREA (M)=   26.60
                                                                            - PARTICULATE CATEGORIES -
                                                                            1      2      3      4      5      6
                                                  FALL VELOCITY (MPS)     .0010  .0070  .0190  .0370  .0610  .0990
                                                  MASS FRACTION           .1000  .4000  .2800  .1200  .0600  .0400
                                                  REFLECTION COEFFICIENT 1.0000  .8800  .7200  .6500  .5900  .5000
                                                      - SOURCE STRENGTHS ( GRAMS PER SEC   PER SQUARE METER        ) -
                                                                                  - SEASON 1 -
                                      SPEED CATEGORY                        - STABILITY CATEGORIES -
                                                    (1)           (2)           (3)           (4)           (5)           (6)
                                          1     4.00000-01    3.00000-01    2.00000-01    1.00000-01    0.00000       5.00000-02
                                          2     5.00000-01    4.00000-01    3.00000-01    2.50000-01    2.00000-01    1.00000-01
                                          3     0.00000       5.00000-01    4.00000-01    5.00000-01    2.50000-01    0.00000
                                          4     0.00000       0.00000       5.00000-01    5.00000-01    0.00000       0.00000
                                          5     0.00000       0.00000       7.00000-01    7.00000-01    0.00000       0.00000
                                          6     0.00000       0.00000       1.00000+00    1.00000+00    0.00000       0.00000
                                                                                  - SEASON 2 -
                                      SPEED CATEGORY                        - STABILITY CATEGORIES -
                                                    (1)           (2)           (3)           (4)           (5)           (6)
                                          1     4.00000-01    3.00000-01    2.00000-01    1.00000-01    0.00000       5.00000-02
                                          2     5.00000-01    4.00000-01    3.00000-01    2.50000-01    2.00000-01    1.00000-01
                                          3     0.00000       5.00000-01    4.00000-01    5.00000-01    2.50000-01    0.00000
                                          4     0.00000       0.00000       5.00000-01    5.00000-01    0.00000       0.00000
                                          5     0.00000       0.00000       7.00000-01    7.00000-01    0.00000       0.00000
                                          6     0.00000       0.00000       1.00000+00    1.00000+00    0.00000       0.00000
                                                                                  - SEASON 3 -
                                      SPEED CATEGORY                        - STABILITY CATEGORIES -
                                                    (1)           (2)           (3)           (4)           (5)           (6)
                                          1     4.00000-01    3.00000-01    2.00000-01    1.00000-01    0.00000       5.00000-02
                                          2     5.00000-01    4.00000-01    3.00000-01    2.50000-01    2.00000-01    1.00000-01
                                          3     0.00000       5.00000-01    4.00000-01    5.00000-01    2.50000-01    0.00000
                                          4     0.00000       0.00000       5.00000-01    5.00000-01    0.00000       0.00000
                                          5     0.00000       0.00000       7.00000-01    7.00000-01    0.00000       0.00000
                                          6     0.00000       0.00000       1.00000+00    1.00000+00    0 00000       0.00000
                                                                                  - SEASON 4 -
                                      SPEED CATEGORY                        - STABILITY CATEGORIES -
                                                    (1)           (2)           (3)           (4)           (5)           (6)
                                          1     4.00000-01    3.00000-01    2.00000-01    1.00000-01    0.00000       5.00000-02
                                          2     5.00000-01    4.00000-01    3.00000-01    2.50000-01    2.00000-01    1.00000-01
                                          3     0.00000       5.00000-01    4.00000-01    5.00000-01    2.50000-01    0.00000
                                          4     0.00000       0.00000       5.00000-01    5.00000-01    0.00000       0.00000
                                          5     0.00000       0.00000       7.00000-01    7.00000-01    0.00000       0.00000
                                          6     0.00000       0.00000       1.00000+00    1.00000+00    0.00000       0 00000
WARNING - DISTANCE BETWEEN SOURCE     1 AND POINT X,Y=       .00,        .00 IS LESS THAN PERMITTED
```

FIGURE 4-3. Example listing of input sources used in the calculation of seasonal and annual ground-level particulate concentration from a hypothetical potash processing plant.

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE ELEV-ATION (M)	- SOURCE DETAILS DEPENDING ON TYPE -
X		2	VOLUME	20.00	.00	.90	.00	STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)= 4.70 STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)= 1.00

- PARTICULATE CATEGORIES -

	1	2	3	4	5	6
FALL VELOCITY (MPS)	.0010	.0070	.0190	.0370	.0610	.0990
MASS FRACTION	.1000	.4000	.2800	.1200	.0600	.0400
REFLECTION COEFFICIENT	1.0000	.0200	.7200	.6500	.5900	.5000

- SOURCE STRENGTHS (GRAMS PER SEC) -

- SEASON 1 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 2 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 3 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 4 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

WARNING - DISTANCE BETWEEN SOURCE 2 AND POINT X,Y= .00, .00 IS LESS THAN PERMITTED

FIGURE 4-3. (Continued)

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE ELEV-ATION (M)	- SOURCE DETAILS DEPENDING ON TYPE -
X		2	VOLUME	20.00	.00	.90	.00	STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)= 4.70; STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)= 1.00

- PARTICULATE CATEGORIES -

	1	2	3	4	5	6
FALL VELOCITY (MPS)	.0010	.0070	.0190	.0370	.0610	.0990
MASS FRACTION	.1000	.4000	.2800	.1200	.0600	.0400
REFLECTION COEFFICIENT	1.0000	.8200	.7200	.6500	.5900	.5000

- SOURCE STRENGTHS (GRAMS PER SEC) -

- SEASON 1 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 2 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 3 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 4 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

WARNING - DISTANCE BETWEEN SOURCE 2 AND POINT X,Y= .00, .00 IS LESS THAN PERMITTED

FIGURE 4-3. (Continued)

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		4	VOLUME	40.00	.00	4.30	.00	STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)= 4.70 STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)= 1.00

- PARTICULATE CATEGORIES -

	1	2	3	4	5	6
FALL VELOCITY (MPS)	.0010	.0070	.0190	.0370	.0610	.0590
MASS FRACTION	.1000	.4000	.2800	.1200	.0600	.0400
REFLECTION COEFFICIENT	1.0000	.8200	.7200	.6500	.5900	.5000

- SOURCE STRENGTHS (GRAMS PER SEC) -

- SEASON 1 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 2 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 3 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 4 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

WARNING - DISTANCE BETWEEN SOURCE 4 AND POINT X,Y= .00, .00 IS LESS THAN PERMITTED

FIGURE 4-3. (Continued)

```
                                   - SOURCE INPUT DATA -

C T SOURCE SOURCE     X           Y       EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE   HEIGHT  ELEV- /               - SOURCE DETAILS DEPENDING ON TYPE -
R P                  (M)         (M)         (M)   ATION /
D E                                                  (M) /
------------------------------------------------------------------------------------------------------------------------
X        5 VOLUME     49.00         .00     6.10      .00 STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)=  4.70
                                                          STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)=  1.00
                                                                              - PARTICULATE CATEGORIES -
                                                                              1       2       3       4       5       6
                                                          FALL VELOCITY (MPS)      .0010   .0070   .0190   .0370   .0610   .0990
                                                          MASS FRACTION            .1000   .0000   .2800   .1200   .0600   .0400
                                                          REFLECTION COEFFICIENT 1.0000   .8200   .7200   .6500   .5900   .5000
                                                              - SOURCE STRENGTHS ( GRAMS PER SEC                              ) -
                                                                                   - SEASON 1 -
                                        SPEED CATEGORY                        - STABILITY CATEGORIES -
                                                    (1)           (2)           (3)           (4)           (5)           (6)
                                             1  1.30000-01    1.00000-01    8.00000-02    4.00000-02    0.00000       2.00000-02
                                             2  1.60000-01    1.30000-01    1.20000-01    1.00000-01    8.00000-02    5.00000-02
                                             3  0.00000       1.60000-01    1.40000-01    1.30000-01    1.00000-01    0.00000
                                             4  0.00000       0.00000       1.60000-01    1.60000-01    0.00000       0.00000
                                             5  0.00000       0.00000       1.90000-01    1.90000-01    0.00000       0.00000
                                             6  0.00000       0.00000       2.20000-01    2.20000-01    0.00000       0.00000
                                                                                   - SEASON 2 -
                                        SPEED CATEGORY                        - STABILITY CATEGORIES -
                                                    (1)           (2)           (3)           (4)           (5)           (6)
                                             1  1.30000-01    1.00000-01    8.00000-02    4.00000-02    0.00000       2.00000-02
                                             2  1.60000-01    1.30000-01    1.20000-01    1.00000-01    8.00000-02    5.00000-02
                                             3  0.00000       1.60000-01    1.40000-01    1.30000-01    1.00000-01    0.00000
                                             4  0.00000       0.00000       1.60000-01    1.60000-01    0.00000       0.00000
                                             5  0.00000       0.00000       1.90000-01    1.90000-01    0.00000       0.00000
                                             6  0.00000       0.00000       2.20000-01    2.20000-01    0.00000       0.00000
                                                                                   - SEASON 3 -
                                        SPEED CATEGORY                        - STABILITY CATEGORIES -
                                                    (1)           (2)           (3)           (4)           (5)           (6)
                                             1  1.30000-01    1.00000-01    8.00000-02    4.00000-02    0.00000       2.00000-02
                                             2  1.60000-01    1.30000-01    1.20000-01    1.00000-01    8.00000-02    5.00000-02
                                             3  0.00000       1.60000-01    1.40000-01    1.30000-01    1.00000-01    0.00000
                                             4  0.00000       0.00000       1.60000-01    1.60000-01    0.00000       0.00000
                                             5  0.00000       0.00000       1.90000-01    1.90000-01    0.00000       0.00000
                                             6  0.00000       0.00000       2.20000-01    2.20000-01    0.00000       0.00000
                                                                                   - SEASON 4 -
                                        SPEED CATEGORY                        - STABILITY CATEGORIES -
                                                    (1)           (2)           (3)           (4)           (5)           (6)
                                             1  1.30000-01    1.00000-01    8.00000-02    4.00000-02    0.00000       2.00000-02
                                             2  1.60000-01    1.30000-01    1.20000-01    1.00000-01    8.00000-02    5.00000-02
                                             3  0.00000       1.60000-01    1.40000-01    1.30000-01    1.00000-01    0.00000
                                             4  0.00000       0.00000       1.60000-01    1.60000-01    0.00000       0.00000
                                             5  0.00000       0.00000       1.90000-01    1.90000-01    0.00000       0.00000
                                             6  0.00000       0.00000       2.20000-01    2.20000-01    0.00000       0.00000
WARNING - DISTANCE BETWEEN SOURCE    5 AND POINT X,Y=      .00,       .00 IS LESS THAN PERMITTED
```

FIGURE 4-3. (Continued)

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE ELEVATION (M)	- SOURCE DETAILS DEPENDING ON TYPE -
X		6	VOLUME	55.00	.00	7.80	.00	STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)= 4.70; STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)= 1.00

- PARTICULATE CATEGORIES -

	1	2	3	4	5	6
FALL VELOCITY (MPS)	.0010	.0070	.0190	.0370	.0610	.0890
MASS FRACTION	.1000	.0000	.2800	.1200	.0600	.0400
REFLECTION COEFFICIENT	1.0000	.8200	.7200	.6300	.5900	.5000

- SOURCE STRENGTHS (GRAMS PER SEC) -

- SEASON 1 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 2 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 3 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 4 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

WARNING - DISTANCE BETWEEN SOURCE 6 AND POINT X,Y= .00, .00 IS LESS THAN PERMITTED

FIGURE 4-3. (Continued)

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		7	VOLUME	69.00	.00	9.60	.00	STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)= 4.70 STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)= 1.00

- PARTICULATE CATEGORIES -

	1	2	3	4	5	6
FALL VELOCITY (MPS)	.0010	.0070	.0190	.0370	.0610	.0990
MASS FRACTION	.1000	.4000	.2800	.1200	.0600	.0400
REFLECTION COEFFICIENT	1.0000	.0200	.7200	.6500	.5900	.5000

- SOURCE STRENGTHS (GRAMS PER SEC) -

- SEASON 1 -

SPEED CATEGORY	- STABILITY CATEGORIES - (1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 2 -

SPEED CATEGORY	- STABILITY CATEGORIES - (1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 3 -

SPEED CATEGORY	- STABILITY CATEGORIES - (1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 4 -

SPEED CATEGORY	- STABILITY CATEGORIES - (1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

WARNING - DISTANCE BETWEEN SOURCE 7 AND POINT X,Y= .00, .00 IS LESS THAN PERMITTED

FIGURE 4-3. (Continued)

```
                                   - SOURCE INPUT DATA -

C T SOURCE SOURCE     X           Y       EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE   HEIGHT  ELEV- /            - SOURCE DETAILS DEPENDING ON TYPE -
R P                  (M)         (M)        (M)    ATION /
D E                                                 (M)  /
----------------------------------------------------------------------------------------------------------------------
X        8 VOLUME      79.00        .00  11.30     .00 STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)=   4.70
                                                       STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)=   1.00
                                                                        - PARTICULATE CATEGORIES -
                                                                          1      2      3      4      5      6
                                                       FALL VELOCITY (MPS)      .0010  .0070  .0190  .0370  .0610  .0990
                                                       MASS FRACTION            .1000  .4000  .2800  .1200  .0600  .0400
                                                       REFLECTION COEFFICIENT 1.0000  .9200  .7200  .6500  .5900  .5000
                                                            - SOURCE STRENGTHS ( GRAMS PER SEC                          ) -
                                                                              - SEASON 1 -
                               SPEED CATEGORY                           - STABILITY CATEGORIES -
                                             (1)          (2)          (3)          (4)          (5)          (6)
                                      1  1.30000-01   1.00000-01   8.00000-02   4.00000-02   0.00000      2.00000-02
                                      2  1.60000-01   1.30000-01   1.20000-01   1.00000-01   8.00000-02   5.00000-02
                                      3  0.00000      1.60000-01   1.40000-01   1.30000-01   1.00000-01   0.00000
                                      4  0.00000      0.00000      1.60000-01   1.60000-01   0.00000      0.00000
                                      5  0.00000      0.00000      1.90000-01   1.90000-01   0.00000      0.00000
                                      6  0.00000      0.00000      2.20000-01   2.20000-01   0.00000      0.00000
                                                                              - SEASON 2 -
                               SPEED CATEGORY                           - STABILITY CATEGORIES -
                                             (1)          (2)          (3)          (4)          (5)          (6)
                                      1  1.30000-01   1.00000-01   8.00000-02   4.00000-02   0.00000      2.00000-02
                                      2  1.60000-01   1.30000-01   1.20000-01   1.00000-01   8.00000-02   5.00000-02
                                      3  0.00000      1.60000-01   1.40000-01   1.30000-01   1.00000-01   0.00000
                                      4  0.00000      0.00000      1.60000-01   1.60000-01   0.00000      0.00000
                                      5  0.00000      0.00000      1.90000-01   1.90000-01   0.00000      0.00000
                                      6  0.00000      0.00000      2.20000-01   2.20000-01   0.00000      0.00000
                                                                              - SEASON 3 -
                               SPEED CATEGORY                           - STABILITY CATEGORIES -
                                             (1)          (2)          (3)          (4)          (5)          (6)
                                      1  1.30000-01   1.00000-01   8.00000-02   4.00000-02   0.00000      2.00000-02
                                      2  1.60000-01   1.30000-01   1.20000-01   1.00000-01   8.00000-02   5.00000-02
                                      3  0.00000      1.60000-01   1.40000-01   1.30000-01   1.00000-01   0.00000
                                      4  0.00000      0.00000      1.60000-01   1.60000-01   0.00000      0.00000
                                      5  0.00000      0.00000      1.90000-01   1.90000-01   0.00000      0.00000
                                      6  0.00000      0.00000      2.20000-01   2.20000-01   0.00000      0.00000
                                                                              - SEASON 4 -
                               SPEED CATEGORY                           - STABILITY CATEGORIES -
                                             (1)          (2)          (3)          (4)          (5)          (6)
                                      1  1.30000-01   1.00000-01   8.00000-02   4.00000-02   0.00000      2.00000-02
                                      2  1.60000-01   1.30000-01   1.20000-01   1.00000-01   8.00000-02   5.00000-02
                                      3  0.00000      1.60000-01   1.40000-01   1.30000-01   1.00000-01   0.00000
                                      4  0.00000      0.00000      1.60000-01   1.60000-01   0.00000      0.00000
                                      5  0.00000      0.00000      1.90000-01   1.90000-01   0.00000      0.00000
                                      6  0.00000      0.00000      2.20000-01   2.20000-01   0.00000      0.00000
WARNING - DISTANCE BETWEEN SOURCE     8 AND POINT X,Y=      .00,      .00 IS LESS THAN PERMITTED
```

FIGURE 4-3. (Continued)

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE / ELEV- / ATION / (M) /	- SOURCE DETAILS DEPENDING ON TYPE -
X		9	VOLUME	89.00	.00	13.00	.00	STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)= 4.70
								STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)= 1.00

- PARTICULATE CATEGORIES -

	1	2	3	4	5	6
FALL VELOCITY (MPS)	.0010	.0070	.0190	.0370	.0610	.0990
MASS FRACTION	.1000	.4000	.2000	.1200	.0600	.0400
REFLECTION COEFFICIENT	1.0000	.8200	.7200	.6500	.5900	.5000

- SOURCE STRENGTHS (GRAMS PER SEC) -

- SEASON 1 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 2 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 3 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 4 -

- STABILITY CATEGORIES -

SPEED CATEGORY	(1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

WARNING - DISTANCE BETWEEN SOURCE 9 AND POINT X,Y= .00, .00 IS LESS THAN PERMITTED

FIGURE 4-3. (Continued)

- SOURCE INPUT DATA -

C A R D	T A P E	SOURCE NUMBER	SOURCE TYPE	X COORDINATE (M)	Y COORDINATE (M)	EMISSION HEIGHT (M)	BASE ELEV- ATION (M)	- SOURCE DETAILS DEPENDING ON TYPE -
X		10	VOLUME	99.00	.00	14.00	.00	STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)= 4.70 STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)= 1.00

- PARTICULATE CATEGORIES -

	1	2	3	4	5	6
FALL VELOCITY (MPS)	.0010	.0070	.0190	.0370	.0610	.0990
MASS FRACTION	.1000	.0000	.2800	.1200	.0600	.0400
REFLECTION COEFFICIENT	1.0000	.0300	.7200	.6500	.5900	.5000

- SOURCE STRENGTHS (GRAMS PER SEC) -

- SEASON 1 -

SPEED CATEGORY	- STABILITY CATEGORIES - (1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 2 -

SPEED CATEGORY	- STABILITY CATEGORIES - (1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 3 -

SPEED CATEGORY	- STABILITY CATEGORIES - (1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.20000-01	2.20000-01	0.00000	0.00000

- SEASON 4 -

SPEED CATEGORY	- STABILITY CATEGORIES - (1)	(2)	(3)	(4)	(5)	(6)
1	1.30000-01	1.00000-01	8.00000-02	4.00000-02	0.00000	2.00000-02
2	1.60000-01	1.30000-01	1.20000-01	1.00000-01	8.00000-02	5.00000-02
3	0.00000	1.60000-01	1.40000-01	1.30000-01	1.00000-01	0.00000
4	0.00000	0.00000	1.60000-01	1.60000-01	0.00000	0.00000
5	0.00000	0.00000	1.90000-01	1.90000-01	0.00000	0.00000
6	0.00000	0.00000	2.30000-01	2.20000-01	0.00000	0.00000

WARNING - DISTANCE BETWEEN SOURCE 10 AND POINT X,Y= .00, .00 IS LESS THAN PERMITTED
WARNING - DISTANCE BETWEEN SOURCE 10 AND POINT X,Y= 200.00, .00 IS LESS THAN PERMITTED

FIGURE 4-3. (Continued)

```
                                        - SOURCE INPUT DATA -

C T SOURCE SOURCE      X           Y        EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE  HEIGHT   ELEV- /                - SOURCE DETAILS DEPENDING ON TYPE -
R P                  (M)          (M)         (M)    ATION /
D E                                                   (M)  /
---------------------------------------------------------------------------------------------------------------
X       11 VOLUME     109.00          .00   16.50      .00 STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)=   4.70
                                                           STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)=   1.00
                                                                            - PARTICULATE CATEGORIES -
                                                                          1      2      3      4      5      6
                                                           FALL VELOCITY (MPS)     .0010  .0070  .0190  .0370  .0610  .0990
                                                           MASS FRACTION           .1000  .4000  .2800  .1200  .0600  .0400
                                                           REFLECTION COEFFICIENT 1.0000  .8200  .7200  .6500  .5900  .5000
                                                                 - SOURCE STRENGTHS ( GRAMS PER SEC                    ) -
                                                                                  - SEASON 1 -
                                    SPEED CATEGORY                           - STABILITY CATEGORIES -
                                                     (1)          (2)          (3)          (4)          (5)          (6)
                                          1      1.30000-01   1.00000-01   8.00000-02   4.00000-02   0.00000      2.00000-02
                                          2      1.60000-01   1.30000-01   1.20000-01   1.00000-01   8.00000-02   5.00000-02
                                          3      0.00000      1.60000-01   1.40000-01   1.30000-01   1.00000-01   0.00000
                                          4      0.00000      0.00000      1.60000-01   1.60000-01   0.00000      0.00000
                                          5      0.00000      0.00000      1.90000-01   1.90000-01   0.00000      0.00000
                                          6      0.00000      0.00000      2.20000-01   2.20000-01   0.00000      0.00000
                                                                                  - SEASON 2 -
                                    SPEED CATEGORY                           - STABILITY CATEGORIES -
                                                     (1)          (2)          (3)          (4)          (5)          (6)
                                          1      1.30000-01   1.00000-01   8.00000-02   4.00000-02   0.00000      2.00000-02
                                          2      1.60000-01   1.30000-01   1.20000-01   1.00000-01   8.00000-02   5.00000-02
                                          3      0.00000      1.60000-01   1.40000-01   1.30000-01   1.00000-01   0.00000
                                          4      0.00000      0.00000      1.60000-01   1.60000-01   0.00000      0.00000
                                          5      0.00000      0.00000      1.90000-01   1.90000-01   0.00000      0.00000
                                          6      0.00000      0.00000      2.20000-01   2.20000-01   0.00000      0.00000
                                                                                  - SEASON 3 -
                                    SPEED CATEGORY                           - STABILITY CATEGORIES -
                                                     (1)          (2)          (3)          (4)          (5)          (6)
                                          1      1.30000-01   1.00000-01   8.00000-02   4.00000-02   0.00000      2.00000-02
                                          2      1.60000-01   1.30000-01   1.20000-01   1.00000-01   8.00000-02   5.00000-02
                                          3      0.00000      1.60000-01   1.40000-01   1.30000-01   1.00000-01   0.00000
                                          4      0.00000      0.00000      1.60000-01   1.60000-01   0.00000      0.00000
                                          5      0.00000      0.00000      1.90000-01   1.90000-01   0.00000      0.00000
                                          6      0.00000      0.00000      2.20000-01   2.20000-01   0.00000      0.00000
                                                                                  - SEASON 4 -
                                    SPEED CATEGORY                           - STABILITY CATEGORIES -
                                                     (1)          (2)          (3)          (4)          (5)          (6)
                                          1      1.30000-01   1.00000-01   8.00000-02   4.00000-02   0.00000      2.00000-02
                                          2      1.60000-01   1.30000-01   1.20000-01   1.00000-01   8.00000-02   5.00000-02
                                          3      0.00000      1.60000-01   1.40000-01   1.30000-01   1.00000-01   0.00000
                                          4      0.00000      0.00000      1.60000-01   1.60000-01   0.00000      0.00000
                                          5      0.00000      0.00000      1.90000-01   1.90000-01   0.00000      0.00000
                                          6      0.00000      0.00000      2.20000-01   2.20000-01   0.00000      0.00000
WARNING - DISTANCE BETWEEN SOURCE    11 AND POINT X,Y=       .00,        .00 IS LESS THAN PERMITTED
WARNING - DISTANCE BETWEEN SOURCE    11 AND POINT X,Y=    200.00,        .00 IS LESS THAN PERMITTED
```

FIGURE 4-3. (Continued)

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**** ISCLT *************             HYPOTHETICAL POTASH PROCESSING PLANT                    ******** PAGE    27 ****

                                            - SOURCE INPUT DATA -

C T SOURCE SOURCE      X            Y       EMISSION  BASE /
A A NUMBER  TYPE  COORDINATE  COORDINATE  HEIGHT  ELEV- /                  - SOURCE DETAILS DEPENDING ON TYPE -
R P                  (M)          (M)        (M)   ATION /
D E                                                  (M)  /
------------------------------------------------------------------------------------------------------------------------
X       12 VOLUME       131.00          .00  22.50      .00 STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)=  10.80
                                                            STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)=  11.60
                                                                 - SOURCE STRENGTHS ( GRAMS PER SEC                            ) -
                                                                          SEASON 1      SEASON 2      SEASON 3      SEASON 4
                                                                          2.63000+00    2.63000+00    2.63000+00    2.63000+00
WARNING - DISTANCE BETWEEN SOURCE     12 AND POINT X,Y=       .00,          .00 IS LESS THAN PERMITTED
WARNING - DISTANCE BETWEEN SOURCE     12 AND POINT X,Y=     200.00,         .00 IS LESS THAN PERMITTED
X       13 VOLUME       140.00          .00  22.50      .00 STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)=  10.80
                                                            STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)=  11.60
                                                                 - SOURCE STRENGTHS ( GRAMS PER SEC                            ) -
                                                                          SEASON 1      SEASON 2      SEASON 3      SEASON 4
                                                                          2.63000+00    2.63000+00    2.63000+00    2.63000+00
WARNING - DISTANCE BETWEEN SOURCE     13 AND POINT X,Y=     200.00,         .00 IS LESS THAN PERMITTED
X       14 VOLUME       167.00          .00  22.50      .00 STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)=  10.80
                                                            STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)=  11.60
                                                                 - SOURCE STRENGTHS ( GRAMS PER SEC                            ) -
                                                                          SEASON 1      SEASON 2      SEASON 3      SEASON 4
                                                                          2.63000+00    2.63000+00    2.63000+00    2.63000+00
WARNING - DISTANCE BETWEEN SOURCE     14 AND POINT X,Y=     200.00,         .00 IS LESS THAN PERMITTED
X       15 VOLUME       190.00          .00  22.50      .00 STANDARD DEVIATION OF THE CROSSWIND SOURCE DISTRIBUTION (M)=  10.80
                                                            STANDARD DEVIATION OF THE VERTICAL SOURCE DISTRIBUTION (M)=  11.60
                                                                 - SOURCE STRENGTHS ( GRAMS PER SEC                            ) -
                                                                          SEASON 1      SEASON 2      SEASON 3      SEASON 4
                                                                          2.63000+00    2.63000+00    2.63000+00    2.63000+00
WARNING - DISTANCE BETWEEN SOURCE     15 AND POINT X,Y=     200.00,         .00 IS LESS THAN PERMITTED
X       16  STACK       201.00        10.00  50.00      .00 GAS EXIT TEMP (DEG K)= 340.00, GAS EXIT VEL. (M/SEC)=  8.00,
                                                            STACK DIAMETER (M)= 1.000, HEIGHT OF ASSO. BLDG. (M)= 25.00, WIDTH OF
                                                            ASSO. BLDG. (M)=  67.00, WAKE EFFECTS FLAG = 0
                                                                 - SOURCE STRENGTHS ( GRAMS PER SEC                            ) -
                                                                          SEASON 1      SEASON 2      SEASON 3      SEASON 4
                                                                          3.00000+00    3.00000+00    3.00000+00    3.00000+00
WARNING - DISTANCE BETWEEN SOURCE     16 AND POINT X,Y=     200.00,         .00 IS LESS THAN PERMITTED
```

FIGURE 4-3. (Continued)

** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 **

SEASON 1

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

- CONCENTRATION -

Y AXIS (DISTANCE, METERS)	-3000.000	-2000.000	-1500.000	-1250.000	-1000.000	-800.000	-600.000	-400.000	-200.000
3000.000	13.616997	16.810891	18.356266	19.233525	19.902356	20.625919	21.201759	21.602884	21.798932
2000.000	22.783020	27.584421	32.063393	34.803720	37.188672	38.839573	41.300342	43.286392	44.461175
1500.000	29.018424	40.117167	45.781192	49.558081	55.845340	60.430878	65.060946	69.784248	73.490338
1250.000	33.007664	48.404156	57.812235	63.220872	69.673079	77.946799	85.153463	93.095447	100.430190
1000.000	34.582721	57.747243	74.426943	83.335948	93.921556	102.198080	117.300496	134.405924	145.771563
800.000	35.830785	66.203685	89.938190	103.563027	122.058452	139.302376	194.884831	182.647335	211.396776
600.000	36.820998	70.299812	108.800716	131.331247	162.619048	191.393314	233.914997	271.919285	331.560481
400.000	37.331672	73.802182	116.706080	134.427860	218.199671	270.731171	395.318420	485.499912	588.287308
200.000	37.884810	75.335793	122.261150	165.231693	236.824530	301.939160	533.659660	848.470459	1483.300430
.000	38.403270	77.141260	126.762945	173.267048	253.221277	379.330619	617.214340	1190.316204	2911.119293
-200.000	35.176140	67.437188	103.606628	138.851784	190.949066	261.589985	375.357651	513.585052	1021.500537
-400.000	32.602053	59.442305	87.891022	109.718840	141.718382	160.010717	223.655920	343.197296	630.447624
-600.000	29.852404	50.978420	70.207855	81.918691	102.938817	123.252440	165.759817	270.985909	478.198792
-800.000	27.005841	42.575752	56.716330	67.576478	79.861310	98.817122	144.096085	218.350760	324.332962
-1000.000	24.129535	36.353679	48.031611	54.884416	66.742523	91.234782	128.924860	188.122856	233.356682
-1250.000	20.791437	31.182077	38.503721	44.997336	62.728845	83.449615	108.471891	161.014390	168.141409
-1500.000	18.374005	26.488539	32.641378	43.251008	58.729640	73.710485	94.740171	111.481556	127.262635
-2000.000	14.915920	19.740687	31.135496	39.033751	48.225537	50.026190	66.098783	73.866708	80.774837
-3000.000	9.816567	18.381877	24.559273	28.731543	32.072045	34.796732	37.407102	39.835498	41.999429

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

- CONCENTRATION -

Y AXIS (DISTANCE, METERS)	.000	200.000	400.000	600.000	800.000	1000.000	1250.000	1500.000	2000.000
3000.000	22.170279	20.875027	19.920651	18.819462	17.610409	16.326048	14.895370	13.670574	11.803912
2000.000	45.868863	41.856510	38.644834	34.909380	30.970592	27.965487	25.024716	22.158577	18.056702
1500.000	77.124822	68.140335	60.486155	52.320283	45.201609	39.892694	33.651000	30.263329	30.426548
1250.000	107.035131	92.064947	78.874166	65.269807	56.449784	48.023100	42.110441	42.091849	39.002230
1000.000	159.453207	131.491547	109.295262	86.551263	70.872977	63.202829	62.017409	58.945675	49.101901
800.000	239.530056	186.776987	139.829491	109.566168	94.701244	91.193011	84.789304	75.496819	63.196101
600.000	401.208193	283.424896	197.104128	160.666399	146.742023	132.960700	112.697596	104.952324	83.741148
400.000	798.079964	447.284042	336.679783	279.902290	229.160326	213.885267	178.604877	148.783318	105.181254
200.000	2099.566315	1022.300316	690.020973	606.986130	447.874649	337.795872	251.546938	194.377935	126.469180
.000	.000000	4705.437866	2133.509735	1146.510666	710.003708	484.540318	334.176414	245.722200	150.471292
-200.000	2895.978912	1839.577164	1184.709595	840.983459	569.264534	408.760803	293.177822	220.993895	139.397350
-400.000	1287.537979	804.960754	655.048500	503.677750	395.472507	334.057091	249.533657	195.132414	128.261654
-600.000	683.794754	507.234932	382.317074	322.824516	272.997986	237.319185	195.228285	167.498585	115.559818
-800.000	420.558243	340.344494	267.396671	219.996414	194.386766	174.562572	154.444038	133.583345	102.259296
-1000.000	285.791199	242.878387	207.017883	171.755058	145.898260	131.875456	119.899905	109.056379	86.635903
-1250.000	196.919363	173.398451	150.734020	120.688354	114.713129	100.276953	89.183467	83.194344	71.733726
-1500.000	144.806110	130.391167	116.957111	102.635981	91.258114	82.431523	71.385410	64.828494	58.701031
-2000.000	88.782019	82.115747	76.275244	69.428685	62.173820	57.293200	52.339115	47.226230	39.336240

FIGURE 4-4. Example listing of seasonal ground-level particulate concentration for the winter season due to a single source.

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** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

SEASON 1

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE, METERS)	.000	200.000	400.000	600.000	800.000	1000.000	1250.000	1500.000	2000.000
	- CONCENTRATION -								
-3000.000	44.652235	42.406594	40.588500	38.483091	36.162366	33.686798	30.993699	28.829953	25.085259

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE, METERS)	3000.000
	- CONCENTRATION -
3000.000	9.792341
2000.000	17.951743
1500.000	34.667804
1250.000	29.661916
1000.000	38.219460
800.000	45.451096
600.000	52.826692
400.000	60.194146
200.000	67.370555
.000	75.538429
-200.000	71.948288
-400.000	68.541867
-600.000	64.663849
-800.000	60.453509
-1000.000	56.023649
-1250.000	80.673500
-1500.000	43.967045
-2000.000	33.959895
-3000.000	19.592829

** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

SEASON 1

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
2100.0	10.0	35.419290						

FIGURE 4-4. (Continued)

•• SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) ••
SEASON 1
- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF COMBINED SOURCES 1,

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
200.00	.00	4705.437866
-200.00	.00	2911.119293
.00	-200.00	2895.978912
400.00	.00	2133.509739
.00	200.00	2099.566315
200.00	-200.00	1839.577164
-200.00	200.00	1483.300430
.00	-600.00	1207.937979
-400.00	.00	1190.316284
400.00	-200.00	1184.709599

FIGURE 4-4. (Continued)

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** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

- CONCENTRATION -

Y AXIS (DISTANCE, METERS)	-3000.000	-2000.000	-1500.000	-1250.000	-1000.000	-800.000	-600.000	-400.000	-200.000
3000.000	15.221634	18.578736	20.100570	20.916141	21.395505	21.979450	22.384767	22.584387	22.548840
2000.000	25.085996	30.903884	35.708897	38.974826	40.968453	42.357633	44.461069	45.964449	46.507261
1500.000	31.701150	44.379030	51.421357	55.544628	62.251292	66.999136	71.291860	75.116460	77.626460
1250.000	35.923950	53.192155	64.341074	71.112044	78.188807	87.078055	94.562616	101.360938	107.010847
1000.000	37.762331	63.033959	82.023760	92.643948	105.093936	115.192478	131.645319	148.906237	157.368858
800.000	39.245249	71.957693	98.347252	116.238378	135.981680	157.633930	175.535542	206.143169	231.811277
600.000	40.464016	76.752864	118.199650	143.208109	178.931519	213.219812	266.412334	311.423767	372.564270
400.000	41.363557	80.610639	127.492531	168.303101	237.375757	296.659161	395.794228	560.169212	691.885918
200.000	41.883075	82.992779	134.343460	181.328331	259.555923	373.962715	583.919617	943.486504	1780.054550
.000	42.575230	85.331429	140.035275	191.339746	279.630653	414.663986	602.840363	1322.692307	3285.677673
-200.000	38.907401	74.361470	116.238572	152.006949	209.613203	286.037337	410.882469	561.938873	1131.299973
-400.000	35.951738	65.257847	96.119875	119.670203	153.973127	182.560459	244.201986	375.624714	704.935677
-600.000	32.808550	55.661160	76.149775	88.827738	111.977972	134.531500	181.123684	290.690125	893.750008
-800.000	29.565277	46.157100	61.585695	73.581216	87.279699	108.045788	155.002460	231.920065	330.118431
-1000.000	26.295826	39.443785	52.363287	60.028022	73.091817	98.447317	137.456411	196.850786	235.580881
-1250.000	22.509092	33.976512	42.202404	49.383746	67.732247	89.148383	114.847367	146.138521	168.744886
-1500.000	19.944037	28.989935	35.893151	46.869015	62.862158	78.248160	99.162294	113.082483	127.248291
-2000.000	16.301520	21.779318	33.561337	41.690830	51.097478	60.774473	67.980672	74.729506	80.482697
-3000.000	10.872121	19.715400	26.030627	30.247538	33.230254	35.649734	37.919664	39.976707	41.744378

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

- CONCENTRATION -

Y AXIS (DISTANCE, METERS)	.000	200.000	400.000	600.000	800.000	1000.000	1250.000	1500.000	2000.000
3000.000	22.637472	21.218081	20.168184	18.971946	17.669779	16.296588	14.722342	13.296584	11.154195
2000.000	47.136497	42.625257	39.074873	35.011655	30.759928	27.191171	23.811023	20.651116	16.103241
1500.000	79.611476	69.443008	60.974909	51.992751	43.696829	37.710334	30.972582	26.983356	25.902085
1250.000	111.811121	93.974270	79.355749	63.759502	53.646960	44.460725	37.541022	36.326082	32.685589
1000.000	166.622492	134.853356	109.216183	83.036954	65.771640	56.379041	53.320559	49.789945	40.607458
800.000	252.719282	191.737871	137.116941	102.937274	84.658281	78.580712	71.570762	62.894690	51.197633
600.000	429.969204	292.120224	189.494501	144.423738	126.216530	112.244652	93.723008	85.297768	65.943861
400.000	882.005074	451.004166	306.773682	240.616259	192.864162	174.839646	142.180569	116.746348	81.203523
200.000	2501.452545	977.209450	595.886497	490.390499	353.894108	263.703430	194.335102	149.131149	96.188814
.000	.000000	3782.151978	1651.689728	870.036613	540.992012	368.016090	292.794506	185.333508	113.034963
-200.000	2066.782501	1492.697021	900.438637	633.178192	428.426228	307.495807	220.115461	165.665569	104.253480
-400.000	1257.601929	706.441254	519.629356	383.528786	297.078926	249.244905	186.147055	145.559612	95.607776
-600.000	666.668350	469.150101	323.227493	254.241194	208.353203	178.888088	145.639702	124.249961	85.812425
-800.000	410.042606	318.458824	234.122231	182.359068	152.502733	133.417093	116.459707	99.813966	75.608726
-1000.000	278.772209	229.032652	187.669189	146.918722	119.445987	103.217141	91.493530	82.268517	64.617455
-1250.000	192.320225	164.708893	139.282814	113.341066	97.180909	81.968684	69.678401	63.597370	53.830546
-1500.000	141.593710	124.527439	109.166704	93.141042	79.335021	69.384761	57.878736	50.589996	44.492540
-2000.000	87.002696	79.028723	72.157465	64.455022	56.492001	50.292008	44.496250	38.968336	30.646975
-3000.000	43.902699	41.182540	38.963737	36.493826	33.849191	31.093420	27.958133	25.345855	21.445036

FIGURE 4-5. Example listing of annual ground-level concentration due to a single source.

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE , METERS)	3000.000
	- CONCENTRATION -
3000.000	7.856293
2000.000	15.064934
1500.000	20.289669
1250.000	24.110267
1000.000	30.206484
800.000	35.357987
600.000	40.579629
400.000	45.760097
200.000	50.766263
.000	56.472849
-200.000	53.638114
-400.000	50.998768
-600.000	48.010376
-800.000	44.778276
-1000.000	41.388979
-1250.000	37.335234
-1500.000	32.581869
-2000.000	25.498223
-3000.000	15.234725

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
2108.0	14.0	35.667695						

- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF COMBINED SOURCES 1,

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
200.00	.00	3782.131978
-200.00	.00	3285.677673
.00	-200.00	2866.782501
.00	200.00	2581.452345
-200.00	200.00	1780.054550
400.00	.00	1651.689728
200.00	-200.00	1492.697021
-400.00	.00	1322.692307

FIGURE 4-5. (Continued)

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** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 1 (CONT.) **
- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF COMBINED SOURCES 1,

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
.00	-400.00	1257.601929
-200.00	-200.00	1131.299973

FIGURE 4-5. (Continued)

** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 2 (CONT.) **

SEASON 4

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE, METERS)	-3000.000	-2000.000	-1500.000	-1250.000	-1000.000	-800.000	-600.000	-400.000	-200.000
	- CONCENTRATION -								
3000.000	.007545	.009437	.010349	.010712	.011018	.011246	.011377	.011399	.011298
2000.000	.012822	.015294	.018068	.019688	.021128	.022306	.022897	.023495	.023584
1500.000	.016355	.022598	.025397	.028002	.031728	.034511	.037716	.038716	.039707
1250.000	.018687	.027259	.032686	.035077	.039556	.044538	.049014	.052489	.055049
1000.000	.019717	.032494	.041999	.047244	.052161	.058419	.067733	.077849	.081586
800.000	.020600	.037329	.050652	.059693	.069606	.077588	.089619	.107168	.120812
600.000	.021356	.040189	.061015	.074018	.092344	.110026	.130654	.161237	.197886
400.000	.021955	.042574	.067066	.088319	.121948	.153685	.206428	.277712	.378408
200.000	.022367	.044233	.071536	.096556	.138366	.198656	.312275	.529545	.979780
000	.022079	.045906	.075481	.103384	.151697	.225019	.375235	.766300	2.440995
-200.000	.021012	.040299	.063263	.083399	.115359	.158264	.230160	.344057	.661372
-400.000	.019422	.035377	.052315	.065386	.083506	.100018	.135009	.190458	.370773
-600.000	.017736	.030200	.041239	.048286	.060845	.073194	.090610	.144347	.245294
-800.000	.015997	.025074	.033274	.039652	.046913	.054353	.076512	.112451	.158423
-1000.000	.014248	.021307	.028082	.032065	.036836	.048672	.066695	.094156	.111806
-1250.000	.012274	.018221	.022423	.024967	.033410	.043163	.054804	.068924	.079132
-1500.000	.010762	.015435	.018211	.023216	.030442	.037348	.047410	.053293	.059254
-2000.000	.008702	.011110	.016421	.020042	.024198	.028782	.031672	.034677	.037212
-3000.000	.005576	.009512	.012273	.013881	.015433	.016515	.017526	.018437	.019215

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE, METERS)	.000	200.000	400.000	600.000	800.000	1000.000	1250.000	1500.000	2000.000
	- CONCENTRATION -								
3000.000	.011132	.010718	.010313	.009825	.009274	.008676	.007960	.007140	.005815
2000.000	.023277	.021920	.020440	.018649	.016675	.014743	.012669	.010775	.007884
1500.000	.039435	.036255	.032519	.028143	.023800	.020174	.016174	.013332	.012929
1250.000	.055109	.049623	.042936	.035199	.029058	.023578	.018666	.018258	.016407
1000.000	.083024	.072209	.059138	.045782	.035410	.028291	.027081	.025226	.020484
800.000	.126387	.104976	.077414	.056716	.042971	.040443	.036643	.032047	.026113
600.000	.217762	.165655	.108329	.074463	.066224	.058441	.048326	.044038	.033999
400.000	.467843	.296279	.164865	.131019	.102854	.092866	.074963	.061299	.042325
200.000	1.648651	.647888	.369765	.280463	.196432	.143784	.104532	.079405	.050566
000	.000000	3.983659	1.105991	.519474	.305785	.202933	.136970	.099203	.059605
-200.000	2.102750	.987274	.518289	.343365	.227503	.161521	.114872	.085972	.053735
-400.000	.646170	.453522	.265170	.193219	.146355	.124111	.092561	.072742	.047995
-600.000	.315837	.250973	.171062	.122966	.100846	.085959	.069277	.059842	.041825
-800.000	.189593	.162225	.121072	.092402	.072393	.063458	.055065	.046934	.035871
-1000.000	.127975	.113872	.093977	.074128	.059224	.048441	.043014	.038539	.029989
-1250.000	.087773	.080191	.069332	.056940	.040164	.040056	.032451	.029669	.025003
-1500.000	.064444	.059852	.053448	.046148	.039346	.034007	.027947	.023461	.020625
-2000.000	.039547	.037442	.034658	.031422	.027930	.024794	.021679	.018763	.014140

FIGURE 4-6. Example listing of seasonal ground-level concentration for the fall season due to a single source with a maximum 10 table showing the contribution of this source to the maximum 10 receptors of the indicated combined sources.

** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 2 (CONT.) **

SEASON 4

\- GRID SYSTEM RECEPTORS -

\- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE, METERS)	.000	200.000	400.000	600.000	800.000	1000.000	1250.000	1500.000	2000.000
-3000.000	.019990	.019278	.018395	.017387	.016285	.015118	.013770	.012386	.010297

\- GRID SYSTEM RECEPTORS -

\- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE, METERS)	3000.000
3000.000	.003792
2000.000	.007452
1500.000	.010115
1250.000	.011963
1000.000	.015308
800.000	.018061
600.000	.020866
400.000	.023662
200.000	.026373
.000	.029396
-200.000	.027492
-400.000	.025712
-600.000	.023777
-800.000	.021755
-1000.000	.019693
-1250.000	.017134
-1500.000	.015007
-2000.000	.011731
-3000.000	.006980

** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 2 (CONT.) **

SEASON 4

\- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
2108.0	14.0	.018810						

FIGURE 4-6. (Continued)

** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 2 (CONT.) **
SEASON 4
- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF COMBINED SOURCES 2, -11,

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
200.00	.00	3.983659
-200.00	.00	2.440995
.00	-200.00	2.102750
.00	200.00	1.648651
400.00	.00	1.103991
200.00	-200.00	.987274
-200.00	200.00	.979780
200.00	200.00	.847888
-400.00	.00	.766300
600.00	.00	.519474

FIGURE 4-6. (Continued)

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** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) FROM COMBINED SOURCES 2, -11,

SEASON 1

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE, METERS)	-3000.000	-2000.000	-1500.000	-1250.000	-1000.000	-800.000	-600.000	-400.000	-200.000
	- CONCENTRATION -								
3000.000	.064939	.081815	.090442	.093946	.098860	.103081	.106639	.109379	.111137
2000.000	.106435	.130257	.154140	.160670	.182109	.192631	204155	.216342	224829
1500.000	.133526	.187896	.214016	.235257	.267735	.292967	.317284	.343468	.368132
1250.000	.149919	.223726	.271791	.292980	.329242	.372322	.412979	.454770	.498940
1000.000	.158608	.263556	.343058	.388532	.430137	.478582	.557523	.634555	.714442
800.000	.165390	.297984	.408441	.482579	.565467	.628806	.719469	.864366	1.014220
600.000	.171142	.319244	.481266	.589643	.733854	.873284	1.023637	1.241259	1.596157
400.000	.175621	.336467	.524223	.685162	.935265	1.187631	1.562860	2.033065	2.681197
200.000	.178629	.347989	.554271	.739324	1.041162	1.457743	2.216563	3.777196	5.935093
.000	.182407	.359525	.580160	.782611	1.121842	1.610345	2.557164	4.735265	11.875166
-200.000	.168291	.318140	.492181	.641604	.873315	1.172356	1.663902	2.508706	3.755635
-400.000	.156434	.282235	.414114	.515518	.653584	.776860	1.018566	1.332094	2.522483
-600.000	.143768	244061	.333389	.388428	.484526	.578024	.683933	1.079533	1.923621
-800.000	.130615	.205676	.270860	.321324	.378608	.425724	.599228	.904494	1.374565
-1000.000	.117294	.175390	.229886	.262029	.293920	.388997	.547636	.759141	1.014581
-1250.000	.101574	.150537	.184855	.201877	.272781	.360828	.468114	.618119	.741997
-1500.000	.089586	.127973	.148506	.191081	.257228	.321642	.401522	.490660	.566689
-2000.000	.072628	.091397	.139342	.173474	.213293	.252385	.293381	.330088	.363500
-3000.000	.046237	.083204	.110136	.125542	.143730	.156438	.168728	.180281	.190756

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE, METERS)	.000	200.000	400.000	600.000	800.000	1000.000	1250.000	1500.000	2000.000
	- CONCENTRATION -								
3000.000	.111952	.109206	.104955	.099860	.094133	.087930	.079972	.073523	.063042
2000.000	.229038	.220673	.206241	.188658	.169062	.151487	.135083	.119100	.091672
1500.000	.380951	362379	.327661	.285330	.246537	.217032	.182159	.153192	.136965
1250.000	.524333	.493427	.432899	.366990	.309490	.262351	.212829	.215456	.203137
1000.000	.771359	.713399	.595707	.479549	.391676	.318745	.318693	.307152	.258038
800.000	1.139485	1.020829	.814949	.614054	.476670	.468593	.444352	.398503	329583
600.000	1.862839	1.608299	1.126707	.806090	.761112	.703600	.601132	.545856	.436228
400.000	3.595022	2.899255	1.684776	1.476967	1.240294	1.102782	.944229	.784874	.549824
200.000	9.756812	5.556996	3.856307	3.346937	2.446834	1.831592	1.349613	1.033316	.662660
.000	.000000	31.930070	12.969607	6.620630	3.994073	2.668362	1.806482	1.311342	.788890
-200.000	11.878918	9.135990	6.359009	4.656605	3.064423	2.180199	1.548060	1.157483	.721220
-400.000	4.986083	4.801398	3.206142	2.591872	2.045873	1.694547	1.281265	1.001035	.654611
-600.000	2.744623	2.684374	2.090629	1.606699	1.309698	1.206665	.984949	.842692	.580495
-800.000	1.742541	1.741282	1.489770	1.195214	.974189	.883146	.778215	.668289	.510518
-1000.000	1.211973	1.220247	1.074359	.921937	.786617	.662942	.604461	.546487	.428215
-1250.000	.848989	.857030	.783491	.699415	.612264	.536000	.449380	.418619	.356182
-1500.000	.631079	.637160	.594914	.537212	.483866	.437785	.379092	.327110	.293155
-2000.000	.392258	.395542	.378251	.354842	.326906	.302493	.276057	.248939	.199012

FIGURE 4-7. Example listing of seasonal ground-level concentration for the winter season from combined sources.

** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) (CONT.) FROM COMBINED SOURCES 2, -11,

SEASON 1

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

- CONCENTRATION -

Y AXIS (DISTANCE, METERS)	.000	200.000	400.000	600.000	800.000	1000.000	1250.000	1500.000	2000.000
-3000.000	.200044	.201306	.196351	.189764	.181872	.172899	.161055	.151201	.133385

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

- CONCENTRATION -

Y AXIS (DISTANCE, METERS)	3000.000
3000.000	.044778
2000.000	.092869
1500.000	.128675
1250.000	.150842
1000.000	.197223
800.000	.234459
600.000	.272498
400.000	.310465
200.000	.347360
.000	.389162
-200.000	.367450
-400.000	.347265
-600.000	.324709
-800.000	.300586
-1000.000	.275624
-1250.000	.242116
-1500.000	.214588
-2000.000	.167526
-3000.000	.099329

** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) (CONT.) FROM COMBINED SOURCES 2, -11,

SEASON 1

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
2108.0	14.0	.190127						

FIGURE 4-7. (Continued)

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** SEASONAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) (CONT.) FROM COMBINED SOURCES 2, -11,

SEASON 1

- PROGRAM DETERMINED MAXIMUM 10 VALUES -

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
200.00	.00	31.930078
400.00	.00	12.969607
.00	-200.00	11.078918
-200.00	.00	11.075166
.00	200.00	9.756012
200.00	-200.00	9.135990
600.00	.00	6.628650
400.00	-200.00	6.359089
-200.00	200.00	5.935093
200.00	200.00	5.556996

FIGURE 4-7. (Continued)

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) (CONT.) FROM COMBINED SOURCES 2, -11,

- GRID SYSTEM RECEPTORS -
- X AXIS (DISTANCE, METERS) -
- CONCENTRATION -

Y AXIS (DISTANCE, METERS)	-3000.000	-2000.000	-1500.000	-1250.000	-1000.000	-800.000	-600.000	-400.000	-200.000
3000 000	.069260	.086089	.094261	.097300	.101295	.104752	.107432	.109184	.109872
2000.000	.113829	.139457	.163742	.178316	.191371	.200768	.210267	.219971	.225431
1500 000	.142719	.201149	.229943	.251835	.289140	.310397	.333173	.354931	.373716
1250 000	.160227	.239215	.291806	.315501	.353173	.397742	.438834	.475614	.511892
1000.000	.170195	.281285	.367261	.417377	.460400	.515980	.599059	.676507	.744596
800.000	.177876	.319475	.435965	.516569	.600766	.681593	.780576	.936016	1.076431
600 000	.184471	.342399	.513897	.620338	.785579	.941474	1.116451	1 362780	1.735704
400 000	.189712	.362047	.562430	.733071	.990667	1.268020	1.687058	2.239903	3.022726
200.000	.193377	.379630	.597154	.795850	1.119947	1.567640	2.304124	4.055790	6.655715
.000	.197812	.389089	.627195	.843834	1.212592	1.741549	2.768935	5.145699	13.026029
-200.000	.182167	.343431	.530299	.690597	.930822	1.258440	1.780753	2.663162	4.076491
-400 000	.168022	.303298	.443356	.550353	.693908	.823806	1.087994	1.439882	2.707763
-600.000	.154634	.260830	.353786	.411692	.515726	.618547	.737624	1.155553	2.022063
-800.000	.139932	.218254	.287703	.342597	.405933	.459162	.641356	.960242	1.419915
-1000.000	.129120	.186131	.243491	.281111	.317278	.416990	.582169	.800186	1.037266
-1250.000	.107360	.160605	.190764	.210233	.292335	.383847	.494880	.642414	.752789
-1500.000	.093146	.137273	.160744	.205242	.273926	.340524	.422236	.505262	.572336
-2000.000	.077746	.099146	.149079	.184391	.225413	.265213	.303441	.336387	.365416
-3000.000	.050333	.088698	.116398	.132147	.149419	.161615	.172051	.182212	.191178

- GRID SYSTEM RECEPTORS -
- X AXIS (DISTANCE, METERS) -
- CONCENTRATION -

Y AXIS (DISTANCE, METERS)	.000	200.000	400.000	600.000	800.000	1000.000	1250.000	1500.000	2000.000
3000 000	.109461	.106181	.101706	.096419	.090529	.084194	.076034	.068964	.057429
2000.000	.226019	.215747	.200322	.181804	.161612	.142514	.124326	.107304	.079169
1500 000	.378824	.355620	.318213	.273679	.231285	.199005	.162464	.132743	.130384
1250.000	.525057	.485992	.420402	.347719	.285991	.235972	.184911	.132743	.130384
-1000.000	.780725	.706405	.577381	.440875	.354334	.278255	.267645	.254222	.209898
800.000	1 168040	1.025406	.780220	.564905	.419092	.395159	.368211	.326564	.264745
600.000	1 951880	1.617590	1.067551	.718620	.643156	.504642	.492894	.440588	.343289
400 000	3.916326	2.910401	1.545550	1.235953	1.032351	.890357	.751943	.617065	.426287
200 000	11 426832	5.486153	3.340911	2.723108	1.943744	1.438514	1.049357	.798290	.507996
000	.000000	26.065931	10.199074	5.120539	3.070760	2.044789	1.379167	.998500	.598613
-200.000	12.346924	7.784146	4.919493	3.537365	2.330092	1.656991	1.174594	.877025	.545363
-400 000	5.043426	4.389851	2.624337	1.991635	1.552324	1.274572	.964592	.754056	.493092
-600.000	2.747555	2.521705	1.797269	1.292529	1.066030	.916172	.741331	.630294	.435281
-800.000	1.735580	1.650742	1.328572	1.002859	.775941	.677005	.590245	.503175	.380750
-1000 000	1.204036	1.164288	.986290	.796377	.649783	.524719	.462292	.414286	.320976
-1250 000	.842449	.822816	.728316	.622395	.522420	.440913	.353855	.320314	.260765
-1500 000	.625997	.614631	.559033	.490835	.423167	.370443	.308660	.256648	.222772
-2000.000	.389230	.384210	.360108	.330817	.298082	.266220	.235456	.205910	.155410
-3000 000	.198842	.197212	.189711	.180767	.170739	.159077	.145911	.133145	.112311

FIGURE 4-8. Example listing of annual ground-level concentration from combined sources.

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) (CONT.) FROM COMBINED SOURCES 2, -11,

- GRID SYSTEM RECEPTORS -

- X AXIS (DISTANCE, METERS) -

Y AXIS (DISTANCE , METERS)	3000.000
	- CONCENTRATION -
3000.000	.038390
2000.000	.076173
1500.000	.104005
1250.000	.121078
1000.000	.155257
800.000	.182486
600.000	.210169
400.000	.237654
200.000	.264195
.000	.294133
-200.000	.277120
-400.000	.261307
-600.000	.243727
-800.000	.224994
-1000.000	.205666
-1250.000	.180084
-1500.000	.160324
-2000.000	.126348
-3000.000	.077164

** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) (CONT.) FROM COMBINED SOURCES 2, -11,

- DISCRETE RECEPTORS -

X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION	X RANGE (METERS)	Y AZIMUTH BEARING (DEGREES)	CONCENTRATION
2108.0	14.0	.183942						

- PROGRAM DETERMINED MAXIMUM 10 VALUES -

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
200.00	.00	26.065951
-200.00	.00	13.026029
.00	-200.00	12.346924
.00	200.00	11.426832
400.00	.00	10.199074
200.00	-200.00	7.784146
-200.00	200.00	6.655715
200.00	200.00	5.406153

FIGURE 4-8. (Continued)

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** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) (CONT.) FROM COMBINED SOURCES 2, -11,

- PROGRAM DETERMINED MAXIMUM 10 VALUES -

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
-400.00	.00	5.145699
600.00	.00	5.128539

FIGURE 4-8. (Continued)

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     ** SEASONAL GROUND LEVEL CONCENTRATION ( MICROGRAMS PER CUBIC METER          ) DUE TO SOURCE     4 (CONT.) **
                                              SEASON  4
          - 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF COMBINED SOURCES    -16.
```

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
200.00	.00	4.493998
-200.00	.00	2.054139
.00	-200.00	1.823837
.00	200.00	1.551934
-200.00	200.00	.899412
400.00	.00	1.244917
-400.00	.00	.717025
200.00	-200.00	1.014321
.00	-400.00	.617223
-200.00	-200.00	.581724

FIGURE 4-9. Example listing of the 10 values of seasonal ground-level concentration from a single source that contribute to the maximum 10 receptors of the indicated combined sources for the fall season.

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** ANNUAL GROUND LEVEL CONCENTRATION (MICROGRAMS PER CUBIC METER) DUE TO SOURCE 4 (CONT.) **
- 10 CONTRIBUTING VALUES TO PROGRAM DETERMINED MAXIMUM 10 OF COMBINED SOURCES -16,

X COORDINATE (METERS)	Y COORDINATE (METERS)	CONCENTRATION
200.00	.00	4.343051
-200.00	.00	1.806942
.00	-200.00	1.812556
.00	200.00	1.478618
-200.00	200.00	.828512
400.00	.00	1.186533
200.00	-200.00	1.044206
-400.00	.00	.626691
.00	-400.00	.617736
-200.00	-200.00	.524317

FIGURE 4-10. Example listing of the 10 values of annual ground-level concentration for a single source that contribute to the maximum 10 receptors of the indicated combined sources.

with the program output format before using it. Also, the program has the option (ISW(17)) of specifying the number of lines the printer prints per page. This value must be correct in order for the program to maintain a correct output format. The program defaults to 57 lines per printed page. If the printer at your installation is different, input the correct value into ISW(17) on Card Group 2. The warning and error messages produced by the program are generated by data errors within the ISCLT program and are not associated with errors detected by the computer system on which the program is being run. These errors are given in Section 4.2.6 below.

b. <u>Master Tape Inventory Output</u>. The ISCLT program will, on option, generate an output master source/concentration or deposition inventory tape or data file. This file may be a permanent file or a temporary file, depending on what the user desires and requirements of the program. This data tape is written only if the parameter ISW(5) equals "1" or "3" and the data are written to the FORTRAN logical unit specified by ISW(15). The data are written using the FORTRAN binary write routines and tapes should be assigned high density, odd parity with the write-ring in. These assign options are normally the default options on nine-track tape units, except for the write-ring option. These tapes are not transferable between computers of a different manufacturer and may not be transferable between computers of a different series and same manufacturer. Also, if the ISCLT program has been compiled under the UNIVAC FORTRAN V compiler, tapes generated by the program are not compatible with the ISCLT program compiled under the UNIVAC ASCII compiler and vice versa. Check with your installation to see if these FORTRAN generated binary tapes can be transferred. The format and contents of the ISCLT input/output tape are shown in Table 4-5. This table gives the Logical Record, Word Number, Parameter Name and whether the data are in an integer or floating point (real) format. The logical record gives the order the respective data records are written to tape and does not imply the physical (block) length actually on the tape. The physical block length of binary unformatted data depends on the computer (FORTRAN) on which the ISCLT program

TABLE 4-5

INPUT/OUTPUT TAPE FORMAT

Tape Logical Record	Relative Word Number	Parameter Name	Integer (I)/ Floating Point (FP)
1	1	NSOURC	I
	2	NXPNTS	I
	3	NYPNTS	I
	4	NXWYPT	I
	5	NSEASN	I
	6	NSPEED	I
	7	NSTBLE	I
	8	NSCTOR	I
	9 - 28	ISW	I
	29 - 48	UNITS	I
	49 - 68	TITLE	I
2	1 - NXPNTS+NXWYPT	X	FP
3	1 - NYPNTS+NXWYPT	Y	FP
4*	1 - NXPNTS*NYPNTS +NXWYPT	Z	FP
5	1 - 2304	FREQ	FP
	2305 - 2328	TA	FP
	2329 - 2472	HM	FP
	2473 - 2508	DPDZ	FP
	2509 - 2514	UBAR	FP

*Tape logical record 4 is on the tape only if the parameter ISW(4) equals one.

TABLE 4-5 (Continued)

Tape Logical Record	Relative Word Number	Parameter Name	Integer (I)/ Floating Point (FP)
5 (Cont.)	2515 - 2550	P	FP
	2551 - 2566	THETA	FP
	2567	ROTATE	FP
	2568	G	FP
	2569	ZR	FP
	2570	BETA1	FP
	2571	BETA2	FP
	2572	DECAY	FP
	2573	TK	FP
6**	1	NUMS	I
	2	TYPE	I
	3	DX	FP
	4	DY	FP
	5	H	FP
	6	ZS	FP
	7	TS	FP
	8	VEL	FP
	9	D	FP
	10	HB	FP
	11	BW	FP
	12	BL	FP
	13	NVS	I
	14 - 33	VS	FP
	34 - 53	FRQ	FP

**Records 6 through 10 are repeated for each source input to the program.

TABLE 4-5 (Continued)

Tape Logical Record	Relative Word Number	Parameter Name	Integer (I)/ Floating Point (FP)
6** (Cont.)	54 - 73	GAMMA	FP
	74 - 217	Q	FP
	218	QFLG	I
	219	WAKE	I
7**	1 - NXPNTS*NYPNTS +NXWYPT	CON	FP
8**	1 - NXPNTS*NYPNTS +NXWYPT	CON	FP
9**	1 - NXPNTS*NYPNTS +NXWYPT	CON	FP
10**	1 - NXPNTS*NYPNTS +NXWYPT	CON	FP
.	.	.	.
last	1	999999	I

**Records 6 through 10 are repeated for each source input to the program and 8 through 10 are omitted if the input data is annual.

is being run. The maximum physical block length on UNIVAC 1100 series computers is 224 words per block. Some of the logical records shown in Table 4-5 may or may not be present on the tape, depending on the options ISW(4) and NSEASN. Logical record 4 is not on the tape if the parameter ISW(4) is zero. Also, records 7 through 10 are concentration or deposition records and depend on the number of seasons, NSEASN. If the user is using annual data, only record 7 out of records 7 through 10 will be on the tape. Records 6 through 10 are written to the tape for each source input to the program. The last record written for a program run has an integer 999999 in word 1 (NUMS) of the record and two end of file marks (magnetic tape only) are written after this record. The program does not check these tapes for labels, nor does it write a leading label file on the tape. Also, if you desire to write more than one data case (run) to an output tape, make sure the tape is positioned between the two end of file marks after the last case written to the tape. See Section 4.2.2 for the correct tape or data file assign cards.

4.2.5 Program Run Time, Page and Tape Output Estimates

This section gives approximations to the computer run time, tape output and page output for the ISCLT program. Because of the variability of problem runs and input parameters, the equations in this section are meant only to give an approximation of the upper limit of the time, page or tape usage function.

a. Run Time. The total run time required for a problem run using card input sources is given by

$$\text{Time (Seconds)} \cong \left(N_s \cdot \left(N_x \cdot N_y + N_{xy}\right) \cdot N_{se} \cdot N_{st} \cdot N_{sp} \cdot \left(N_{vs} + 1\right) \cdot f\right) \geq 120 \qquad (4\text{-}6)$$

where

N_s = the total number of sources from card for which concentration (deposition) calculations are to be made, NSOURC

N_x = the total number of points in the grid system X-axis, NXPNTS

N_y = the total number of points in the grid system Y-axis, NYPNTS

N_{xy} = the total number of discrete (arbitrarily placed) points NXWYPT

N_{se} = the number of seasons, NSEASN

N_{st} = the number of stability categories, NSTBLE

N_{sp} = the number of wind speed categories, NSPEED

N_{vs} = the maximum number of particulate categories for any source if deposition or concentration with depletion due to deposition is being calculated; otherwise N_{vs} is zero

$$f = \begin{cases} 6 \times 10^{-4}; & \text{for concentration calculations} \\ 7 \times 10^{-4}; & \text{for deposition or concentration with depletion due to deposition} \end{cases}$$

The variable f given above was calculated from example runs on a UNIVAC 1108 computer. If you are using a different computer or if the values of f given here are not accurate for your runs, recalculate f and replace it with a more representative value. If N_s in Equation (4-6) is zero (all sources from tape), use the following equation to approximate the time:

$$\text{Time (seconds)} \cong \left(N'_s \cdot \left(N_x \cdot N_y + N_{xy}\right) \cdot N_{se} \cdot N_g \cdot k\right) \geq 120 \quad (4\text{-}7)$$

where

N'_s = total number of input sources from tape or data file

N_g = number of source combinations to be printed, NGROUP

$k \cong 4 \times 10^{-3}$

The variable k is an approximation from a few example runs and the user may want to substitute a value that works better on his/her computer. Also, if the system on which the user is running this program aborts runs (jobs) that max-time, be generous with the time estimate.

b. Page Output. The total number of pages of output from the long-term ISCLT program depends on the problem being run and is given by:

$$\text{Pages} \cong \underline{A} + \underline{B} + \underline{C} \tag{4-8}$$

where*

$$\underline{A} = \begin{cases} 0 & ; \text{ if the program input data is not printed} \\ 16 & ; \text{ if input data other than source data is printed (ISW(6) = "1")} \\ N_s & ; \text{ if source data only is printed (ISW(6) = "2")} \\ 16 + N_s & ; \text{ if all input data is printed (ISW(6) = "3") and (ISW(4) = "0"), no terrain data} \\ 16 + N_s + \left\lceil \dfrac{N_x}{9} \right\rceil \cdot \left\lceil \dfrac{N_y}{(N_\ell - 19)} \right\rceil + \left\lceil \dfrac{N_{xy}}{3\ (N_\ell - 11)} \right\rceil & ; \text{ if all input data is printed (ISW(6) = "3") and (ISW(4) = "1") terrain data are used} \end{cases} \tag{4-9}$$

N_s = total number of sources input to the program. However, if concentration or deposition from individual sources is not being printed (ISW(8) = "2") use $N_s = \lceil N_s/4 \rceil$

*The ⌈ ⌉ symbols indicate to round up to the next largest integer if there is any fractional part.

N_ℓ = Number of print lines per page (ISW(17)), default is 57.

$$\underline{B} \cong I \cdot \left(N_i + N_c\right) \cdot \left(\left[\frac{\frac{N_x}{9} \cdot (N_y + 11)}{N_\ell} \right] + \left[\frac{N_{xy}}{3 \cdot (N_\ell - 11)} \right] + K \right) \tag{4-10}$$

I = number of seasons for which concentration or deposition is to be printed. If seasonal output only, then I = NSEASN; if annual output only, then I = 1; if both seasonal and annual output, then I = NSEASN+1.

N_i = total number of individual source concentration or deposition tables being printed. If ISW(8) equals "2", then N_i is set to zero. If ISW(8) equals "1" or "3", then N_i is the total number of source ID-numbers defined under the parameter IDSORC. This includes both implied and explicily punched source ID-numbers in IDSORC. Count each source ID-number only once. If the parameter NGROUP is "0" and the array IDSORC is not input, then N_i is the total number of card plus tape input sources. Also, if maximum 10 calculations are being made via ISW(11) or ISW(12), add N_i pages to the total pages in Equation (4-8) above for the individual source contributions to the combined maximum 10.

N_c = total number of combined source concentration or deposition tables being printed (NGROUP). Do not count single sources if they are already counted in N_i.

N_x = NXPNTS

N_y = NYPNTS

N_{xy} = NXWYPT

$$K = \begin{cases} 0; & \text{if maximum 10 values are not printed (ISW(10) = 0)} \\ 1; & \text{if maximum 10 values are printed (ISW(10) > 0)} \end{cases}$$

C $\cong$ the number of pages expected from the system plus other processing within the job

The above equations may not cover every option in the ISCLT program and, if the system the user is using aborts runs that max-page, be generous with the page approximation.

c. Tape Output. The total amount of tape used by a problem run depends on the type of computer, the installation standard block length for unformatted FORTRAN records, the number of tape recording tracks, the tape recording density and the options and data input to the problem run. This section provides the user with the total number of computer words output to tape or data file and an approximation to the tape length used in feet.

The total number of computer words output to tape is given by

$$\text{Words} = \Big(I + 2645 + N_x + N_y + 2N_{xy} + N_s\left(220 + N_{se}\left(N_x \cdot N_y + N_{xy} + 1\right)\right)\Big) \qquad (4\text{-}11)$$

where

$$I = \begin{cases} 0 & ; \text{ if option ISW(4)} = 0 \\ N_x \cdot N_y + N_{xy} + 1 ; & \text{ if option ISW(4)} = 1 \end{cases}$$

N_s = the total number of card and/or tape input sources

N_{se} = the number of seasons, NSEASN

N_x = NXPNTS

N_y = NYPNTS

N_{xy} = NXWYPT

Add 28 to the total number of words written for UNIVAC 1100 series computers.

The user can approximate the length of tape required by

$$\text{Length (feet)} \simeq \left[\left(\frac{\text{Words} \cdot B}{B_y \cdot D}\right) + 0.75\left(\frac{\text{Words}}{B\ell}\right) + 6.0\right] \Big/ 12.0 \qquad (4\text{-}12)$$

where

B = the number of bits per computer word. IBM 360, etc. is 32, UNIVAC 1100 series is 36 and CDC 6000 series is 60.

D = the tape recording density choosen by the user or required by the I/O device, 200, 556, 800 or 1600 bpi.

$B\ell$ = the number of words per physical tape block for unformatted FORTRAN records on the user's computer system. Use 224 for UNIVAC 1100 series computers.

B_y = "6" for 7 track tape or "8" for 9 track tape

The values 0.75 and 6.0 inches are used assuming the interrecord gap is 0.75 and the end-of-file is 6 inches.

4.2.6 Program Diagnostic Messages

The diagnostic messages produced by the ISCLT program are associated only with data and processing errors within the program and should not be confused with those produced by the computer system on which the ISCLT program is run. All messages begin with either the word ERROR or the word WARNING. All ERROR messages terminate the execution of the program and WARNING messages allow the program to continue. However, WARNING messages could indicate data errors and should be examined thoroughly when they occur. A list of the messages are given in Table 4-6 with the probable cause of the respective message.

TABLE 4-6

ISCLT WARNING AND ERROR MESSAGES

1. ERROR - MAX STORAGE = n, USER REQUESTED m REDUCE NO. OF CALC. POINTS. The program execution is terminated because the run required n locations of BLANK COMMON and only m are available. See Equation (4-1) in Section 4.1.2 for the core usage equation. See, also, Equations (4-2) and (4-3) that may place additional restrictions on the user.

2. ERROR - NUMBER OF SETTLING VELOCITIES FOR SOURCE n IS ZERO. Deposition is being calculated and the parameter NVS on Card Group 17 is zero for source n. Set NVS to the number of settling velocity categories and rerun.

3. WARNING - FREQ. OF OCCURRENCE OF SPD VS. DIR IS NOT 1.0 FOR SEASON n, PROG DIVIDES BY xxx.x TO NORMALIZE. The sum over all categories of the joint frequency of occurrence of wind speed and wind direction for season n is not exactly 1.0 and the program normalizes the frequency distribution by the factor xxx.x; execution continues.

4. WARNING - DISTANCE BETWEEN SOURCE n AND POINT X, Y = xx.x, yy.y IS LESS THAN PERMITTED. This is a warning message to inform the user that the program attempted to calculate concentration or deposition at the point xx.x, yy.y for source n, but the distance is less than the model allows and no calculations were made, but execution continues. The user should ignore calculations at xx.x,yy.y for source n or any source combination including source n.

TABLE 4-6 (Continued)

5. ERROR - ELEVATION zzz.z EXCEEDS SOURCE EMISSION ELEVATION FOR SOURCE n, PROG. TERMINATED. If any elevation exceeds a source emission elevation, program execution is terminated.

6. ERROR - DISP CANNOT EQUAL 2 WHEN QFLG IS GREATER THAN 0, OFFENDING SOURCE = n, PROG. TERMINATED. An attempt was made to rescale concentrations that do not vary only by season. The program saves only seasonal concentration on tape and cannot rescale with source strengths that vary by wind speed and/or stability. Input all of the source data via card setting DISP equal to zero and NUMS equal to the respective tape input source ID-number. The tape source will be replaced by the card source.

7. ERROR - DISP GREATER THAN 0 FOR SOURCE n, NO MORE TAPE SOURCES, PROG. TERMINATED. The program has found a source input card (Card Group 17) that indicates it is to update or delete a tape source, but it has run out of tape sources. Check your input source deck and make sure you have the correct input tape.

8. ERROR - DISP GREATER THAN 0 FOR SOURCE n, CANNOT FIND CORRESPONDING TAPE SOURCE, PROG. TERMINATED. The program has found an input source card (Card Group 17) that indicates it is to update or delete source n, but that source is not on the tape. Check the sequence of the input source data as they must be in ascending order of the source ID-number. Also, make sure you have the correct input tape.

TABLE 4-6 (Continued)

9. WARNING - HW/HB > 5 FOR SOURCE n, PROG. USES LATERAL VIRTUAL DIST. FOR UPPER BOUND OF CONCENTRATION (DEPOSITION). The program is informing the user that the supersquat building wake effects option (WAKE) on Card Group 17 was set to blank, "0" and the program defaulted to those equations for the lateral virtual distance that produce the upper bound on the concentration or deposition. The lower bound may be calculated in another run by setting WAKE = 1.

10. ERROR - AVAILABLE CORE = n, PROBLEM REQUIRES m OR MORE LOCATIONS. The program has determined that m locations of BLANK COMMON are required for the run, but only n locations are available. See Equations (4-1), (4-2) and (4-3) in Section 4.1.2.

11. ERROR - MAX. NO. OF SOURCES EXCEEDED FOR NGROUP OF ISW(11) = 2 OPTION. The number of sources the program has input exceeds the number the program is capable of processing under the special condition c, under the parameters NGROUP or ISW(11) = "2". See Equations (4-2) and (4-3) in Section 4.1.2 or Equations (4-4) and (4-5) in Section 4.2.3.

12. ERROR - STACK DIAMETER < = 0 FOR SOURCE n. Stack sources require a stack diameter greater than zero. Check the order of the input source deck.

13. WARNING - EXIT VELOCITY IS < = 0 FOR SOURCE n, PROG. SETS TO 1.0E-5 AND CONTINUES. The program sets a zero exit velocity for stacks to 1.0E-5, because it is used as a divisor in the plume rise equations. If you did not intend to set the exit velocity to zero for no plume rise, check the offending card and the order of the input source deck.

14. ERROR - SIGYO $\leq$ 0 FOR SOURCE n. Volume sources must have SIGYO greater than zero. Check the order of the input source deck.

15. ERROR - SIGZO $\leq$ 0 FOR SOURCE n. Volume sources must have SIGZO greater than zero. Check the order of the input source deck.

16. ERROR - XO $\leq$ 0 FOR SOURCE n. Area sources must have XO greater than ZERO. Check the order of the input source deck.

17. ERROR - SOURCE n LESS IN VALUE THAN LAST SOURCE n READ. Source input deck is out of order or miss punched.

18. ERROR - DISP CODE FOR SOURCE n IS OUT OF RANGE. The parameter DISP must equal 0, 1 or 2. Check card and order of input source deck.

19. ERROR - TYPE CODE FOR SOURCE n IS OUT OF RANGE. The parameter TYPE must equal 0, 1 or 2. Check card and order of source input deck.

19. ERROR - QFLG CODE FOR SOURCE n IS OUT OF RANGE. The parameter QFLG must equal 0, 1, 2 or 3. Check card and order of source input deck.

4.2.7. Program Modifications for Computers other than UNIVAC 1100 Series Computers

The ISCLT program is written in the FORTRAN language and uses the FORTRAN features compatible with standard ANSI FORTRAN. The program can be implemented on most computers that meet the following requirements:

- Must have the equivalent of 65,000 UNIVAC 1110 words of executable core storage
- Must use 32 or more bits per computer word
- Must use 4 or more characters (bytes) per computer word
- Must allow object time dimensioning (FORTRAN)
- Must have a 132 column line printer

The program also assumes the input card device is logical unit 5, the output printer is logical unit 6, the input tape unit is logical unit 2 and the output tape unit is logical unit 3. However, all but unit 5 can be overridden with an alternate unit number by input option. If the user must change unit 5 to an alternate number for the card input device, he must change the variable IUNT in the main program. This variable appears after the input comments section in the FORTRAN listing of the main program.

The user may also adjust the computer core required by the program by reducing or increasing the dimension (size) of BLANK COMMON in the program. This is the first statement in the main program and, if changed, the user must also change the value of the variable IEND in the main program. The variable IEND appears after the input comments section in the main program. Also, the user must change the value of E in Equations (4-1), (4-2), (4-3), (4-4) and (4-5) in the body of this text. Program capabilities can be severly restricted if the size of BLANK COMMON is reduced.

It is not possible to give all changes required to implement this program on all computers. However, changes necessary to implement this program on IBM and CDC medium to large scale computers are given below:

Changes required for use on IBM 360 or above computers:

- Change the call ACOS to ARCOS in subroutine DISTR on the 17th line

Changes required for use on CDC 6000 or above series computers:

- Add the following line on the first line of the main program

  PROGRAM ISCLT (INPUT, OUTPUT, TAPE nn, TAPE mm)

  Where TAPEnn and TAPEmm are the names used on the tape REQUEST card and nn and mm are the logical unit numbers used to reference the input and output tapes, respectively. See the CDC FORTRAN Extended Reference Manual for your machine for variations in this card and alterations of this card by the LGO runstream card

- The program uses the END= clause in the read statement for card source input data

  READ (IUNT, 9023, END = 1120) NUMS1, DISP. etc.

  If your FORTRAN does not recognize this statement, remove the ",END = 1120" from this statement on line 612 of subroutine MODEL. Also, if this clause is removed from this statement, the user must insure the program never trys to read beyond the last input card source or the program will error off. Also, the END= clause is used in some of the tape read statements at program listing sequence numbers -- S0107820, S0205430, S0205920 and S0205990. If your FORTRAN does not recognize the END= clause, it must be removed from these statements. The removal of the END= clause from these statements will eliminate the capability of the ISCLT program in some cases to position a tape to the correct file via the input parameter NOFILE when multiple passes are required through the tape data. This problem can be overcome by writting the ISCLT output data to a mass-storage file and then copying the mass-storage file to an output tape file when the program has terminated.

- Two successive file marks are written at the end of execution. The program uses the FORTRAN BACKSPACE command to back the output tape back over the last end of file mark written. If your FORTRAN BACKSPACE command does not back over end of file marks, the tape will be left positioned after the second end of file mark at the end of execution. However, if the program must make multiple passes through the tape for the output reports, the tape will be left positioned after the first file mark at the end of the data set. The program will make multiple passes through the data file, if Condition c under ISW(11) or NGROUP does not apply to the run and Condition a was selected (see Section 4.1.2.a).

3.3 PTMAX

The program reads the input data from unit 5 according to the following format:

VARIABLE NAME
COLUMNS
FORMAT
FORM
VARIABLE
UNITS

ANY NUMBER OF SETS CONSISTING OF ONE CARD TYPE 1 AND ONE CARD TYPE 2 MAY BE USED. THESE SHOULD BE FOLLOWED BY TWO BLANK CARDS.

CARD TYPE 1. * * * T I T L E C A R D * * *

AIR	1-80	20A4	AAAA	AIPHANUMERIC DATA FOR HEADING-	

CARD TYPE 2. * * * S O U R C E C A R D * * *

Q	1-10	F10-0	XXXXX-XX	SOURCE STRENGTH	(G/SEC)
HP	11-20	F10-0	XXX-X	PHYSICAL HEIGHT	(M)
TS	21-30	F10-0	XXX-X	STACK GAS TEMPERATURE	(DEG K)
VS	31-40	F10-0	XX-X	STACK GAS VELOCITY	(M/SEC)
D	41-50	F10-0	XX-XX	DIAMETER	(M)
VF	51-60	F10-0	XXXX-X	VOLUME FLOW	(M**3/SEC)

VF CAN BE LEFT BLANK. D AND VS WILL BE USED TO CALCULATE VF
IF VF GIVEN. IT IS ASSUMED CORRECT AND D AND VS ARE NOT USED

The input data and the concentration results are written on unit 6 (generally a printer).

CARD TYPE 5 (UP TO ANY NUMBER OF CARDS, LAST ONE BLANK FOR CONTROL)

* * * M E T E O R O L O G Y   C A R D * * *

```
THETA 1-10  F10-0 XXX.      WIND DIRECTION                      (DEG)
U     11-20 F10-0 XX-X      WIND SPEED                        (M/SEC)
KST   21    11,9X X         STABILITY CLASS          (DIAMENSIONLESS)
HL    31-40 F10-0 XXXX.     MIXING HEIGHT                         (M)
T     41-50 F10-0 XXX-X     AMBIENT AIR SURFACE TEMP.         (DEG K)
P     51-60 F10-0 XXXX-X    AMBIENT AIR PRESSURE                 (MB)
        T AND/OR P CAN BE LEFT BLANK.  DEFAULT VALUES OF T = 293
         AND P = 960 WILL BE USED.
```

The input data and the concentration results are written on unit 6 (generally a printer).

3.5 CDM

The following pages contain Chapters 3 and 4 of:

Brubaker et al. (1977) Addendum to User's Guide for Climatological Dispersion Model. EPA-450/3-77-015 (PB-274 040).

3. DESCRIPTION OF INPUT

This section provides a description of the input required by CDMQC, including a detailed card input sequence listing. The input may be logically divided into four blocks:

- miscellaneous operation data
- meteorological joint frequency function
- source emission inventory
- receptor data.

Of these four parts, only the meteorological joint frequency function input is identical to that for CDM. The changes in the other inputs are not large, however, and relatively little modification of existing data sets will be required to make them usable with the new version.

The discussion will be in terms of cards as the sole input to the program, but in fact only the first two records or card images must be input on logical unit number 5 (by convention, a card reader). All subsequent data must be input on the unit specified by the parameter IRD on the second card. This unit may be the card reader (IRD=5) or any other device set up to supply the required data in the appropriate format.

3.1 GENERAL DESCRIPTION

The first block of data contains miscellaneous operational data including a title card, input and output option specifications, miscellaneous meteorological data, area source emission grid specifications and integration parameters and pollutant background values. This block corresponds generally to cards 1-3 in the basic CDM, although two entirely new cards have been added and a minor change has been made in a third.

The second block consists of the meteorological joint frequency function. No changes have been made from the basic CDM.

The third block consists of the source emission inventory data. For convenience, the poi... and area inventories are now read in separately, the point source data first, followed by the area source data. The format of the individual cards is such that existing inventory data can be used unchanged except for the separation of point and area sources and the insertion of a blank card between the two parts.

Preceding page blank

The fourth block consists of the set of receptor cards, and substantial additions have been made to each receptor card compared to the basic CDM requirements. Due to program changes, a limit of 200 now exists on the total number of receptors which CDMQC can treat in a given run. As explained in Sec. 2.1, if calibration is to be done in a given run of the program, the cards for the NCALR receptors involved must be placed at the beginning of the set of receptor cards. Additional receptor cards may follow. Each receptor card contains receptor coordinates, measured pollutant concentrations, pollutant standard geometric deviations, four output control parameters, and an optional four-character receptor identification name. The measured concentrations of either or both pollutants are required if that receptor is to be used for model calibration, but are optional if the receptor is not used for calibration. The standard geometric deviations of either or both pollutants are required if Larsen statistical output is desired for the specified pollutants at that receptor, but are optional otherwise. The coordinates are the only parameters which should never be blank; any or all of the other quantities may be omitted under various circumstances.

Either one or two pollutants may be treated in a single run of the computer program. If only one pollutant is treated, that pollutant must be pollutant 1. A test is made on the name of pollutant 2, LPNAM(2) on card number 3; if this space is left blank, it is assumed that only one pollutant will be treated. If LPNAM(2) is not blank, it is assumed that two pollutants are to be treated. No test is made on the name of pollutant 1. In general, a name should be supplied for each pollutant treated since it is used for identification in the output.

Table 3.1 gives a summary of the differences in input requirements and format between CDM and CDMQC.

3.2 DETAILED CARD INPUT SEQUENCE

Table 3.2 provides the detailed card input sequence for the CDMQC. The parameters are defined in the table for the benefit of the user, but the User's Guide or other sections of this addendum should be consulted if questions arise regarding the significance of any input variable.

Table 3.1. Differences in Card Input Sequence Between CDM and CDMQC

Card number		Modification or Comparison
CDMQC	CDM	
1	--	Entirely new card
2	1	NLIST replaced by new parameters NLIST1 and NLIST2
3	--	Entirely new card
4	2	No difference
5	3	No difference
6-101	4-99	No difference
102-299	100-999	Point source inventory separated
300	--	Addition of blank card
301-999	100-999	Area source inventory separated
1000	1000	No difference
1001	1001	Measured concentrations renamed, new format used; Addition of standard geometric deviations; Redefinition of NROSE output control parameter; Addition of output control parameters IPNCH, NCULP and NLARS; Addition of receptor identifier NRAM.

Table 3.2. Card Input to CDMOC[a,b]

CARD NO.	COLUMN	FORMAT	CONTENTS
1	1-80	20A4	*ITIT (1) - ITIT (20) (Title of run to be printed at top of every page of output)
2	1-8	2A4	AROS (1) - AROS (2) (Identification for punched output of the computed area source concentrations of the two pollutants)
	9-16	2A4	PROS (1) - PROS (2) (Identification for punched output of the computed point source concentrations of the two pollutants)
	17-21	I5	IRUN (Computer run identification number)
	23-24	I2	*NLIST1 (Index governing printout of wind rose input data: If NLIST1≤0, data is printed.)
	25-26	I2	*NLIST2 (Index governing printout of source input data: If NLIST2≤0, data is printed.)
	27-31	I5	IRD (Data input file number)
	32-36	I5	IWR (Output print file number)
	37-41	I5	IPU (Output punch file number)
	42-59	2F9.0	CA(1)-CA(2) (Constants of the linear equation Y=CA + C3 x X, used to calibrate the calculated concentrations of the two pollutants considered in the model)
	60-77	2F9.0	C3(1)-C3(2) (Slope of the linear equation, Y=CA + C3 x X, used to calibrate the calculated concentrations of the two pollutants considered in the model)
3	1-6	I6	*NCALR (Total number of receptors which will be used in computing calibration coefficients; for either or both pollutants. Leave blank if coefficients not to be computed. NCALR ≤ 50.)

Card Input to CDMQC (continued)

CARD NO.	COLUMN	FORMAT	CONTENTS
3 (cont'd)	8-11	I4	*IOCAL (Indicates calibration option desired. If IOCAL=0, regression constants are input and not computed. If IOCAL=1, constants will be computed and processing will stop if confidence level not satisfactory. Otherwise, constants will be used to calibrate. If IOCAL=2, constants will be computed and default values (slope=1, intercept=0) will be used to calibrate if confidence level not satisfactory. Otherwise, calculated constants will be used to calibrate. If IOCAL=3, constants will be computed, the results printed and processing will stop.)
	13-22	F10.0	*BKGR(1) (Arithmetic mean background concentration of pollutant 1, in micrograms/cubic meter)
	23-32	F10.0	*BKGR(2) (Arithmetic mean background concentration of pollutant 2, in micrograms/cubic meter)
	34-37	A4	*LPNAM(1) (Name of pollutant 1)
	39-42	A4	*LPNAM(2) (Name of pollutant 2)
	44-55	3F4.0	*PAV(1,1) - PAV(3,1) (Up to three desired averaging times (hours) for statistical output for pollutant 1)
	57-68	3F4.0	*PAV(1,2) - PAV(3,2) (Up to three desired averaging times (hours) for statistical output for pollutant 2)
	70-74	F5.0	*CTOF (Percentage: sources contributing less than this percent to total calibrated concentration will not be individually listed in any culpability lists.)
4	1-6	F6.0	DELR (Initial integration increment of radial distance from receptor, meters)

Card Input to CDMOC (continued)

CARD NO.	COLUMN	FORMAT	CONTENTS
4 (cont'd)	7-12	F6.0	RAT (Ratio of length of a basic emission grid square and the length of a map grid square)
	13-18	F6.0	CV (Conversion factor which upon multiplication by RAT expresses the distance of the side of an emission grid square in meters. For example, if the map units are in kilometers, CV=1000.)
	19-24	F6.0	HT (Average afternoon mixing height in meters)
	25-30	F6.0	HMIN (Average nocturnal mixing height in meters)
	31-36	F6.0	XG (X map coordinate of the south-west corner of the emission grid array)
	37-42	F6.0	YG (Y map coordinate of the south-west corner of the emission grid array)
	43-48	F6.0	XGG (X map coordinate of the southwest corner of the plotting grid)
	49-54	F6.0	YGG (Y map coordinate of the south-west corner of the plotting grid)
	55-60	F6.0	RATG (Ratio of the length of the grid square used for plotting and the length of a map grid square)
	61-66	F6.0	TOA (Mean atmospheric temperature in degrees centigrade)
	67-72	F6.0	TXX (Width of basic emission square in meters)
5	1-6	F6.0	DINT (Number of intervals used to integrate over a 22.5° sector. Maximum value is 20, typical value is 4.)
	7-12	F6.0	YD (Ratio of average daytime emission rate to the 24-hour emission rate average.)

Card Input to CDMQC (continued)

CARD NO.	COLUMN	FORMAT	CONTENTS
5 (cont'd)	13-18	F6.0	YN (Ratio of the average nighttime emission rate to the 24-hour emission rate average)
	19-54	6F6.0	SZA (1) - SZA (6) (Initial σ_z in meters for each stability class. Six different values can be used, but normally only one value is used.)
	55-66	2F6.0	GB(1) - GB(2) (Decay half life in hours for the two pollutants)
6-101	1-49	[7X, 6F7.0]	F(i,j,k) (Joint frequency function, identical to $\phi(k,l,m)$; i=index for stability class, j=index for wind speed, k=index for wind direction)
[Point Source cards follow]			
102[c]	1-6	F6.0	X (X map coordinate of a point source)
	7-13	F7.0	Y (Y map coordinate of a point source)
	*[a]	*	*
	21-36	2F8.0	S1-S2 (Source emission rate in grams per second for the two pollutants)
	37-43	F7.0	SH (Stack height in meters)
	44-48	F5.0	D (Diameter of stack in meters)
	49-55	F7.0	VS (Exit speed of pollutants from stack in meters per second)
	56-62	F7.0	T (Gas temperature of stack gases in degrees centigrade)
	63-67	F5.0	SA (If this field is blank, Briggs' formula is used to compute stack height. Otherwise, the product of plume rise and wind speed is entered in square meters per second)

Card Input to CDMQC (continued)

CARD NO.	COLUMN	FORMAT	CONTENTS
300	—	—	*This is a blank card which follows information on the emission point sources. It is used to test the end of the point sources and must not be left out.
[Area source cards follow]			
301[d]	1-6	F6.0	X (X map coordinate of the south-west corner of an area emission grid square)
	7-13	F7.0	Y (Y map coordinate of the south-west corner of an area emission grid square)
	14-20	F7.0	TX (Width of an area grid square in meters)
	21-36	2F8.0	S1-S2 (Source emission rate in grams per second for the two pollutants)
	37-43	F7.0	SH (Stack height in meters)
1000	—	—	This is a blank card which follows information on the area emission sources. It is used to test the end of sources and must not be left out.
[Receptor cards follow]			
1001[e]	1-8	F8.0	RX (X map coordinate of the receptor)
	9-16	F8.0	RY (Y map coordinate of the receptor)
	30-35	F6.0	*COBS(1)[f](Measured concentration of the first pollutant at the receptor in micro-grams/cubic meter. Leave blank if not known.)
	36-41	F6.0	*COBS(2)[g](Measured concentration of the second pollutant at the receptor in micro-grams/cubic meter. Leave blank if not known.)

Card Input to CDMQC (continued)

CARD NO.	COLUMN	FORMAT	CONTENTS
1001 (cont'd)	43-47	F5.0	*SGD(1)[h] (Standard Geometric Deviation (24-hour) of pollutant 1 to be used for output at other averaging times)
	48-52	F5.0	*SGD(2)[i] (Same as SGD(1), but for pollutant 2)
	54-55	I2	*IPNCH (A control parameter which, if greater than zero will cause standard concentration output to be punched.)
	56-57	I2	*NROSE (A control parameter for concentration rose output: If NROSE = 0 (blank), no concentration rose data will be printed or punched; If NROSE = 1, concentration roses will be printed but not punched; If NROSE = 2, concentration roses will be printed and punched.)
	58-59	I2	*NCULP (A control parameter which specifies source contribution list option (print only): If NCULP = 0, no list is printed; If NCULP = 1, list for pollutant 1; If NCULP = 2, list for pollutant 2; If NCULP = 3, list for both pollutants.)
	60-61	I2	*NLARS (A control parameter which specifies Larsen statistical output option (print only): If NLARS = 0 (blank), no statistical output; If NLARS = 1, for pollutant 1 only; If NLARS = 2, for pollutant 2 only; If NLARS = 3, for both pollutants.)
	77-80	A4	*NRAM (Optional receptor identification name)

Card Input to CDMQC (continued)

[a]Asterisks denote additions to or changes in card input sequence given in Table 6 of the CDM User's Guide.

[b]The data listed on "cards" 1 and 2 must in fact be input on cards. All data on subsequent "cards" must be input from logical unit number IRD, provided on card number 2. This unit may be the card reader or any other input device which can supply the data in card image format.

[c]There will be as many cards of this type as there are point sources. The maximum number of point sources which can be handled is 200. The next card type will arbitrarily be numbered 300.

[d]There will be as many cards of this type as there are area sources. The maximum number of area sources which can be handled is 2500. The next card type will arbitrarily be numbered 1000.

[e]There will be as many cards of this type as there are receptors. The maximum number of receptors which may be handled is 200.

[f]Required only if this receptor is to be used in calibration for pollutant 1.

[g]Required only if this receptor is to be used in calibration for pollutant 2.

[h]Required only if Larsen statistical output is desired for pollutant 1 at this receptor.

[i]Required only if Larsen statistical output is desired for pollutant 2 at this receptor.

4. DESCRIPTION OF OUTPUT

This section provides a description of the output which may be obtained in a given run of the CDMQC computer program. The user must specify the logical unit numbers for the output; this is done by means of the parameters IWR and IPU on input data card number two. It is intended that IWR refer to a line printer and that IPU refer to a punched card output unit, but they may refer to any other devices compatible with the output format. The discussion will be in terms of printed and punched output. Samples of both types of output for a test example may be found in Appendix C.

4.1 PRINTED OUTPUT

The user has considerable flexibility in specifying what quantities will or will not be printed out. For job identification purposes, a three-line heading is supplied at the top of each page of printed output. This heading consists of the phrase CLIMATOLOGICAL DISPERSION MODEL, below which the user-supplied job title (ITIT(1) - ITIT(20)) is printed, below which the user-supplied run identification number (IRUN) is printed. The heading allows the output to be separated without losing track of what job the output resulted from.

The following information is always printed on the first two pages of output:

- pollutant list (user-supplied pollutant names)
- area source grid specification and integration parameters
- miscellaneous meteorological data including morning and afternoon mixing heights, mean ambient temperature and pollutant halflives
- day and night emission rate factors
- background pollutant concentrations
- the cut-off for source contribution lists
- the calibration option in effect and related input parameters
- averaging times to be used for each pollutant in applying the Larsen procedure.

Following this section of output, the user may have the meteorological joint frequency function printed or not as desired. The joint frequency data will be printed if the parameter NLIST1 is less than or equal to zero (or left blank). The printing is suppressed if NLIST1 is greater than zero.

Similarly, the source emission inventory will be printed next if the parameter NLIST2 is less than or equal to zero (or blank) and will not be printed if NLIST2 is greater than zero.

Calibration results are then printed if calibration is attempted on the given run (i.e., if IOCAL is greater than zero). See Sec. 2.1 and Appendix B for a description of the output from the calibration procedure. An explicit statement of the results of the statistical test on the calculated correlation coefficient(s) is printed along with a statement of the action taken by the program as described in Table 2.1.

The last major section of output contains the calculated concentrations. For each receptor, including those used for calibration, the calibrated calculated point and area contributions for each pollutant treated, the background values, and the total predicted concentration of each pollutant at the given receptor along with the receptor identifier (NRAM) and receptor coordinates are always printed. These results are printed in tabular form.

In addition, the user may request the following additional output at any or all receptors:

- Point and area concentration roses for each pollutant being treated; concentration roses are printed if the parameter NROSE is greater than zero, and not printed if NROSE is less than or equal to zero (or blank).
- Individual source contribution lists for either or both pollutants, according to the value of the parameter NCULP; see Sec. 2.2.
- Results from the application of the Larsen statistical transformation for either or both pollutants, according to the value of the parameter NLARS; see Sec. 2.3.

The order in which the results are printed depends upon the nature of any additional output beyond the basic point, area and total concentration(s) at each receptor. Receptors are processed by the program one at a time in the order in which they are specified by the user. If pollution roses and/or an individual source contribution list are requested for a given receptor, these results are printed out immediately following the calculations and are not saved through the entire run. Consequently, these results are the first to appear, and are arranged by receptor in the order in which the receptors are processed.

Following any pollution roses or source contribution lists requested by the user, the table of point, area and total concentration estimates previously described is printed.

Finally, if Larsen statistical transformation results are requested for either or both pollutants at any or all receptors, these results are printed out in tabular form following the table of annual average concentration estimates. A separate table is printed for each combination of pollutant and averaging time, containing results for only those receptors at which statistical output was requested for the given pollutant.

Examples of each type of output are given in Appendix C as part of the output from the test example.

4.2 DIAGNOSTIC MESSAGES

Three new tests have been added to the program to detect common user input errors and to call the user's attention to their existence when they occur. A brief description of each together with the diagnostic message that is printed follows.

Inconsistent Specification of Area Source Locations. The area source emission grid may be not larger than 50 grid squares in either the x or the y direction, this limit being determined by the dimensions of various arrays defined within the computer program. This limit, together with the user-specified size of a basic grid square (TXX), imposes a limit to the total size of the emission grid. A test is made to see that each area source falls within the boundaries of the grid. If any area source lies partially or wholly outside these boundaries, the following message is printed:

```
NOTE:  AREA SOURCE NNNNN, WITH X COORD XXXXXXX.XX AND Y COORD
       YYYYYYY.YY, VIOLATES AREA SOURCE ARRAY LIMITS.  AREA SOURCES
       MUST LIE ENTIRELY WITHIN A MMMMMMMM.MM METER SQUARE WITH
       SOUTHWEST CORNER AT THE USER-DEFINED ORIGIN (XG, YG).
       AREA SOURCE NNNNN WILL NOT BE INCLUDED IN THIS CALCULATION.
```

In this message, the actual values of all quantities indicated will be printed. The quantities printed are:

NNNNN	Area source ID
XXXXXXX.XX	X coordinate of southwest corner of area source which violates limits.
YYYYYYY.YY	Y coordinate of southwest corner of area source which violates limits
MMMMMMM.MM	Total possible size of emission grid, equal to (50)(TXX) meters

As indicated in the message, the calculation will proceed but the area source in violation will be omitted from the inventory.

Inconsistent Specification of RAT, CV, and TXX. The user-supplied quantities CV, RAT, and TXX are not all independent, but are related by the equation

$$RAT = TXX/CV. \tag{1}$$

A test is made to insure that this relationship is satisfied, and if it is not the following message is printed:

INPUT ERROR: RAT*CV MUST EQUAL TXX. CALCULATION TERMINATED.

As the message indicates, the run is stopped after the message is printed. The user must correct the input and resubmit the job.

Insufficient Range in Area Source Calculations. As discussed in Section 2.2 and in Appendix A, the area source algorithm evaluates the average emission rate on a series of arcs centered on the receptor of interest. No more than 100 arcs are used, this limit again being determined by internally fixed array dimensions. This limit, together with the user-supplied radial integration step DELR, imposes an upper limit to the distance to which the area source calculations will be taken. If there are area sources beyond this range, they will not be included in the calculations. A test is made for each receptor to determine if this situation exists, and if it does the following message will be printed:

WARNING: MORE THAN 100 ARCS ARE REQUIRED FOR CALCULATION
OF AREA CONTRIBUTION. AREA SOURCES BEYOND 100TH
ARC ARE NOT INCLUDED IN CALCULATION.

The limit need be violated for only one sector at a given receptor in order for the message to be printed. As indicated, the program does not terminate the job, but ignores the contribution from area sources beyond the range. Table A.2 gives the range of the area source integration as a function of DELR.

4.3 PUNCHED OUTPUT

Two types of punched card output for each receptor are available to the user. The first type, called the standard concentration output, consists of one card containing the receptor coordinates in both plotting grid units and in map units, calibrated point and area concentrations, background concentrations, total predicted concentrations, measured concentrations of each pollutant, and the computer run identification number. All concentrations are reported in micrograms/ cubic meter. To obtain the first type of punched card output for a given receptor, the value of the parameter IPNCH on the corresponding receptor card must be greater than zero.

The second type of punched output consists of the point and area concentration roses for each designated receptor. Two or four cards are punched, depending on the number of pollutants treated. Each concentration rose card contains a user-supplied card identifier (PROS(I) or AROS(I), I=1 or 2), sixteen calibrated concentration values corresponding to the sixteen wind directions used, and receptor map coordinates. To obtain this output for a given receptor, the parameter NROSE on the receptor card must be assigned the value 2.

These two types of output are independent of each other; either or both may be obtained at a given receptor. The punching of the standard concentration output is controlled entirely by the parameter IPNCH and the punching of the pollution roses is controlled entirely by the parameter NROSE.

Table 4.1 gives the detailed format of the punched card output available from CDMQC.

Table 4.1. Format of Punched Output

CARD	COLUMN	FORMAT	CONTENTS
1 [a]	1-8	F8.2	PUX (X coordinate of receptor in plotting grid units)
	9-14	F6.2	PUY (Y coordinate of receptor in plotting grid units)
	15-18	I4	KPX(1) (Calibrated area concentration for first pollutant)
	19-22	I4	(2) (Calibrated area concentration for second pollutant)
	23-26	I4	(3) (Calibrated point concentration first pollutant)
	27-30	I4	(4) (Calibrated point concentration for second pollutant)
	31-34	I4	(5) (Input background concentration for first pollutant)
	35-38	I4	(6) (Input background concentration for second pollutant)
	39-42	I4	(7) (Calibrated total concentration for first pollutant)
	43-46	I4	(8) (Calibrated total concentration for second pollutant)
	47-50	I4	COBS(1) (Measured concentration of first pollutant)
	51-54	I4	COBS(2) (Measured concentration of second pollutant)
	55-64	F10.2	RX (X map coordinate of receptor)
	65-74	F10.2	RY (Y map coordinate of receptor)
	75-79	I5	IRUN (Computer run identification number)
	80		I (Card identifier, a literal 'I')
2 [b]	1-4	A4	PROS(1) (Card identifier)
	5-68	16I4	KPX(1)-KPX(16) (Point concentration by wind direction)

Format of Punched Output (continued)

CARD	COLUMN	FORMAT	CONTENTS
2[b] (cont'd)	69-74	I6	RX (X map coordinate of receptor multiplied by 100 to remove decimals)
	75-80	I6	RY (Y map coordinate of receptor multiplied by 100 to remove decimals)
3[b]	--	--	(Same as Card 2 for second pollutant)
4[b]	1-4	A4	AROS(1) (Card identifier)
	5-68	16I4	KPX(1)-KPX(16) (Area concentration by wind direction)
	69-74	I6	RX (X map coordinate of receptor multiplied by 100 to remove decimals)
	75-80	I6	RY (Y map coordinate of receptor multiplied by 100 to remove decimals)
5b	--	--	(Same as Card 4 for second pollutant)

[a]Card punched only if IPNCH greater than zero.

[b]Card punched only if NROSE equals two.

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3.6 MC-LAGPAR

This is an APL program consisting of one main (MCLAGPAR) calling the following subroutines:

- READGRID
- READEMIS
- READPAR
- INITPUFF
- TESTDOM1
- READMETEO
- LOCATE
- WIND
- TURB
- FICOMP
- NEWUVWPR
- ROTATION
- MOVEPAR
- TESTDOM2
- DRYDEP
- CHEMDECAY
- DELETE
- PUFFSTAT
- SAVECONC

To run this program, the APL workspace GRIDPUFF must be loaded and the following command must be issued:

OUT ← MCLAGPAR

The program reads the input data contained in the following CMS files:

- EMIS DATA A
- GRID DATA A
- METEO DATA A
- RUN DATA A

which are described in Section 3.6.1.

The program output is written in the variables OUT and in the CMS file named CONC DATA A, as described in Section 3.6.2.

3.6.1 Input Data

The CMS file EMIS DATA A contains the following inputs that must be separated at least by one blank character:

- N P, number of particles
- Q, total emission ~~rate (g/s)~~ (Kg)
- X E, Y E, Z E, initial location of the puff release (m)
- S X E, S Y E, S Z E, initial standard deviations of puff concentration distribution (m)
- ~~S F, standard deviation of the buoyancy~~
- GR, gravity constant (m/s^2)
- VS, exit velocity of the initial emission (m/s)
- RS, exit radius of the initial emission (m)
- TS, exit temperature of the emission (^{o}K)
- T, ambient temperature at the emission level (^{o}K)
- T PR MAX
- S F, standard deviation of the buoyancy

The CMS file GRID DATA A contains the following information, separated by at least one blank character:

X O, Y O, Z O, origin of the grid system (m)

D X, D Y, D Z, space grid increments (m)

N X, N Y, N Z, number of cells along x, y, and z

The CMS file METEO DATA A contains the meteorological information. According to the user's option, such information can be read only once (stationary simulations) or changed at each time step. Such meteorological information is described by N M + 1 records, described below:

1st record: it contains the following variables:

- N M, number of following records
- T D, time constant for dry deposition (s)
- T C, time constant for chemical decay (s) — TDEPMAX — TRES

Each of the following N M records contains:

- Z M, elevation
- U X, U Y, U Z, wind vector
- S U, S V, S W, standard deviation of particle wind fluctuations
- RU, RV, RW, autocorrelations
- RUW, cross-correlation
- DTHDZ

The CMS file RUN DATA A contains the following information, separated by at least one blank character:

N K, number of time steps

N T, number of sub-steps in each time step

D T, length of the sub-step (s)

I S T E A D Y, if equal to zero non-stationary computations are performed

I O P T, if different from zero, puff parameters are printed at the end of each time step

I O P T C, if different from zero, only ground level concentrations are calculated

3.6.2 Output Data

In the variable OUT, the puff baricenters and standard deviations are saved at each sub-step.

In the output file CONC DATA A, the three (or two) dimensional concentration field is saved at each time-step.

4. DATA BASE

4.1. Programmer

Naser El-Karmi

4.2 General Description

A Data Base for Meteorological and Air Quality Data (DBMAQD) package has been developed and implemented on the DATA GENERAL NOVA computer system of the EES Division. The package is a preliminary one and still under development. FORTRAN is the language used for this package.

This manual briefly introduces the various capabilities of this package and provides instructions on how to use it. Examples will also be given to illustrate the use of the DBMAQD package.

The package can be initiated by entering:

AIRPOL

Whenever it is initiated, the package can be used with these five commands:

LOC : locate

ANL : analyze

PRT : print

HLP : help

END : end

The following is a description of each command.

4.2.1 Locate Command

The locate command LOC should always be used first before the ANL command. LOC is used to locate that part of the file to be analyzed by specifying the starting and ending dates.

The locate command syntax is:

LOC, p, SH, SM, SD, SY, EH, EM, ED, EY

Where:

p : is either S (single) or M (multiple) parameter allocation

SH : is the starting hour

SM : is the starting month

SD : is the starting day (between 1 and 31)

SY : is the starting year (only the last 2 digits)

EH : is the ending hour

EM : is the ending month

ED : is the ending day (between 1 and 31)

EY : is the ending year (only the last 2 digits)

The arguments of the LOC command (day, month and hour) can be entered as single or double digits (e.g., 01 or 1). Similarly, blanks or commas are both acceptable.

An example of the LOC command is the following:

LOC, S, 01, 12, 01, 82, 22, 12, 31, 82

4.2.2 Analyze Command

The ANL command is used to select and analyze certain records in which the parameters chosen should be within specified ranges. The syntax of the ANL command is:

ANL, p, "PARM", RMIN, RMAX

Where:

p : is either S (single) or M (multiple) parameter allocation

"PARM": is the parameter name for which the anlaysis is to be made.

PARM could be one of these:

TEMP for temperature

WINS for wind speed

PRES for pressure

HUMD for humidity

RMIN : is the minimum value of the parameter of interest

RMAX : is the maximum value of the parameter of interest

The ANL command arguments can be separated by commas or blanks. RMIN and RMAX could be entered in any format. More than one PARM could be specified in one ANL command. Operands (and, or) should be entered by the user to specify if some or all of the parameters of the records to be selected should be within the ranges specified in the ANL command. The number of operands is equal to the number of parameters entered in the ANL command minus 1. Below is an example of the ANL command using two parameters:

ANL, M, "TEMP" 25.7, 31.8, "WINS", 7, 17.

4.2.3 <u>Print Command</u>

The print command syntax is:

PRT, device code

Where, the device code could be any of the following:

13 : printer

10 : CRT fixed

27 : disk file

26 : movable disk file

28 : magnetic tape

29 : plotter (to be implemented in the future)

The PRT command is used to identify to the system the device address where the output should be sent. An example of the PRT command where the output must be printed and saved on a magnetic tape is the following:

PRT, 13

PRT, 28

In this example two print commands are used since only one output device code can be specified for each PRT command.

4.2.4 Help Command

This command allows the user to get information regarding all available legal commands for running the package. This on-line user can be accessed any time after initiating the DBMS package by issuing this command:

HLP

4.2.5 End Command

This command is used to terminate the execution of the package and reset all data files. To use it, END just needs to be entered (but this command should not be issued until results, if needed, have been sent to a certain desired output device by the PRT command).

EXAMPLE:

1. User enters: AIRPOL

   Response: the package prints the package identification and the recent updates. It also prints the present date and time:

   DATE: 4/23/83 TIME: 10:15:20

2. Package prints:

   ENTER COMMAND:

   LOC, M, 1, 1, 1, 83, 24, 11, 10, 83

3. Package Prints:

ENTER COMMAND:

User enters:

ANL, M, "TEMP", 10, 15, "WINS", 7, 17,

Package prints:

ENTER FIRST OPERAND (0) OR (1) AND

User enters:

1

The package prints:

DATA HAS BEEN PROCESSED

4. The package prints:

ENTER COMMAND:

User enters:

PRT, 10

Package prints the results of the analysis and provides all records with the information specified in the ANL command and then provides averages, minimum and maximum values and the time. The minimums and maximums occur for all the parameters (TEMP, WINS, PRES AND HUMD) in the data file.

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