**This technical report has been made
electronically available on
the World Wide Web
through a contribution from
*Douglas G. LaVerne***

In honor of
Melvin E. LaVerne
***Scientist and Author at
Oak Ridge National Laboratory***

Office of Scientific and Technical Information
Office of Science
U.S. Department of Energy
August 2010

U.S. DEPARTMENT OF
ENERGY

*Office of
Science*

MASTER

The Oak Ridge Fog and Drift Code (ORFAD) User's Manual

M. E. LaVerne

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION FOR THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
Price: Printed Copy ~~\$6.00~~ ; Microfiche \$3.00
5.50

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the Energy Research and Development Administration/United States Nuclear Regulatory Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Contract No. W-7405-eng-26

Energy Division

THE OAK RIDGE FOG AND DRIFT CODE (ORFAD)
USER'S MANUAL

M. E. LaVerne

Date Published: January 1977

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

1

•

1

1

1

1

CONTENTS

	<u>Page</u>
ABSTRACT	1
1. INTRODUCTION	1
2. DESCRIPTION OF THE PHYSICAL MODEL	2
2.1 Plume Rise	2
2.2 Fog and Ice Occurrence	2
2.3 Drift Deposition	4
2.4 Salt Concentration	4
3. WEATHER DATA	6
3.1 Data Decoding	6
3.2 Tape Protection at ORNL	6
3.3 Special Handling of Data	7
4. CALCULATION OF PLUME RISE	8
4.1 Flux Buoyancy Parameter	8
4.2 Stability Parameter	9
4.3 Plume Rise for a Single Tower	10
4.3.1 Calm conditions	10
4.3.2 Windy conditions	10
4.3.2.1 Pasquill stability class ≤ 4	10
4.3.2.2 Pasquill stability class > 4	11
4.4 Plume Rise for Multiple Towers	11
5. CALCULATION OF FOG AND ICE FOG	12
5.1 Water Vapor Density of Plume	12
5.2 Saturation Deficit	12
5.3 Fog	13
5.4 Ice Fog	13
6. CALCULATION OF DRIFT DEPOSITION AND SALT CONCENTRATION	14
6.1 Determination of dC/dD	15
6.2 Determination of dD/dX	15
6.2.1 No evaporation; relative humidity $\geq 76\%$	15
6.2.2 Evaporation; relative humidity $< 76\%$	19
6.2.2.1 Evaporation distance	19
6.2.2.2 Saturated solution droplets; relative humidity $\geq 50\%$	19
6.2.2.3 Dry particles; relative humidity $< 50\%$	21
6.2.2.4 Solution for dD/dX	22
6.3 Drift Deposition and Salt Concentration	22
7. PROGRAM OPERATION	24
7.1 ORFAD Organization	24
7.2 ORFAD Subroutines and Functions	25
7.3 Input Preparation	27

	<u>Page</u>
7.3.1 Description of input quantities	27
7.3.2 Suggested input form	27
7.3.3 Input card deck	27
7.3.4 Options	34
7.3.4.1 Title and tape number	34
7.3.4.2 Dissolved solids concentration	34
7.3.4.3 Wet bulb depression	34
7.3.4.4 Contour plots	35
7.3.4.5 Condensed vapor fraction	35
7.3.4.6 Elevation for salt concentration	35
7.3.4.7 Sample plume and drift	35
7.3.4.8 Annual tables	36
7.4 Job Submission	36
7.4.1 Overall job deck makeup	36
7.4.2 Job control language	36
7.4.2.1 Jobnames	37
7.4.2.2 Plot data set names	39
7.4.2.3 The CLASS card	39
7.4.2.3.1 Execution time	39
7.4.2.3.2 The "SPECIAL" parameter	39
7.4.2.3.3 Output specifications	39
7.4.3 Overriding the disk programs	40
7.4.4 Program checkout using the data cell	40
7.5 Program Output	40
7.5.1 Tables	41
7.5.1.1 Fog and ice	41
7.5.1.2 Drift	42
7.5.1.3 Salt concentration	42
7.5.1.4 Annual tables	42
7.5.2 Plots	42
7.5.2.1 Horizontal plane	42
7.5.2.2 Vertical plane	42
8. REFERENCES	43
APPENDIX A. NOMENCLATURE	45
APPENDIX B. PASQUILL STABILITY CLASSES	49
APPENDIX C. DIFFUSION COEFFICIENTS	53
APPENDIX D. FALL DISTANCE OF EVAPORATING DROPLET	55
APPENDIX E. FORTRAN LISTING OF ORFAD PROGRAMS	57
APPENDIX F. SAMPLE ORFAD OUTPUT	101
APPENDIX G. TRANSLATION OF CODED WIND DIRECTIONS TO DIRECTION INDEXES	117

THE OAK RIDGE FOG AND DRIFT CODE (ORFAD)
USERS' MANUAL

M. E. LaVerne

ABSTRACT

ORFAD is a computer program written for the purpose of providing estimates of fog and drift resulting from the operation of wet cooling towers. The program uses hourly weather data from tapes.

The physical and calculational models are described, and detailed instructions are given for input preparation and running the program. A program listing and sample output are appended.

1. INTRODUCTION

ORFAD is a computer program originally developed for use in the preparation of environmental statements for central station power plants. Its purpose was, and is, to provide reasonable estimates of the incremental amounts of fog chargeable to the operation of wet cooling towers and of the salt drift deposited in the vicinity of a power plant using such towers.

Since publication of the original report,¹ a number of modifications has been made in the program, most notably in the method employed for drift calculation. These modifications, coupled with changes in program input preparation and operating procedures, have generated a need for an updating and fuller explanation of ORFAD. This report is intended to fill that need by providing a current explanation of the basis for ORFAD and detailed instructions for running the program.

In the preparation of this report, I have consulted on numerous occasions with John V. Wilson, the originator of ORFAD, in order to clarify obscure points. His very considerable assistance is gratefully acknowledged.

2. DESCRIPTION OF THE PHYSICAL MODEL

We assume that the effluent from a wet cooling tower forms a plume containing both pure water vapor and particulate matter, the latter consisting of saline water droplets whose total mass is substantially smaller than that of the vapor. The initial concentration of the dissolved solids, assumed to be principally NaCl, is equated to that in the cooling-tower water. The horizontal transport rate of the tower effluent is equated to wind speed, which is assumed to be independent of height.

The distribution of water vapor density is assumed to be Gaussian with respect to the plume centerline. Water droplets, on the other hand, are assumed to fall in distinct trajectories determined by droplet size and ambient conditions.

2.1 Plume Rise

The plume, because it will be warmer and will contain more water vapor than the surrounding air, will be buoyant and will rise from the tower. The wind will then bend the plume over toward the horizontal, forming a more or less gently rising curve downwind from the tower.

As the plume rises, it experiences shear forces along its edges as a result of the difference in velocity between the plume and the surrounding viscous air. Air is entrained into the plume, causing it to expand both laterally and vertically. The plume rise and air entrainment result in cooling and dilution of the contained moisture; as a consequence, the plume buoyancy is diminished, and the plume ultimately levels off at some maximum altitude.

Figure 1 illustrates the plume rise process schematically.

2.2 Fog and Ice Occurrence

The distribution of water vapor density about the plume centerline is assumed to be Gaussian, with greater lateral than vertical dispersion. (Refer to Fig. 1.)

Fig. 1. Schematic of model for fog calculation.

Condensation is presumed to occur if, at any point in the expansion of the plume, the vapor added by the plume causes the local vapor concentration to reach or exceed the saturation level; that is, if the plume adds enough moisture to overcome the saturation deficit of the entrained air, fogging occurs.

If fogging conditions exist and, in addition, the ambient temperature is below freezing, icing is assumed to occur.

2.3 Drift Deposition

The water droplets are assumed to travel in ballistic trajectories set by the rise velocity of the plume centerline and the fall velocity of a droplet relative to the plume centerline. Figure 2 is a schematic of the drift calculational model. The relative fall velocity, found from the relations of Hosler, Pena, and Pena,² is determined from the droplet size and relative humidity range. Relative humidity determines whether the droplets fall without evaporation, or evaporate to a saturated solution, or evaporate to dry particles. Implicitly, all droplets and particles are taken to be spherical.

A specified distribution of fractional mass with respect to particle diameter is used to assign droplets to classes. Each class has a nominal diameter and represents a certain fraction of the total drift discharged from the tower. Separate calculations are made for each class, and the results are summed to get the total drift.

2.4 Salt Concentration

The salt concentration is determined by dividing the terminal fall velocity into the previously found drift deposition.

Fig. 2. Schematic of model for drift calculation.

3. WEATHER DATA

The hourly or trihourly surface weather observations described in Ref. 3 are currently used by ORFAD. These observations are available on magnetic tape from the National Oceanographic and Atmospheric Administration (NOAA).⁴ The periods covered by the data, depending on location, range up to 25 years. Any one tape will generally carry data for 10 years.

From the numerous items recorded, ORFAD uses wind speed and direction, dry and wet bulb temperatures, total cloud cover, cloud ceiling, and obstructions to vision, the last item being defined as smoke, haze, or a combination thereof.

3.1 Data Decoding

In order to fit large quantities of data onto one tape, NOAA has employed a special type of coding involving the overpunching of the numbers. As a result, these data cannot be read directly by the usual FORTRAN input statements, and, therefore, a special decoding subroutine, SIGNCK, has been incorporated in ORFAD to interpret the data from tape.

Through 1964, data were recorded at intervals of 1 hr; for later years, data were recorded at 3-hr intervals, beginning at 0 hr Coordinated Universal Time (formerly Greenwich Mean Time). Hours having no data were left blank. Thus, tapes for 1965 and later are two-thirds empty, with the remaining third containing data similar to those for earlier years. ORFAD uses information on the geographic location of the towers to determine which hours on the tapes contain data.

In the tally after 1964, the program assumes that each reading applies to a 3-hr increment. If a period of several years spanning 1964 and 1965 is to be averaged, each hour through 1964 is given a weight of 1, and each trihourly reading thereafter is given a weight of 3.

3.2 Tape Protection at ORNL

In order to prevent accidental erasure or other damage to the original weather tapes purchased from NOAA, it is customary at ORNL to

copy the originals onto "pool" tapes and to run the program with these copies. Occasionally, the utility program doing the copying encounters a faulty record or other difficulty and omits a record from the copy. Thus, the copied weather data may not cover all hours of the year.

3.3 Special Handling of Data

The original weather data tapes use special coding for entries that are invalid or missing for any reason. ORFAD tallies but does not analyze these entries. An exception is made where the datum is relative humidity; if valid dry and wet bulb temperatures are present, they are used to calculate a relative humidity.

The weather data tapes provide for reporting fog, ground fog, and ice fog. Sometimes, when these fogs are reported, the dry and wet bulb temperatures will differ. The program tallies these hours of natural fog but does not analyze them. Presumably, if fog already exists, the cooling tower will not increase its incidence. Conversely, fog may not be reported when dry and wet bulb temperatures are equal. In this case, since natural fog is not present, any calculated fog is charged to tower operation. However, we should note that the situation is somewhat ambiguous, the temperatures having been recorded only to the nearest degree.

The data tapes use CALM as a wind direction. However, even with CALM recorded, the wind speed is sometimes given as nonzero. ORFAD will analyze these hours, assigning them to directions in proportion to the relative frequencies of the winds in those directions. When the wind speed is recorded as zero, the program substitutes 1 knot, on the basis that there is always a slight wind aloft.

4. CALCULATION OF PLUME RISE

The steps involved in finding the rise of the plume centerline consist of

1. determining a flux buoyancy parameter F for a single tower;
2. calculating a stability parameter s for the atmosphere;
3. obtaining the plume rise ΔH_1 for a single tower;
4. applying a correction to obtain the plume rise ΔH_N for N towers, given that for one tower.

4.1 Flux Buoyancy Parameter

The flux buoyancy parameter as defined by Hanna⁵ is an extension of that given by Briggs,⁶ incorporating an additional term to account for the release of latent heat from condensing moisture. For a moist plume in which a fraction f of the vapor condenses,

$$F = W_o g R_o^2 \left[1 - T_{eo}/T_{po} + (q_{po} - q_{eo}) (0.61 + f h_{fg}/C_p T_{po}) \right], \quad (1)$$

where

- F = the flux buoyancy parameter, m^4/sec^3 ,
- W_o = tower exit velocity, m/sec ,
- g = acceleration of gravity, $9.8066 m/sec^2$,
- R_o = tower inside radius at exit, m ,
- T_{eo} = environment temperature, K ,
- T_{po} = plume initial temperature, K ,
- q_{po} = plume initial mixing ratio, water vapor to dry air, g/g ,
- q_{eo} = environment mixing ratio, water vapor to dry air, g/g ,
- f = fraction of vapor condensed,
- h_{fg} = latent heat of water vapor, cal/g ,
- C_p = specific heat of air at constant pressure, $cal/g K$.

A complete listing of nomenclature may be found in Appendix A.

The term $0.61(q_{p0} - q_{eo})$ represents the additional buoyancy resulting from the difference in molecular weight between water vapor and air. The final term gives the additional buoyancy resulting from release of latent heat by condensation of some fraction of the original water vapor. An estimate of $f = 0$ is ordinarily used and will give conservative results in the sense of overestimating fog and drift.

The environmental temperature at the top of the cooling tower is determined from that at the base by using the temperature gradient corresponding to the Pasquill atmospheric stability class.

The water vapor in the plume is calculated on the basis that 25% of the heat is removed as sensible heat and 75% as latent heat. The initial temperature of the plume is then taken as the wet bulb temperature corresponding to the enthalpy of the air leaving the tower, which, in turn, is equated to the sum of the enthalpy entering the tower and the enthalpy increase inside the tower. The enthalpy increase is taken as the product of the circulating-water temperature range and the ratio of the water mass flow rate to the air mass flow rate. Enthalpy of the leaving air as a function of wet bulb temperature is calculated from

$$h = (t_w + 4.305)/(3.917 - 0.024846t_w) \quad 10 \leq t_w \leq 80 \quad (2a)$$

or

$$h = (t_w - 13.85)/(2.766 - 0.015652t_w) \quad 80 < t_w, \quad (2b)$$

where

h = enthalpy, Btu/lb,

t_w = wet bulb temperature, °F.

4.2 Stability Parameter

The stability parameter is defined by

$$s = g(\partial T_{eo}/\partial z + 0.01)/T_{eo}, \quad (3)$$

where s is stability parameter, sec^{-2} , and $\partial T_{eo}/\partial z$ is atmospheric temperature gradient, K/m. The temperature gradient is that corresponding to the Pasquill stability class determined from the given weather data. An explanation of this atmospheric stability classification is given in

Appendix B, together with a listing of the temperature gradients used in ORFAD.

4.3 Plume Rise for a Single Tower^{5,6}

The plume rise is dependent on whether calm or windy conditions prevail and, for the windy case, on the stability of the atmosphere.

4.3.1 Calm conditions

For all stability classes, the plume rise in calm air is given by

$$\Delta H_1 = 5.0F^{0.25} s^{-0.375} , \quad (4)$$

where ΔH_1 is plume rise for a single tower, m, and F and s are as previously defined.

4.3.2 Windy conditions

Under windy conditions, plume rise is further dependent on the stability of the atmosphere.

4.3.2.1 Pasquill stability class <4

For an unstable-to-neutral atmosphere, we calculate a quantity X^* defined by

$$X^* = 2.16F^{0.4} H_0^{0.6}, \quad (5)$$

where H_0 is the tower height or 304.8 m, whichever is smaller, that is,

$$H_0 = \min(H_T, 304.8) . \quad (6)$$

The plume rise is then given by

$$\Delta H_1 = 1.6F^{1/3} U^{-1} X^{2/3} , \quad (7)$$

where

$$X = \min(X_{me}, 3X^*) , \quad (8)$$

U is wind speed, m/sec, X_{me} is downwind distance from the tower, m, and F and X^* are as previously defined.

4.3.2.2 Pasquill stability class >4

For a stable atmosphere, the plume rise is again given by Eq. (7) but with X now being determined from

$$X = \min(X_{me}, 2.4U s^{-1/2}) . \quad (9)$$

4.4 Plume Rise for Multiple Towers

When a set of N towers forms a cluster with a maximum dimension L, the following relations given by Briggs⁷ are used to determine the plume rise for the cluster from that for a single tower:

$$\Delta H_N = \left(\frac{N + S}{1 + S} \right)^{1/3} \Delta H_1 \quad (10)$$

with

$$S = 6 \left(\frac{L}{N^{1/3} \Delta H_1} \right)^{3/2} , \quad (11)$$

where

N = number of towers in the cluster,

L = the maximum cluster dimension, m,

ΔH_1 = the plume rise for a single tower, m,

ΔH_N = the plume rise for the cluster, m.

When several cooling towers are in the same general vicinity, it is a matter of judgment whether they should be analyzed as a single cluster or separately. Briggs has suggested that the effects be analyzed both ways and the more conservative result selected.

After the number of towers in the cluster has been determined, a further judgment is needed to find the maximum dimension L. Ordinarily, the diameter of the smallest circle that circumscribes all the towers is a good choice.

5. CALCULATION OF FOG AND ICE FOG

In predicting the amount of ground-level fog induced by cooling-tower operation, the ORFAD program holds the tower accountable only if (1) naturally occurring fog was not reported and (2) the moisture content of the plume was sufficient to equal or exceed that required to saturate the air during the data period considered. If fog was reported, the occurrence will be tallied, but the remainder of the fog and ice calculation will be bypassed on the basis that if a fog already exists, the cooling tower will not increase its incidence.

5.1 Water Vapor Density of Plume

Under the previously mentioned assumption of a Gaussian distribution of water vapor within the plume, the vapor concentration at ground level is given by

$$\chi = \frac{Q}{\pi \sigma_y \sigma_z U} \exp \frac{-H^2}{2\sigma_z^2}, \quad (12)$$

where

- χ = water vapor concentration at ground level, g/m³,
- Q = water vapor mass velocity at tower exit, g/sec,
- H = plume centerline height above ground, m,
- σ_y = lateral diffusion coefficient, m,
- σ_z = vertical diffusion coefficient, m,
- U = wind speed, m/sec.

The diffusion coefficients are derived from the relations given by Briggs,⁸ as shown in Appendix C.

5.2 Saturation Deficit

The saturation deficit, or the increment in water vapor density required in order to saturate the air at the same dry bulb temperature, is given by

$$d_s = 7345 \frac{p_s - p_v}{T_a}, \quad (13)$$

where

d_s = saturation deficit, g/m³,

p_s = saturation vapor pressure at ambient dry bulb temperature,
in. Hg,

p_v = vapor pressure at ambient dry and wet bulb temperatures, in.
Hg,

T_a = ambient dry bulb absolute temperature, °R.

The constant multiplier, 7345, comes from a fit of the perfect gas law to water vapor at 15°C (59°F), followed by appropriate adjustment to yield d_s in the given units.

5.3 Fog

Fogging is assumed to occur if the added vapor concentration equals or exceeds the saturation deficit. We further assume that the fogging will occur over a distance of $1.25\sigma_y$ on either side of the downwind vector. This distance corresponds to Briggs' plume half-width,⁸ which is determined by equating the integral of the Gaussian distribution in the lateral direction to that of a uniform distribution having the same centerline concentration. The result is $\sqrt{\pi/2}\sigma_y$, that is, $1.25\sigma_y$, as given above. At the same distance X from the tower, the sector arc length is $\pi X/8$ (each sector covering 22 1/2°). The hours of fog are then adjusted by multiplying by the ratio of the fogging width to the arc length, that is, by $2.50\sigma_y/(\pi X/8)$. For example, a fog in which $2.50\sigma_y$ corresponds to a 10° sector would be tallied as 10/22.5 or 4/9 hr of fog on the average for each hour of clock time for that sector.

5.4 Ice Fog

The calculation for ice fog follows that for fogging. If the local moisture concentration exceeds the saturation deficit and, in addition, the temperature is below the freezing point, icing is assumed to occur. The hours of ice are adjusted, of course, in the same manner as the hours of fog.

6. CALCULATION OF DRIFT DEPOSITION AND SALT CONCENTRATION

As originally written and as described in Ref. 1, the drift calculation assumed that all drift particles of a certain original size class formed a plume having a Gaussian distribution of particle concentration about its own centerline. The centerline of the particle plume was assumed to lie below that of the vapor plume by the distance through which the finite-size drift particles had fallen, as determined by the method of Hosler et al.² The drift deposition was then calculated as the product of the ground-level concentration and the velocity of the final fall.

The above procedure was modified about the time of publication of Ref. 1. The diffusion model described above was abandoned, and a ballistic trajectory model in which all particles of a given initial size reach the ground at the same distance from the tower was employed. The method of Hosler et al.² was retained for computing the trajectories.

The trajectory model assumes that all droplets of a given original size fall to the ground at the same distance from the tower for the same conditions of wind, relative humidity, and atmospheric stability. This distance is that at which the total fall distance of the droplet just equals the local plume height above ground.

The fraction of droplets falling in the interval ΔX spanning X is approximated in ORFAD by

$$\Delta C = \Delta X \frac{dC}{dD} \frac{dD}{dX} , \quad (14)$$

where $X(D)$ is the distance at which a droplet of diameter D strikes the ground and $C(D)$ is the cumulative distribution function of the droplets.

The drift deposition can be determined from the fraction of drift falling at a given distance, the area of the corresponding 22.5° sector, and the total salt emission from the tower.

The airborne salt concentration is then found as the drift deposition rate divided by the velocity of the final fall.

6.1 Determination of dC/dD

The cumulative distribution function C is developed from the input data on droplet size distribution, as shown in Fig. 3. Integration of the basic input frequency function, shown in part (a) of the figure, is carried out over 25 subintervals spanning the droplet sizes given, resulting in the cumulative distribution function in part (b). Differencing of C at the boundaries of the 25 subintervals and dividing by the subinterval width yields dC/dD , as shown in part (c). Note that this function coincides with the original function except for scale unless a subinterval spans a boundary of the basic intervals. There, the derived function value is the weighted mean of the adjacent values. The weights are selected to be area preserving.

6.2 Determination of dD/dX

Hosler et al.² classify droplets into three categories: (1) those that do not evaporate at all, (2) those that evaporate to saturated solutions, and (3) those that evaporate to dry particles. In the first category, the fall velocity V_f is a constant dependent only on droplet diameter.

Within categories 2 and 3, the fall velocity of the evaporating droplet is determined by averaging an initial value dependent on the original size of the droplet and a final uniform value attained after some evaporation distance H_e . The residual droplet is assumed to strike the ground with this final velocity.

The assumption that all droplets and particles are spherical is implicit throughout the model.

6.2.1 No evaporation; relative humidity $\geq 76\%$

For the nonevaporating case, the quantity dD/dX can be derived analytically. First, we note for convenience that

$$\frac{dD}{dX} \equiv \frac{dV_f}{dX} \frac{dD}{dV_f} \quad (15)$$

Fig. 3. Development of cumulative distribution function and its derivative from the basic input frequency function.

From the relation

Time of fall = horizontal transport time

or

$$H/V_f = X/U, \quad (16)$$

we get

$$V_f = \frac{UH}{X}, \quad (17)$$

so that

$$\frac{dV_f}{dX} = \frac{1}{X} \left(V_f - U \frac{dH}{dX} \right). \quad (18)$$

[Actually, the sign of the right-hand side of Eq. (18) has been changed so that the drift depositions will be positive.]

We now consider the second factor dD/dV_f , for which we require V_f as a function of D . Because there is no evaporation, the droplets fall at uniform velocities characterized by their diameters, as shown in Fig. 4. Small droplets are assumed to follow Stokes' law, while medium and large droplets fall according to wind tunnel data⁹ reported in the International Meteorological Tables, 1966. The fall velocity V_f is given by the equations

$$V_f = D^2/33414 \quad D \leq 74.36 \text{ } \mu\text{m} \quad (19a)$$

$$V_f = 0.00445(D - 37.18) \quad D > 74.36 \text{ } \mu\text{m}, \quad (19b)$$

where V_f is fall velocity, m/sec, and D is original droplet diameter, μm . Then, we have, for $D \leq 74.36 \text{ } \mu\text{m}$,

$$\frac{dD}{dV_f} = \frac{1}{2} \frac{D}{V_f} \quad (20)$$

Fig. 4. Terminal fall velocity of water droplets. Data from International Meteorological Tables, 1966.

and

$$\frac{dD}{dX} = \frac{D}{2V_f X} \left(V_f - U \frac{dH}{dX} \right) . \quad (21)$$

For the larger droplets, we obtain

$$\frac{dD}{dV_f} = \frac{1}{0.00445} . \quad (22)$$

Hence, for $D > 74.36 \mu\text{m}$,

$$\frac{dD}{dX} = \frac{1}{0.00445X} \left(v_f - U \frac{dH}{X} \right). \quad (23)$$

6.2.2 Evaporation; relative humidity <76%

For relative humidity below 76%, evaporation is assumed to occur, with a droplet possibly attaining a saturated solution or becoming a dry particle. The fall velocity of the droplet or particle is found by averaging an initial velocity dependent on initial droplet size and a final velocity dependent on relative humidity. A repetitive solution now becomes necessary in order to determine the diameter of a droplet falling at a given distance.

6.2.2.1 Evaporation distance

The distance a droplet falls while evaporating depends on the initial droplet diameter and the ambient relative humidity. This distance has been given graphically by Hosler et al.² and is approximated in ORFAD by the expression

$$H_e = \frac{7.4146 \cdot 10^{-6} D^{2.667}}{(1 - r)^{1.079}}, \quad (24)$$

where H_e is evaporation distance, m, D is original droplet diameter, m, and r is relative humidity.

6.2.2.2 Saturated solution droplets; relative humidity $\geq 50\%$

In the relative humidity range from 50 to 76%, evaporation is assumed to occur until the droplets become saturated. The droplets then fall at a constant velocity dependent on their final diameter. The vertical distance the droplets fall before becoming saturated is given by Eq. (24). The initial velocity is that obtained from the appropriate one of Eq. (19).

A mass balance gives the diameter of the saturated droplet as

$$D_s = D \left[\frac{\rho_w c}{\rho_s c_s} \right]^{1/3}, \quad (25)$$

where

D_s = diameter of the saturated droplet, μm ,

D = diameter of the original droplet, μm ,

ρ_w = initial water density, g/cc,

= $1.0 + 0.7 c$, for $c \leq 0.05$ g/g,

ρ_s = saturated solution density, 1.197 g/cc,

c = initial concentration, g/g,

c_s = saturated solution concentration, 0.26 g/g.

The final fall velocity is given by

$$v_s = V_s \rho_s / \rho, \quad (26)$$

where v_s is final fall velocity of the saturated droplet, m/sec, V_s is fall velocity of a droplet of diameter D_s [from Eq. (19)], m/sec, and ρ is density of pure water, 1.0 g/cc.

The average fall velocity $\bar{V}_e$ during evaporation (i.e., while falling through the distance H_e) is then found as the mean of the initial and final fall velocities.

$$\bar{V}_e = (V_f + v_s)/2, \quad (27)$$

where V_f is the initial fall velocity of a droplet of original diameter D [from Eq. (19)], in m/sec. An evaporation time is computed from

$$t_e = \frac{H_e}{\bar{V}_e}, \quad (28)$$

where H_e is found from Eq. (24).

The droplet falls a distance H in time t , where

$$H = V_f t - \frac{1}{2} \frac{V_f^2 - v_s^2}{2H_e} t^2 \quad t < t_e \quad (29a)$$

or

$$H = H_e + (t - t_e) v_s \quad t \geq t_e \quad (29b)$$

The time t is the horizontal distance divided by the wind speed, as indicated in Eq. (16), and H must equal the plume height above ground at the same distance. The origin of the second term on the right-hand side of Eq. (29a) is explained in Appendix D.

6.2.2.3 Dry particles; relative humidity <50%

For relative humidities below 50%, the droplets are assumed to evaporate to dry particles. The particles then fall at a constant velocity dependent on their final diameters. Except for differing velocities, this category is handled in the same manner as the saturated solution droplets.

A mass balance gives the diameter of the dry particle as

$$D_d = D \left[\frac{\rho_w c}{\rho_d} \right]^{1/3}, \quad (30)$$

where D_d is diameter of the dry particle, m , ρ_d is dry particle density, 2.165 g/cc, and the remaining quantities are as previously defined.

The final fall velocity is given by

$$v_d = V_d \rho_d / \rho, \quad (31)$$

where v_d is final fall velocity of the dry particle, m/sec, and V_d is fall velocity of a particle of diameter D_d [from Eq. (19)], m/sec.

The average fall velocity $\bar{V}_e$ during the drying out period (i.e., while falling through the distance H_e) is then found as the mean of the initial and final fall velocities:

$$\bar{V}_e = (V_f + v_d)/2 . \quad (32)$$

The particle falls a distance H in the time t , where

$$H = V_f t - \frac{1}{2} \frac{V_f^2 - v_d^2}{2H_e} t^2 \quad t < t_e \quad (33a)$$

or

$$H = H_e + (t - t_e) v_d \quad t \geq t_e . \quad (33b)$$

6.2.2.4 Solution for dD/dX

Starting from the largest size, the program selects a drop size from the droplet distribution function. The distance from the tower at which this selected drop will strike the ground is then found from Eqs. (25) through (29) for saturated drops or from Eqs. (30) through (33) for dry particles, depending on the relative humidity.

This calculation, using successively smaller drops, is repeated until two consecutive drop sizes yield fall distances spanning the current deposition distance. The slope dD/dX of the diameter vs distance curve is then approximated by the ratio of the difference in the two drop sizes to the difference in the corresponding fall distances.

6.3 Drift Deposition and Salt Concentration

We calculate a source term Q_1 from

$$Q_1 = \frac{qF_w c}{C_{pw} \Delta t} , \quad (34)$$

where

Q_1 = total salt from the tower, g/sec,

q = heat rejection, cal/sec,

F_w = fraction of circulating water as drift,

c = concentration of salt in circulating water, g/g,

C_{pw} = specific heat of circulating water, 1.0 cal/g·°C,

Δt = circulating-water temperature range, °C.

Then

$$\chi_2 = Q_1 \Delta C / A, \quad (35)$$

where χ_2 is salt deposition rate, g/sec·m², A is area of deposition sector, m², and ΔC is fraction of total output salt deposited in sector. The area, radial width, and mean radius of a 22.5° sector are related by

$$\Delta X = \frac{8A}{\pi X}, \quad (36)$$

where ΔX is radial width of sector, m, X is mean radius of sector, m. Finally, using the definitions of ΔC from Eq. (14) and of ΔX from Eq. (36) we obtain

$$\chi_2 = \frac{8}{\pi} \frac{Q_1}{X} \frac{dC}{dD} \frac{dD}{dX} \quad (37)$$

as the equation for drift deposition rate (g/sec·m²). The equation applies whether droplet evaporation occurs or not, evaporation entering only into the determination of dD/dX .

Salt concentration (g/m³) is then found from the deposition by dividing by the final fall velocity, that is,

$$C_s = \chi_2 / v, \quad (38)$$

where v is final fall velocity, m/sec. The velocity v is found from Eqs. (19), (26), or (31), as appropriate to a nonevaporating droplet, a saturated solution droplet, or a dry particle, respectively.

7. PROGRAM OPERATION

This section presents a brief description of the organization of the ORFAD program and the subroutines and functions employed (exclusive of plotting and system-supplied routines), instructions on input preparation and job submission, and the program output. Some knowledge of the computer procedures is presumed; for example, the user is assumed to have appropriate computer charge numbers and jobname initials for use at ORNL.

7.1 ORFAD Organization

The overall organization of ORFAD is illustrated in Fig. 5, which shows the calling sequences for the subroutines and functions used by the program. A complete listing of the FORTRAN programs used may be found in Appendix E.

Fig. 5. Overall organization of ORFAD, showing the calling sequences for subroutines and functions.

Table 1 shows the intercommunication among the subprograms through the medium of COMMON storage, both labeled and blank.

7.2 ORFAD Subroutines and Functions

The main program calls, directly or indirectly, a number of subprograms that perform the functions described below. The plotting routines have not been included

<u>Name</u>	<u>Function</u>
READIN	Reads hourly weather data from tapes obtained from NOAA.
SIGNCK	Tests the validity of weather data and supplies the proper signs.
TAPCHK	Verifies that proper tape was mounted, checks tape data period and start date against requested values.
SAMPLE	Provides sample values of plume rise and drift for program verification.
PV	Calculates atmospheric vapor pressure from wet and dry bulb temperatures and elevation above sea level.
PVS	Calculates pressure of saturated vapor, in. Hg, at a given wet bulb temperature, °F.
PVSF	Calculates pressure of saturated vapor, psi, at a given wet bulb temperature, K.
BP	Determines the standard barometric pressure, in. Hg, at a given altitude in feet above sea level.
SØLAR	Provides equation of time and declination of sun for use in subroutine STACØN.
PRISE	Calculates plume rise above stack top as a function of downwind distance.
TRAJ	Calculates various quantities used for drift calculation in main program, such as evaporation distances and fall velocities for saturated and dry particles.
STACØN	Calculates the Pasquill atmospheric stability class.
SYSZ	Calculates the diffusion coefficients σ_y and σ_z as functions of downwind distance and stability class.
TABLE	Prints output tables.

Table 1. Blank and labeled COMMON storage in ORFAD

Program name	COMMON storage names ^a													
	MAINC	TAPE	SAMP	DROPS	STAB	Blank	TABUL	TITLER	LGND	CONT	Q7QUAD	SUB	SCANC	IBREAK
MAIN	X	X	X	X	X	X	X	X	X					
READIN		X												
TAPCHK		X												
SAMPLE			X	X		X								
TRAJ			X	X										
STACON					X									
PRISE						X								
SYSZ						X								
TABLE							X							
BLOCK DATA								X	X					
CONPLT	X							X						
RCONTR											X			
LTRIS										X				
UTRIS										X				
Q7PLOT											X			
CONTUR										X		X		
SUBPLT										X		X		
BOUNDS	X													
SCAN	X							X					X	X
PLTINT	X													
PLOTT1	X							X					X	X

^aSOLAR, SIGNCK, PREP, PV, PVS, PVSF, and BP have no COMMON storage. Programs from CONPLT down are plotting routines. PREP is also a plotting routine.

7.3 Input Preparation

This section discusses the preparation of input for ORFAD, starting with descriptions of the input quantities required, together with their names and locations within the input deck, and followed by a suggested input form for convenient organization of the data. Sample numbers have been inserted. An example of an input deck, as it might be punched on cards from the sample input, is given next. Finally, the use of available options is discussed, together with some of their consequences.

7.3.1 Description of input quantities

Table 2 lists all the input quantities required for a computer run with program ORFAD, giving location in the card deck, the FORTRAN name, and a short description of each quantity. Some comments relative to the use (or misuse) of the quantities have been included.

7.3.2 Suggested input form

Figure 6 shows a suggested input form for use with ORFAD, complete with a set of sample input numbers. Note that, where relevant, units have been specified at the extreme right. The monthly concentration array C0NCM has been labeled with the months to which the respective numbers apply.

7.3.3 Input card deck

The input card deck for ORFAD contains, for each case, 12 cards giving the tower dimensions and operating parameters, miscellaneous output instructions such as the distance at which calculations will be performed, the number and type of contours to be plotted, etc. Figure 7 shows the input quantities from Fig. 6 as they could be punched on cards.

All input cards, except the first of each set of 12, are read with an 8E10.3 format. With a decimal point present, the numbers may be punched anywhere within their assigned columns. However, proofreading is easier if numbers are started in columns 1, 11, 21, etc. Very small or very large numbers may be punched in an E-format, but care must be taken to avoid misinterpretation by the program. For example, the 0.0000001 in

Table 2. Locations, names, and descriptions of input quantities

Card No.	Column	FORTTRAN name	Description
1	1-72	LØC	Any descriptive title may be inserted in these columns. The title will be printed on the first page of the output, on the first page of each set of annual tables, and on the first page of the overall-average tables. <u>CAUTION</u> : Do not allow the title to extend into any of columns 73-80. Any nonnumeric characters that appear in these columns will cause the operating system to terminate the program with a note to the effect that you have used an "illegal decimal character." Be warned.
	73-80	TAPEN	The weather tape number is optional; if it is supplied, subroutine TAPCHK will do various things for you, such as verifying that the correct tape was mounted, that the data period requested is compatible with that actually on the tape, etc. It is the user's responsibility to see that the TAPCHK arrays contain information covering the requested tape. If TAPEN is omitted, no checking is done, but a note to that effect is printed.
2	1-10	HT	This is the height of the stack top above local ground level, m.
	11-20	RA	RA is the temperature range, i.e., the temperature of the circulating water entering the tower minus the temperature of that leaving. Temperatures are in °F.
	21-30	APP	This is the ratio of the circulating-water mass flow rate to the air mass flow rate through the tower.
	31-40	RØ	Inside radius of the top of the tower, m.
	41-50	WØ	Exit velocity of the stack gases, m/sec.
	51-60	HEATT	Total heat rejected, Mcal/sec. If there are several towers in the cluster, use the sum for all.
	61-70	LAT	Latitude of the tower, in degrees N. If the latitude is south, enter the latitude as a negative number. Note that the entry must be in decimal degrees, not degrees, minutes, and seconds.

Table 2 (continued)

Card No.	Columns	FORTTRAN name	Description
2	71-80	LØNG	Longitude of the tower, in degrees W. If the longitude is east, enter the longitude as a negative number. Use decimal degrees.
3	1-10	ELEV	Elevation of tower base above mean sea level, ft.
	11-20	FRACDR	Mass fraction of circulating water carried out of the tower as drift.
	21-30	DRCLAS	Number of size classes of drift particles. The number of entries on cards 6 and 7 should agree with this number. Failure to agree can lead either to a terminated computer run or erroneous results. The maximum value for DRCLAS is currently 8.
	31-40	CØNC	Concentration of dissolved solids in the cooling tower water, mass fraction.
	41-50	YRS	Number of years for which data are to be analyzed.
	51-60	ZØNE	Time zone of cooling tower. Eastern Standard Time Zone is 5; Central Standard is 6, etc. ZØNE is used by the program to determine which hours should have data on the tapes for the years after 1964.
	61-70	START	Last two digits of the first year to be analyzed. This number is used in conjunction with YRS to determine the period to be analyzed. For example, to analyze the years 1959 through 1967, enter 9 in columns 41-42 and 59 in columns 61-63.
	71-80	WBD	This quantity, the wet bulb depression, in °F, may be used to resolve the ambiguous cases where wet and dry bulb temperatures have been reported equal on the weather tape but natural fog was not reported. If a greater-than-zero value is entered for WBD, it is used for calculating the saturation deficit in the ambiguous cases.
4	1-80	CØNCM	Monthly concentration array, January through August. These eight months are entered in the eight 10-digit fields on the card, columns 1-10, 11-20, etc.

Table 2 (continued)

Card No.	Columns	FORTTRAN name	Description
5	1-40	CØNCM	Monthly concentration array, September through December. The last four months are entered in the first four 10-digit fields.
6	1-80	DIAM	Enter the characteristic diameters , μm , of the drift particles in each of the DRCLAS size classes. As before, the numbers are entered in up to eight 10-digit fields, columns 1-10, 11-20, etc.
7	1-80	DRFRAC	Weight fractions for the drift particles in each of the DRCLAS classes. Enter in up to eight 10-digit fields, as before.
8	1-10	DNUM	Number of drift contours to be plotted. The actual values used are selected by the program. The program starts with the highest value that can be plotted, and succeeding contour values are decreased by a factor of 2 until DNUM contours have been plotted.
	11-20	TØTTWR	Total number of cooling towers.
	21-30	TØWERS	Number of cooling towers in a single cluster.
	31-40	CLUSIZ	Maximum dimension of a single cluster, m. This will ordinarily be the diameter of the smallest circle enclosing all the towers of a cluster.
	41-50	FRACØN	Fraction of the plume vapor that condenses. The fraction determines the added buoyancy resulting from release of latent heat in the plume. A value of zero should yield conservative fogging and drift estimates (conservative in the sense of overestimation).
	51-60	XNDIS	Number of distances at which calculations of fog, drift, etc., will be made. The maximum number currently is 19.
	61-70	HSALT	The height above ground, m, at which the airborne salt concentration is to be calculated.
	71-80	SAMP	This parameter is used to trigger a calculation of a sample plume rise and drift. If SAMP = 0. (or, equivalently, is left blank), the sample calculation is bypassed. If SAMP = 1., the sample calculation is performed, but the computer run is terminated immediately thereafter. SAMP = 2. (or greater) produces the sample calculation and continues the computer run.

Table 2 (continued)

Card No.	Columns	FORTTRAN name	Description
9	1-80	XMI	Distance array, miles. These are the distances downwind from the towers at which calculations for fog, drift, etc., will be made. This card contains the first eight distances in the standard 10-digit fields.
10	1-80	XMI	This card continues the distance array, assuming more than eight values are used. If XNDIS is ≤ 8 , leave this card blank.
11	1-30	XMI	This card completes the distance array. If XNDIS is ≤ 16 , leave this card blank.
12	1-10	XNUM	Number of fog, ice, and salt contours to be plotted. Values on the contours are selected by the program, as explained for DNUM (card 8).
	11-20	VPLT	Enter any positive number to get plots in the 16 compass directions in vertical planes. Contour values are selected as previously explained.
	21-30	ANNUM	Enter any positive number to get annual fog, drift, ice, and salt tables. If ANNUM is entered as zero (or left blank), no annual tables but only the overall averages will be printed. This provides for considerable saving in lines printed.

		Date 6 Aug 75		
Card No.	Cols.	FORTTRAN name	Description	Value
1	1-72	L0C	Title. Example Cooling Tower Calculation - Natural Draft - Case 1	
	73-80	TAPEN	Weather tape number	2088.
2	1-10	HT	Stack top height above ground, m	137.
	11-20	RA	Temperature range, °F	25.
	21-30	APP	Water to air mass flow ratio, g/g	2.67
	31-40	R0	Tower inside radius at exit, m	33.5
	41-50	W0	Stack gas exit velocity, m/sec	4.2
	51-60	HEATT	Total heat rejected, Mcal/sec	1128.1
	61-70	LAT	Latitude of towers, °N (minus if S)	41.27
	71-80	L0NG	Longitude of towers, °W (minus if E)	73.95
3	1-10	ELEV	Tower base elevation above MSL, ft	20.
	11-20	FRACDR	Fraction of water as drift, g/g	0.00005
	21-30	DRCLAS	Number of drift size classes, ≤8	4.
	31-40	C0NC	Concentration of dissolved solids, g/g	
	41-50	YRS	Years of data to analyze	10.
	51-60	Z0NE	Tower time zone, FST = 5	5.
	61-70	START	Last two digits of first year	59.
	71-80	WBD	Wet bulb depression, °F	
4	1-10	C0NCM	Dissolved solids monthly concentration array, optional use overrides C0NC, g/g	0.00054 Jan
	11-20			0.0022 Feb.
	21-30			0.000036 Mar.
	31-40			0.0000001 Apr.
	41-50			0.000046 May
	51-60			0.0025 Jun.
	61-70			0.008 Jul.
	71-80			0.01 Aug.
5	1-10	C0NCM	Dissolved solids monthly concentration array, concluded, g/g	0.009 Sep
	11-20			0.0048 Oct.
	21-30			0.0006 Nov.
	31-40			0.0004 Dec.
6	1-10	DIAM	Diameter array for drift particles, um; number of entries should agree with DRCLAS, maximum = 8	50.
	11-20			100.
	21-30			150.
	31-40			200.
	41-50			
	51-60			
	61-70			
	71-80			

Note Format for card 1 = 18A4, F8.0, for cards 2-12, 8F10.3
The default input value for any unspecified quantity = 0.0

		Date 6 Aug 75		
Card No.	Cols.	FORTTRAN name	Description	Value
7	1-10	DRFRAC	Weight fraction array for drift particles, entries should sum to 1.0, number of entries should agree with DRCLAS, maximum = 8	0.2
	11-20			0.46
	21-30			0.24
	31-40			0.1
	41-50			
	51-60			
	61-70			
	71-80			
8	1-10	DNUM	Number of drift contours to plot	5.
	11-20	T0TTWR	Total cooling towers	1.
	21-30	T0WERS	Cooling towers per cluster	1.
	31-40	CLUSI7	Maximum cluster dimension, m	67.
	41-50	FRAC0N	Fraction of vapor condensed	
	51-60	XNDIS	Number of distances, maximum = 19	19.
	61-70	HSALT	Height at which salt concentration is calculated, m	8.
	71-80	SAMP	= 0. No sample plume = 1 Sample plume only ≥ 2. Sample plume + full calculation	2.
9	1-10	XMI	Distance array, miles, distances downwind from towers at which calculations will be made, number of entries should agree with XNDIS maximum = 19	0.25
	11-20			0.5
	21-30			0.75
	31-40			1.
	41-50			1.25
	51-60			1.5
	61-70			1.75
	71-80			2.
10	1-10	XMI	Distance array, continued, miles	2.25
	11-20			2.5
	21-30			2.75
	31-40			3.
	41-50			3.25
	51-60			3.5
	61-70			3.75
	71-80			4.
11	1-10	XMI	Distance array, concluded, miles	4.25
	11-20			4.5
	21-30			5.
12	1-10	XNUM	Number of fog, ice, and salt contours to plot	4.
	11-20	VPLT	Any positive number to get vertical plane plots	
	21-30	ANNUM	Any positive number to get annual fog, drift, ice, and salt tables	

Fig. 6. Suggested input form for ORFAD with sample values inserted.

Fig. 7. ORFAD input deck as punched from the data of Fig. 6.

The first card of each set is read with an 18A4, F8.0 format; as a result, the title must not extend past column 72. Information other than numeric (or blanks) in columns 73-80 will cause immediate termination of the computer run.

7.3.4 Options

Some of the input items in ORFAD are optional in the sense that the program will function with or without them. However, the output, and, to some extent, the calculation will depend on whether the options are exercised.

In general, any unspecified input number will be taken as zero. This means that if an option requires a number in order to be activated, leaving the quantity blank (or, equivalently, inserting zero) omits the option. The general principle is that optional items must be requested.

7.3.4.1 Title and tape number

Both items on this card are optional. A title need not be given, although it is certainly convenient for output identification. The tape number similarly may be omitted with no untoward effects. If the tape number is omitted, no checking is done, and a message to that effect is printed in the case output. If a tape number is given for a tape on which the checking subroutine has no data, a warning message is also printed in the output.

7.3.4.2 Dissolved solids concentration

The dissolved solids concentration may be specified as a single quantity to be used for the entire year or as a set of monthly values. The program determines which to use by examining the CØNCM array. If the array is empty, CØNC (the yearly concentration) is used; otherwise, CØNCM is used. Hence, one or the other must be specified. If the array is nonzero, CØNC is irrelevant and will be ignored (actually, ORFAD, for various reasons, will take it to be 1.0).

7.3.4.3 Wet bulb depression

In the normal course of events, if the wet and dry bulb temperatures are reported as equal (on the weather tape) and fog has not been reported, ORFAD will calculate a period of additional fog induced by the tower irrespective of the amount of added vapor. Unfortunately, the situation is ambiguous; the weather tape temperatures are reported to whole

degrees only, so that the real difference could be up to 1° when the two temperatures are reported equal. The wet bulb depression (WBD) permits the user to resolve the ambiguity, if desired, by stating what difference to use in place of zero. WBD is then used in setting the saturation deficit utilized in determining whether fog occurs, but only when wet and dry bulb temperatures have been reported equal. Lacking anything better, 0.5 could be used for WBD on the basis that this is the mean of the zero minimum and the 1.0 maximum.

7.3.4.4 Contour plots

DNUM and XNUM specify the number of contours to be plotted in the horizontal plane. Specifying any nonzero value for VPLØT generates a set of vertical plane plots, one for each of the 16 compass directions used. About 135 cards are punched per case if horizontal plane plots only are called for, and roughly five times that many are punched if vertical plane plots are also requested. Since the default limit on punched cards is 1000, this option can cause trouble unless the user is watchful.

7.3.4.5 Condensed vapor fraction

FRACØN, the fraction of vapor condensed, affects the plume rise through release of latent heat. Ordinarily, this quantity will be left blank. However, if the user has reason to believe that condensation is occurring or if he just wants to determine the effect of the condensation, the parameter may be set to some positive fraction.

7.3.4.6 Elevation for salt concentration

The parameter HSALT determines the height above ground at which concentration of airborne salt will be computed. Ground level is obtained if the quantity is left blank.

7.3.4.7 Sample plume and drift

Setting SAMP to some nonzero value directs the computer to calculate a sample plume and drift for program-generated combinations of distance, wind speed, stability class, relative humidity, etc. If only the sample

calculation is wanted, use 1.0 for SAMP; this will terminate the calculation immediately after the sample output. Setting SAMP = 2.0 or more will yield the sample values and continue the calculation.

7.3.4.8 Annual tables

If ANNUM is specified, annual tables of fog, ice, drift, and salt will be produced. For a calculation covering a 10-year period, this results in the generation of 89 pages of output; leaving ANNUM blank reduces the output to about 9 pages. The annual averages over the entire period are produced in any event, so that, unless results for individual years are required, leaving ANNUM blank is strongly recommended.

7.4 Job Submission

Job submission is treated here only to the extent necessary for the running of ORFAD jobs at ORNL. The job deck makeup and job control language will be covered only in that detail felt necessary for a reasonable chance of successful operation. Some variations are provided for the benefit of the experimentally minded.

7.4.1 Overall job deck makeup

The current version of ORFAD is stored on the on-line disk at ORNL, and the sample job deck shown in Table 3 is set up to use that version. Note that hexadecimal decks may be incorporated to supplant any of the routines on disk. Table 4 is a more general job deck, in which both FORTRAN and hexadecimal-level card decks may be used to replace any disk versions of programs. Note the differences between Tables 3 and 4; in particular, note that the cataloged procedure FØRTHLG is called for in Table 3, whereas FØRTHCLG is required in Table 4.

7.4.2 Job control language

The job control language (JCL) portions required for using ORFAD are set forth in Tables 3 and 4. This section discusses a few of the more commonly experienced stumbling blocks encountered in their use. Any greater treatment of the rather esoteric subject of JCL would be neither appropriate nor feasible here.

Table 3. Sample job deck with ORFAD on the on-line disk at ORNL^a

```
//MELF JOB (98765), 'Y-12 9204-1 LA VERNE'
// *CLASS CPU91=20M, SPECIAL=TAPE, IØ=15
// EXEC FØRTHLG, PARM.GØ='EU=-1, DUMP=H', REGION.GØ=250K
//LKED.SYSLIB DD
//          DD
//          DD
//          DD DSNAME=LABLIB, DISP=SHR
// DD DSNAME=A8.G1, P31394.C10207.CHANDLER.GRAPHICS,
// VØL=REF=ZZZZZ, DISP=SHR
//LKED.PLØTSUBS DD DISP=(SHR, PASS), DSN=JGSPLØTH
//LKED.FT33F001 DD DISP=SHR, UNIT=2314, VØL=SER=ZZZZZ,
// DSNAME=ØNLINEA.MELHF235.ØRFAD
//LKED.SYSIN DD *
```

(Any hexadecimal decks go here. Use is optional.)

```
INCLUDE PLØTSUBS
INCLUDE FT33F001
/*
//GØ.FT49F001 DD UNIT=IN2ØU2, DCB=(RECFM=VS, LRECL=3204, BLKSIZE=3208),
// DISP=(NEW, KEEP), SPACE=(3208, (30, 10), RLSE), DSN=PLØT00.MELF
//GØ.FT51F001 DD SYSØUT=A
//GØ.FT07F001 DD SYSØUT=B, DCB=(RECFM=FB, LRECL=80, BLKSIZE=3520)
//GØ.FT08F001 DD UNIT=TAPE9, VØL=SER=8, LABEL=(1, NL), DISP=ØLD,
// DCB=(RECFM=F, BLKSIZE=495)
//GØ.FT05F001 DD *
```

(Input decks go here)

```
/*
//
```

^aCaution: If hexadecimal decks are used, remember that they will supersede any routines with the same names occurring on the disk.

7.4.2.1 Jobnames

The computer operating system at ORNL views dimly any attempt to run more than one job with a given jobname at one time. At best, such an attempt delays execution of the second job until the first one has left the system; at worst, cancellation could result. The solution is to use a series of jobnames when multiple runs are anticipated, say, MEL1, MEL2,

Table 4. Sample job deck using FORTRAN decks with ORFAD
on the on-line disk at ORNL^a

```
//MEL1 J0B (98765),'Y-12 9204-1 LA VERNE'
//*CLASS CPU91=20M,SPECIAL=TAPE,I0=15
// EXEC F0RTHCLG,PARM.G0='EU=-1,DUMP=H',REGION.G0=250K
//F0RT.SYSIN DD *
```

(FORTRAN decks go here)

```
/*
//LKED.SYSLIB DD
//          DD
//          DD
//          DD DSN=LABLIB,DISP=SHR
// DD DSN=A8.G1.P31394.C10207.CHANDLER.GRAPHICS,
// VOL=REF=ZZZZZZ,DISP=SHR
//LKED.PLOTSSUBS DD DISP=(SHR,PASS),DSN=JGSPL0TH
//LKED.FT33F001 DD DISP=SHR,UNIT=2314,VOL=SER=ZZZZZZ,
// DSN=0NLINEA.MELHF235.0RFAD
//LKED.SYSIN DD *
```

(Hexadecimal decks, if used, go here)

```
INCLUDE PLOTSSUBS
INCLUDE FT33F001
/*
//G0.FT49F001 DD UNIT=IN20U2,DCB=(RECFM=VS,LRECL=3204,BLKSIZE=3208),
// DISP=(NEW,KEEP),SPACE=(3208,(30,10),RLSE),DSN=PL0T00.MEL1
//G0.FT51F001 DD SYS0UT=A
//G0.FT07F001 DD SYS0UT=B,DCB=(RECFM=FB,LRECL=80,BLKSIZE=3520)
//G0.FT08F001 DD UNIT=TAPE9,VOL=SER=8,LABEL=(1,NL),DISP=0LD,
// DCB=(RECFM=F,BLKSIZE=495)
//G0.FT05F001 DD *
```

(Input decks go here)

```
/*
//
```

^aCaution: If hexadecimal decks are used, remember that they will supersede any routines of the same names occurring on the disk. Similarly, FORTRAN decks will take precedence over both hexadecimal decks and routines on the disk.

etc., and never reuse any jobname until that particular job has been returned.

7.4.2.2 Plot data set names

Similar considerations apply to the plot data set name on the GØ.FT49F001 data definition card (PLØT00.MEL1 in Table 4). Here the probable result is operator cancellation of the run because the plot data set will be reported as "unavailable." One simple solution is (1) to follow the recommendation in the immediately preceding paragraph and (2) to make the plot data set qualifier (in the example, MEL1) and the jobname equal.

7.4.2.3 The CLASS card

The /*CLASS card is essential for running ORFAD at ORNL. If the CLASS card is absent, the system will assign parameters appropriate to a class B job, but since ORFAD is inherently a class F job, the job will fail.

7.4.2.3.1 Execution time

Execution time is specified in the CPU91 parameter of the CLASS card. Running time for ORFAD is 15 to 20 min; 15 may be marginal and 20 should be adequate for one case. For multiple cases, allow 20 min each to be safe, that is, set CPU91=40M for two cases, etc. In most cases, you will use less time.

7.4.2.3.2 The "SPECIAL" parameter

The SPECIAL=TAPE entry must be present. Leaving it out will cause cancellation of the job.

7.4.2.3.3 Output specifications

As mentioned previously, output will depend on the options exercised. Reasonable "guesstimates" seem to be about 3200 lines, 600 to 700 cards, and 15,000 input-output (IØ) operations per case. System assigned (default) values at ORNL are 10,000 lines, 1000 cards, and 10,000 IØ.

Thus, a CLASS card for four cases with most options in use might read:
//*CLASS CPU91=80M,LINES=15,CARDS=30,IØ=60,SPECIAL=TAPE. Note that
lines and IØ are given in thousands, cards in hundreds.

7.4.3 Overriding the disk programs

It is inevitable that, sooner or later, some ORFAD user will find that he prefers a different way of performing some calculation in the program. Figure 5 and Table 1 have been presented previously in order to assist in making such changes. For further assistance, Appendix E contains a complete listing of ORFAD, both the main program and all subprograms except for system-supplied routines.

The disk programs may be overridden by using either hexadecimal decks with the job deck of Table 3 or a combination of FORTRAN and hexadecimal decks with the job deck of Table 4.

7.4.4 Program checkout using the data cell

As an aid in checking out program modifications, two sets of weather data, each for one year, have been placed on a data cell at ORNL. Use of the data cell removes the necessity for mounting a tape and leads to faster turnaround of debugging runs.

Necessary changes in the JCL for data cell use are as follows. The CLASS card reduces to //*CLASS CPU91=5M (note that SPECIAL=TAPE has been deleted). Other items on the card will generally be within the default ranges and need not be specified. The FT08F001 card (including its continuation) must be replaced, as shown in Table 5.

7.5 Program Output

The output from ORFAD consists of both tabular and graphical presentations of additional hours of fog and ice, drift deposition, and salt concentration resulting from cooling tower operation. A sample set of output may be found in Appendix F.

Table 5. Job control language changes required for data cell use at ORNL^a

(A) Data period prior to 1965; data at 1-hr intervals

```

/** HOUSTON TX. WEATHER DATA 1/59 - 12/59 (ONE-HOUR INTERVALS)
//GØ.FT08F001 DD UNIT=2321,VØL=SER=DCZZZZ,
// DSN=ØNLINEA.ECLDE818.HOUSTON,DISP=SHR

```

(B) Data period in 1965 or later; data at 3-hr intervals

```

/** NASHVILLE, TN. WEATHER DATA 1/65 - 12/65 (THREE-HOUR INTERVALS)
//GØ.FT08F001 DD UNIT=2321,VØL=SER=DCZZZZ,
// DSN=ØNLINEA.ECLDE818.NASHVLE,DISP=SHR

```

^aThe first card of each set (beginning with /**) is an optional comment card and may be omitted.

7.5.1 Tables

Four types of tables are produced: one for additional fog, one for additional ice fog, one for drift, and one for salt concentration at a selected height.

7.5.1.1 Fog and ice

For fog and ice, the program prints out the annual number of additional hours of fog (not counting naturally occurring fogs) and ice that would be experienced as a result of full-time operation of the cooling tower. These values are printed for specified discrete distances from the tower for each of the 16 wind directions (points) used. The occurrences of "calms" are distributed among the 16 points in proportion to the relative frequencies of winds in those directions.

7.5.1.2 Drift

For drift, the program prints, for the same locations and hours as used for fogs, the annual rate of deposition per unit area of the dissolved solids from the drift in grams per year per square metre of horizontal surface. The amount of drift deposited in liquid form is neither calculated nor printed.

7.5.1.3 Salt concentration

The salt concentration is printed as grams per cubic metre at a pre-selected altitude above ground level. The arrangement and arguments for the tables are similar to those for drift.

7.5.1.4 Annual tables

If annual tables are requested, the above tables are printed for each of the years in the specified period. In any event, the annual averages for the entire period are printed as the last set of tables.

7.5.2 Plots

Optionally, the printed tables may be supplemented by contour maps plotted in either the horizontal or the vertical plane or in both.

7.5.2.1 Horizontal plane

Contour maps for each of the four quantities in the printed tables may be plotted in the horizontal plane for the overall period averages. Points on the contour maps are located as on an ordinary geographical map, and the numerical value on the contour line indicates the amount of fog, drift, etc., occurring thereon. Since the directions are true directions, when the wind is, say, from the north, the drift will fall south of the tower and will be plotted there.

7.5.2.2 Vertical plane

Optionally, contour maps of hours of fog may also be plotted in the vertical plane for each of the 16 compass directions from the tower.

8. REFERENCES

1. J. V. Wilson, ORFAD, A Computer Program to Estimate Fog and Drift from Wet Cooling Towers, ORNL/TM-4568 (January 1975).
2. C. L. Hosler, J. Pena, and R. Pena, Determination of Salt Deposition Rates from Drift from Evaporative Cooling Towers, Department of Meteorology, Pennsylvania State University, University Park, Pa. (May 1972).
3. Tape Reference Manual, Airways Surface Observations, TDF 14, U.S. Weather Bureau (now National Oceanographic and Atmospheric Administration), undated.
4. Weather data tapes from NOAA, National Weather Records Center, Federal Office Building, Asheville, N.C. 28801.
5. S. R. Hanna, Meteorological Effects of Cooling Tower Plumes, NOAA-ATDL Report, ATDL Contribution No. 48 (January 1971).
6. G. A. Briggs, Jr., Plume Rise, AEC Critical Review Series, TID-25075 (November 1969).
7. G. A. Briggs, Jr., Plume Rise from Multiple Sources, NOAA-ATDL Report, ATDL Contribution No. 91 (March 1974).
8. G. A. Briggs, Jr., Diffusion Estimation for Small Emissions, NOAA-ATDL Draft Report, ATDL Contribution File No. 79 (May 1973).
9. S. Letestu (ed.), International Meteorological Tables, WMO-No. 188.TP. 94, Secretariat of the World Meteorological Organization, Geneva, Switzerland, 1966.

,

,

,

,

,

,

Appendix A

NOMENCLATURE

a	Acceleration	m/sec^2
a_s	Solar altitude	deg
A	Sector area	m^2
B	Diffusion coefficient parameter	
c	Concentration of salt in circulating water	g/g
c_s	Salt concentration in saturated droplet	g/g
C	Cumulative distribution function for droplets	
C_s	Salt concentration in air	g/m^3
ΔC	Incremental droplet deposition	
C_p	Specific heat of air	$\text{cal/g}\cdot^\circ\text{C}$
C_{pw}	Specific heat of water	$\text{cal/g}\cdot^\circ\text{C}$
d_s	Saturation deficit	g/m^3
D	droplet diameter	μm
D_d	Diameter of dry particle	μm
D_s	Diameter of saturated solution droplet	μm
f	Fraction of condensation in plume	
F	Flux buoyancy parameter	m^4/sec^3
F_w	Fraction of circulating water as drift	
g	Acceleration of gravity	m/sec^2
h	Enthalpy of air at tower exit	Btu/lb
h_{fg}	Latent heat of water	cal/g
H	Plume height	m
ΔH_1	Plume rise for one tower	m
ΔH_N	Plume rise for N towers in a cluster	m
H_e	Evaporation distance	m
L	Maximum dimension of a tower cluster	m
p_s	Saturation vapor pressure at dry bulb temperature	in. Hg
p_v	Vapor pressure at ambient temperature	in. Hg
q	Tower heat rejection	cal/sec
q_{eo}	Environment mixing ratio (water vapor to dry air)	g/g

q_{po}	Initial plume mixing ratio (water vapor to dry air)	g/g
Q	Water vapor mass velocity at tower exit	g/sec
Q_1	Total salt from tower	g/sec
r	Relative humidity	
R_o	Tower inside radius at exit	m
R_y	Lateral plume radius	m
R_z	Vertical plume radius	m
s	Stability parameter	sec ⁻²
S	Briggs parameter for multiple plume rise	
t	Evaporating droplet fall time	sec
Δt	Circulating-water temperature range	°C
t_w	Wet bulb temperature for enthalpy h	°F
T_a	Ambient dry bulb temperature	°R
T_{eo}	Environment temperature	K
T_{po}	Plume initial temperature	K
$\partial T_{eo} / \partial z$	Atmospheric temperature gradient	K/m
U	Wind speed	m/sec
v	Final velocity of a droplet	m/sec
v_d	Final velocity of a dry particle	m/sec
v_s	Final velocity of a saturated solution droplet	m/sec
V_d	Initial velocity of droplet of diameter D_d	m/sec
$\bar{V}_e$	Average fall velocity during evaporation	m/sec
V_f	Initial velocity of droplet of diameter D	m/sec
V_s	Initial velocity of droplet of diameter D_s	m/sec
W_o	Tower exit velocity	m/sec
X^*, X_{me}, X	Downwind distance from tower	m
ΔX	Width of sector in downwind direction	m
ρ	Density of pure water	g/cm ³
ρ_d	Density of dry particle	g/cm ³
ρ_s	Density of saturated solution	g/cm ³
ρ_w	Density of initial droplet	g/cm ³
σ_y	Plume lateral diffusion coefficient	m
σ_z	Plume vertical diffusion coefficient	m

x	Water vapor density at ground level	g/m^3
x_2	Salt deposition rate	$\text{g/sec}\cdot\text{m}^2$

1

2

3

4

5

6

Appendix B

PASQUILL STABILITY CLASSES

The following explanation of the derivation of the Pasquill stability classes, as used in ORFAD, is adapted from Exhibit 3 of Ref. 1. This system for classifying atmospheric stability is based on work accomplished by F. Pasquill of the British Meteorological Office in 1961. Stability near the ground is dependent primarily on net radiation and wind speed.

Without the influence of clouds, insolation (incoming radiation) during the day is dependent upon solar altitude, which is a function of time of day and time of year. When clouds are present, their cover and thickness decrease incoming and outgoing radiation; in this case insolation is estimated by solar altitude and modified for existing conditions of total cloud cover and cloud ceiling height. At night, estimates of outgoing radiation are made by considering cloud cover.

This stability classification system has been made completely objective for computer determination of stability class. The stability classes are as follows: (1) extremely unstable, (2) unstable, (3) slightly unstable, (4) neutral, (5) slightly stable, (6) stable, and (7) extremely stable. Classes 6 and 7 are combined in ORFAD and identified as class 6, as suggested in Ref. 1.

Table B-1 gives the stability classes as functions of wind speed and net radiation. The net radiation index (NRI) ranges from 4, the highest

Table B.1. Stability class as a function of
net radiation and wind speed

Wind speed (knots)	Net radiation index						
	4	3	2	1	0	-1	-2
0, 1	1	1	2	3	4	6	7
2, 3	1	2	2	3	4	6	7
4, 5	1	2	3	4	4	5	6
6	2	2	3	4	4	5	6
7	2	2	3	4	4	4	5
8, 9	2	3	3	4	4	4	5
10	3	3	4	4	4	4	5
11	3	3	4	4	4	4	4
12	3	4	4	4	4	4	4

positive net radiation (directed toward the ground), to -2, the highest negative net radiation (directed away from the ground). Instability occurs with high positive net radiation and low wind speed; stability occurs with high negative net radiation and light winds; and a neutral condition occurs with cloudy skies or high wind speeds.

The NRI used with wind speed to obtain stability class is determined by the following procedure.

1. If the total cloud cover is 10/10 and the ceiling is less than 7000 ft, $NRI = 0$ (day or night).
2. At night (night being defined as the period from 1 hr before sunset to 1 hr after sunrise),
 - a) $NRI = -2$ for total cloud cover $\leq 4/10$;
 - b) $NRI = -1$ for total cloud cover $> 4/10$.
3. During the day, use the following procedure:
 - a) Determine the insolation class number as a function of solar altitude from Table B-2.
 - b) If total cloud cover is $\leq 5/10$, use the NRI in Table B-1 corresponding to the insolation class number.
 - c) If total cloud cover is $\geq 5/10$, modify the insolation class number by following these six steps:
 - (1) Subtract 2 for ceiling < 7000 ft.
 - (2) Subtract 1 for ceiling ≥ 7000 but $< 16,000$ ft.
 - (3) Subtract 1 if total cloud cover is 10/10. This will apply only to ceilings ≥ 7000 ft, since cases with 10/10 coverage below 7000 ft are considered in the first step of the procedure.
 - (4) If the insolation class number has not been modified by the immediately preceding steps 1, 2, or 3, assume the modified class number equal to the class number.
 - (5) If the modified insolation class number is less than 1, set it equal to 1.
 - (6) Use the NRI in Table B-1 corresponding to the modified insolation class number.

Table B-3 shows the temperature gradients, $\partial T_{eo}/\partial z$, as used by ORFAD, as a function of the Pasquill stability class. The gradients are expressed in K/m.

Table B-2. Insolation and insolation class number as functions of solar altitude

a_s , solar altitude	Insolation	Insolation class No.
$60^\circ < a_s$	Strong	4
$35^\circ < a_s \leq 60^\circ$	Moderate	3
$15^\circ < a_s \leq 35^\circ$	Slight	2
$a_s \leq 15^\circ$	Weak	1

Table B-3. Atmospheric temperature gradient as a function of Pasquill stability class

Pasquill stability class	$\partial T_{eo}/\partial z$, temperature gradient (K/m)
1	-0.0263
2	-0.0173
3	-0.01457
4	-0.01
5	+0.00455
6	0.0263

.

.

.

.

.

.

Appendix C

DIFFUSION COEFFICIENTS

The following expressions, which are used in ORFAD for the diffusion coefficients σ_y and σ_z , are derived from Briggs' expressions⁸ for the plume half-width and half-depth, R_y and R_z , respectively. The diffusion coefficients (in metres) are related to R_y and R_z by

$$\sigma_y = 0.8R_y, \quad (C-1)$$

and

$$\sigma_z = 0.8R_z. \quad (C-2)$$

Both the downwind distance X and the diffusion coefficients are in metres. In Table C-1, $B = \sqrt{1 + 0.0001X}$.

Table C-1. Diffusion coefficients as functions of stability class and downwind distance^a

Stability class	σ_y (m)	σ_z (m)
1	$0.22X/B$	$0.20X$
2	$0.16X/B$	$0.12X$
3	$0.11X/B$	$0.08X/\sqrt{1 + 0.0002X}$
4	$0.08X/B$	$0.06X/\sqrt{1 + 0.0015X}$
5	$0.06X/B$	$0.03X/(1 + 0.0003X)$
6	$0.04X/B$	$0.02X/(1 + 0.0003X)$

^a $B = \sqrt{1 + 0.0001X}$; X is in metres.

.

,

^

,

^

^

Appendix D
FALL DISTANCE OF EVAPORATING DROPLET

From elementary mechanics, the distance H that an object (in this case, an evaporating droplet) will fall in a time t under constant acceleration a and with an initial velocity V_f is given by

$$H = V_f t + \frac{1}{2} a t^2 . \quad (D-1)$$

The evaporating droplet attains the velocity v after some evaporation time t_e , so that

$$a = - \frac{V_f - v}{t_e} . \quad (D-2)$$

The evaporation time is

$$t_e = \frac{H_e}{\bar{V}_e} , \quad (D-3)$$

where H_e is the evaporation distance defined by Eq. (24) of the text and

$$\bar{V}_e = \frac{1}{2} (V_f + v) . \quad (D-4)$$

Then

$$a = - \frac{V_f^2 - v^2}{2H_e} \quad (D-5)$$

and

$$H = V_f t - \frac{1}{2} \frac{V_f^2 - v^2}{2H_e} t^2 , \quad (D-6)$$

which becomes Eq. (29a) of the text when $v = v_s$, the final fall velocity of a saturated droplet, and Eq. (33a) when $v = v_d$, the final velocity of a dry particle.

,

,

,

,

,

,

,

Appendix E

FORTRAN LISTING OF ORFAD PROGRAMS

1

3

→

```

C *** INPUT CARD 2. ***** ORFA 990
  READ 8010,HT,RA,APP,RO,WO,HEATT,LAT,LONG ORFA1000
C *** INPUT CARD 3. ***** ORFA1010
  READ 8010,ELEV,FRACDR,DRCLAS,CONC,YRS,ZONE,START,WBO ORFA1020
C *** INPUT CARDS 4, 5. ***** ORFA1030
  READ 8010, (CONCM(M),M=1,12),CHECK ORFA1040
  IF (CONCM(1).GT.0.) GO TO 25 ORFA1050
  DO 24 I=1,12 ORFA1060
24 CONCM(I)=1.0 ORFA1070
  GO TO 26 ORFA1080
25 CONTINUE ORFA1090
  CONC=1.0 ORFA1100
26 CONTINUE ORFA1110
  IST =START ORFA1120
  IZONE=ZONE ORFA1130
  NYR=YRS ORFA1140
  IDRCL=DRCLAS ORFA1150
  PRINT 8040,HT,RA,APP,RO,WO,HEATT,FRACDR,CONC,LAT,LONG,ZONE,ELEV ORFA1160
C ***** ORFA1170
C *** INPUT CARD 6. ***** ORFA1180
  READ 8010,(DIAM(J),J=1,IDRCL) ORFA1190
  PRINT 8050,(DIAM(J),J=1,IDRCL) ORFA1200
C *** INPUT CARD 7. ***** ORFA1210
  READ 8010,(DRFRAC(J),J=1,IDRCL) ORFA1220
  PRINT 8060,(DRFRAC(J),J=1,IDRCL) ORFA1230
  WTSUM=0. ORFA1240
  DO 27 J=1,IDRCL ORFA1250
27 WTSUM=WTSUM+DRFRAC(J) ORFA1260
  IF (ABS(WTSUM-1.).LT.1.E-3) GO TO 29 ORFA1270
  DO 28 J=1,IDRCL ORFA1280
28 DRFRAC(J)=DRFRAC(J)/WTSUM ORFA1290
  PRINT 8055 ORFA1300
  PRINT 8060, (DRFRAC(J),J=1,IDRCL) ORFA1310
29 CONTINUE ORFA1320
C *** INPUT CARD 8. ***** ORFA1330
  READ 8010,DNUM,TOTWR,TOWERS,CLUSIZ,FRACON,XNDIS,HSALT,SAMP ORFA1340
  IF (XNDIS.GT.19.) XNDIS=19. ORFA1350
  NUMBER=DNUM ORFA1360
  NDIS=XNDIS ORFA1370
  IF (DNUM.GT.0.) IPLOT=1 ORFA1380
C *** INPUT CARDS 9, 10, 11. ***** ORFA1390
  READ 8010,(XMI(IX),IX=1,19) ORFA1400
  XMI(NDIS+1)=2.0*XMI(NDIS)-XMI(NDIS-1) ORFA1410
  OAREA=0. ORFA1420
  DO 35 IX=1,NDIS ORFA1430
  R=0.5*(XMI(IX)+XMI(IX+1)) ORFA1440
  AREA=508543.*R**2-OAREA ORFA1450
  OAREA=AREA+OAREA ORFA1460
  AREAS(IX)=AREA ORFA1470
35 CONTINUE ORFA1480
  PRINT 8070,TOTWR,TOWERS,CLUSIZ,FRACON,HSALT ORFA1490
C *** INPUT CARD 12. ***** ORFA1500
  READ 8010, XNUM,VPLT,ANNUM ORFA1510
  IF (XNUM.GT.0.) IPLOT=1 ORFA1520
  IF (CONCM(1).NE.1.) PRINT 8090,CONCM ORFA1530
  IF (NYR.EQ.1) PRINT 8075, NYR,IST ORFA1540
  IF (NYR.GT.1) PRINT 8080, NYR,IST ORFA1550
  IF (SAMP.EQ.1.0) GO TO 37 ORFA1560
  CALL READIN(JHR,JWS,JDB,JWB,JRH,JAT,JCL,IST,JWD,JFOG,JEND) ORFA1570
  RFWIND 8 ORFA1580
  CALL TAPCHK(NTAPE,NYR,IST) ORFA1590
37 CONTINUE ORFA1600
  START=IST ORFA1610
  PRINT 8100 ORFA1620
  Q1=2.06265E9*FRACDR*CONC*HEATT/RA ORFA1630
C *** 2.06265E9=1.E6*1.8*3600./PI ORFA1640
C CIRCULATING WATER FLOW RATE, GM/SEC=1.8E6*HEATT/RA ORFA1650
C EVAPORATION RATE, GM/SEC=.75*(1.E6*HEATT/589.=1273.34*HEATT ORFA1660
  Q10=Q1 ORFA1670
  Q=405.318*HEATT ORFA1680
C *** 405.318=.75*1.E6/(589.*PI) ORFA1690
  DELQ1=Q/(353130.*RO*RO*WO*TOTWR) ORFA1700
C *** 353130.=1292.9*273.13 ORFA1710
C *** 1292.9 GM/CU M = DENSITY OF DRY AIR AT 0 DEG C, 1 ATMOSPHERE ORFA1715
  DO 30 M=1,NALT ORFA1720
  ALT(M)=M*250.-250. ORFA1730
30 BPELEV(M)=BPE(ELEV+ALT(M)) ORFA1740
  DELQ2=DELQ1 ORFA1750
  QSAVE=Q ORFA1760
  CALL TRAJ(CONC,DO) ORFA1770
  RAPP=RA*APP ORFA1780
C PRINT SAMPLE PLUME RISE VALUES ORFA1790
  IF (SAMP.GT.0.) CALL SAMPLE(DELQ1,DO,RAPP) ORFA1800
  IF (SAMP.EQ.1.0) CALL EXIT ORFA1810
C ***** ORFA1820
  LONG=LONG-15.*ZONE ORFA1830
  DO 40 I=1,5 ORFA1840
  JSUM=0 ORFA1850
40 JCOUNT(I)=0 ORFA1860
  IYRA=65-IST ORFA1870
  INCR=1 ORFA1880
  IZ1=1 ORFA1890
  IYR=0 ORFA1900
C ***** ORFA1910
  START YEAR LOOP ORFA1910
50 KGO=1 ORFA1920
  IYR=IYR+1 ORFA1930
  IF (IYR.GT.IYRA) INCR=3 ORFA1940
  IF (INCR.GT.1) IZ1=10-IZONE ORFA1950
  IF (IZ1.GT.3) IZ1=IZ1-3 ORFA1960
  ICAPD=0 ORFA1970
  IDAYS=1 ORFA1980
  JEND=0 ORFA1990

```

```

MOLD=0
Q2=0.
ISUM=0
C          ZERO ANNUAL TOTALS
DO 60 I=1,5
60 ICOUNT(I)=0
DO 70 IDIR=1,17
CP(IDIR)=0.
DO 70 IX=1,NDIS
DRIFT(IDIR,IX)=0.
ICE(IDIR,IX)=0.
SALT(IDIR,IX)=0.
IFR(IDIR,IX)=0
DO 70 M=1,NALT
FOG(M,IX,IDIR)=0.
70 CONTINUE
80 ICARD=ICARD+1
IF(ICARD.EQ.1) CALL SOLAR(IDAYS,KGO,EDABC)
IF(ICARD.LT.4) GO TO 90
ICARD=0
IDAYS=IDAYS+1
90 CONTINUE
C          READ WEATHER DATA AND SCREEN FOR ERRORS
C
C          CALL READIN(JHR,JWS,JDB,JWB,JRH,JAT,JCL,IST,JWD,JFOG,JEND)
IF(JEND.EQ.2) GO TO 420
INMO=KMONTH
C          MONTHLY OR DAILY SCHEDULED ITEMS SHOULD BE HANDLED HERE
IF(INMO.EQ.MOLD) GO TO 100
MOLD=INMO
DELQ1=DELQ2*PF(INMO)
Q=QSAVE*PF(INMO)
C          Q=VAPOR FLUX, GM WATER/SEC DIVIDED BY PI
Q1=Q10 *PF(INMO)*CONCM(INMO)
C          Q1=DRIFT SOLUTE FLUX, GM/HR DIVIDED BY PI
RA=RANGE(INMO)
HEATT=HLOAD(INMO)
IF(CONCM(1).NE.1.)CALL TRAJ(CONCM(INMO),DD)
100 Q2=Q2+Q1*18.84956
C
DO 290 J=IZ1,6,INCR
DBT=JDB(J)
WBT=JWB(J)
U=JWS(J)*.514444
C          PARAMETERS FOR STACON VIA /STAB/
ICC=JAT(J)
ICL=JCL(J)
IWS=JWS(J)
IWD=JWD(J)
IF(IWD.NE.18) GO TO 110
IWD=16
GO TO 120
110 IWD=IWD-9*(IWD/101-1)
IF(IWD.LE.0) IWD=17
120 JHR=JHR(J)
SKIP=0.
IF(JFOG(J).EQ.0.OR.JFOG(J).GT.3) GO TO 150
INDEX=JFOG(J)
ICOUNT(INDEX)=ICOUNT(INDEX)+INCR
SKIP=1.
GO TO 150
130 ICOUNT(4)=ICOUNT(4)+INCR
IF (SKIP.NE.1.) SKIP=2.
GO TO 160
140 ICOUNT(5)=ICOUNT(5)+INCR
GO TO 290
150 IF(IWD.GT.17) IWD=17
IF(IWS.GT.199) GO TO 140
IF(DBT.GT.199.) GO TO 140
IF(WBT.GT.199.) GO TO 140
IF(WBT.GT.DBT) GO TO 140
IF(WBT.EQ.DBT) GO TO 130
160 CP(IWD)=CP(IWD)+INCR
ISUM=ISUM+INCR
IF(U.LE.0.)U=.51444
IDIR=IWD
IF(ICL.LT.0)ICL=250
TEO=AB(DBT)
VP=PV(DBT,WBT,ELEV)
RH=VP/PVS(DBT)
IF(RH.LE.0.)GO TO 140
RHFAC=(1.0-RH)**1.079
IRH=2
IF (RH.LT.0.5) IRH=1
C          END WEATHER DATA PROCESSING
C
C
C

```

```

ORFA2000
ORFA2010
ORFA2020
ORFA2030
ORFA2040
ORFA2050
ORFA2060
ORFA2070
ORFA2080
ORFA2090
ORFA2100
ORFA2110
ORFA2120
ORFA2130
ORFA2140
ORFA2150
ORFA2160
ORFA2170
ORFA2180
ORFA2190
ORFA2200
ORFA2210
ORFA2220
ORFA2230
ORFA2240
ORFA2250
ORFA2260
ORFA2270
ORFA2280
ORFA2290
ORFA2300
ORFA2310
ORFA2320
ORFA2330
ORFA2340
ORFA2350
ORFA2360
ORFA2370
ORFA2380
ORFA2390
ORFA2400
ORFA2410
ORFA2420
ORFA2430
ORFA2440
ORFA2450
ORFA2460
ORFA2470
ORFA2480
ORFA2490
ORFA2500
ORFA2510
ORFA2520
ORFA2530
ORFA2540
ORFA2550
ORFA2560
ORFA2570
ORFA2580
ORFA2590
ORFA2600
ORFA2610
ORFA2620
ORFA2630
ORFA2640
ORFA2650
ORFA2660
ORFA2670
ORFA2680
ORFA2690
ORFA2700
ORFA2710
ORFA2720
ORFA2730
ORFA2740
ORFA2750
ORFA2760
ORFA2770
ORFA2780
ORFA2790
ORFA2800
ORFA2810
ORFA2820
ORFA2830
ORFA2840
ORFA2850
ORFA2860
ORFA2870

```

```

C          CALCULATE SATURATION DEFICIT                                ORFA2880
C
CALL STACON(ICON)                                                    ORFA2890
IF(ICON.GT.6) ICON=6                                                ORFA2900
C
ABDB=AB(DBT)                                                         ORFA2910
VPH=PV(DBT,DBT-WBD,ELEV)                                           ORFA2920
DO 200 M=1,NALT                                                      ORFA2930
TEMP=DBT+ALT(M)*TGI(ICON)*.3048                                    ORFA2940
PVSAB=PVS(TEMP)/AB(TEMP)                                           ORFA2950
SDH(M)=7345.0*(PVSAB-VPH/ABDB)                                     ORFA2960
SD(M)=7345.0*(PVSAB-VP/ABDB)                                       ORFA2970
200 CONTINUE                                                         ORFA2980
C
C          CALCULATE TOWER EFFLUENT TEMPERATURE                     ORFA2990
C
IF (WBT.LT.80.) ENTHAL=(WBT+4.30501)/(3.917-0.024846*WBT)         ORFA3000
IF (WBT.GE.80.) ENTHAL=(WBT-13.850)/(2.766-0.015652*WBT)         ORFA3010
ENTHAL=ENTHAL+RAPP                                                  ORFA3020
IF(ENTHAL.GT.43.697)TS=(2.766*ENTHAL+13.85)/(1.+0.015652*ENTHAL) ORFA3030
IF(ENTHAL.LE.43.697)TS=(3.917*ENTHAL-4.305)/(1.+0.024846*ENTHAL) ORFA3040
TPO=AB(TS)                                                          ORFA3050
DELQ=DELQ1*TPO                                                      ORFA3060
K=25                                                                ORFA3070
OR=0.                                                                ORFA3080
OPR=0.                                                                ORFA3090
OXME=0.                                                             ORFA3100
DO 280 IX=1,NDIS                                                    ORFA3110
XME=XMI(IX)*1609.                                                  ORFA3120
C          CALCULATE PLUME RISE                                     ORFA3130
C
CALL PRISE(PR)                                                       ORFA3140
DPR=PR-OPR                                                          ORFA3150
DXME=XME-OPR                                                        ORFA3160
OXME=XME                                                            ORFA3170
OPR=PR                                                              ORFA3180
C          CALCULATE FOGGING AND ICING                             ORFA3190
C
H=HT+PR                                                             ORFA3200
CALL SYSZ(SY,SZ)                                                    ORFA3210
IF(SKIP.EQ.1.) GO TO 230                                           ORFA3220
6.41713=2.52/(PI/8)                                               ORFA3230
DELFQ=6.41713*INCR*SY/XME                                         ORFA3240
QM=Q/(SY*SZ*U)                                                     ORFA3250
DO 220 M=1,NALT                                                      ORFA3260
HI=H-ALT(M)*0.3048                                                 ORFA3270
F=-0.5*((HI/SZ)**2)                                                ORFA3280
E=AMAX1(F,-150.)                                                  ORFA3290
CHI=QM*EXP(EI)                                                      ORFA3300
IF (SD(M).LE.0.) GO TO 205                                         ORFA3310
IF (CHI.LE.SDH(M)) GO TO 220                                       ORFA3320
GO TO 210                                                           ORFA3330
205 CONTINUE                                                         ORFA3340
IF (CHI.LT.SDH(M)) GO TO 220                                       ORFA3350
210 CONTINUE                                                         ORFA3360
FOG(M,IX,IDIR)=FOG(M,IX,IDIR)+DELFQ                               ORFA3370
IF(M.GT.1) GO TO 220                                               ORFA3380
IFR(IDIR,IX)=IFR(IDIR,IX)+DELFQ                                    ORFA3390
IF(DBT.LT.32.) ICE(IDIR,IX)=ICE(IDIR,IX)+DELFQ                    ORFA3400
220 CONTINUE                                                         ORFA3410
IF(IRM.LT.0.76) GOT0 240                                           ORFA3420
NO EVAPORATION                                                      ORFA3430
VFALL=(HT+PR)*U/XME                                                ORFA3440
DIA=37.18*VFALL/.004451                                            ORFA3450
IF (VFALL.LT.0.16548) DIA=SQR(33414.*VFALL)                      ORFA3460
IDIA=DIA/DO*1.                                                      ORFA3470
IF(IDIA.GT.251)GO TO 280                                           ORFA3480
DVDR=(VFALL-U*DPR/OXME)/XME                                       ORFA3490
DDDR=DVDR/0.004451                                                 ORFA3500
IF (VFALL.LT.0.16548) DDDR=0.5*DIA*DVDR/VFALL                    ORFA3510
OCDD=CUMUL(IDIA)/DO                                               ORFA3520
GO TO 270                                                           ORFA3530
240 CONTINUE                                                         ORFA3540
R=DF(K,IRH)/PHFAC                                                  ORFA3550
IF(M.LT.R) GO TO 45                                                ORFA3560
XR=U*(H-R)/VF(K,IRH)                                              ORFA3570
GO TO 48                                                            ORFA3580
45 XR=2.*U*R*(1.-SQR(1.-H/R))/VI(K)                                ORFA3590
48 CONTINUE                                                         ORFA3600
C          ITERATIVE SOLUTION FOR DIAMETER OF DROP FALLING AT THIS DISTANCE
C
IF(XR.GT.XME) GO TO 260                                           ORFA3610
K=K-1                                                                ORFA3620
OR=XR                                                                ORFA3630
IF(K) 280,280,250                                                  ORFA3640
260 OCDD=CUMUL(K)                                                  ORFA3650
IF(K.GE.251) GO TO 280                                           ORFA3660
VFALL=VF(K,IRH)                                                    ORFA3670
DDDR=1./(XR-OR)                                                    ORFA3680
270 CHI2=Q1*DDDR*OCDD*INCR*8./XME                                  ORFA3690
DRIFT(IDIR,IX)=DRIFT(IDIR,IX)+CHI2                                ORFA3700
SALT(IDIR,IX)=SALT(IDIR,IX)+CHI2/VFALL/3600.                     ORFA3710
280 CONTINUE                                                         ORFA3720
290 CONTINUE                                                         ORFA3730
IF(JEND.LE.0) GO TO 80                                             ORFA3740
C          PRINT PAGE HEADINGS                                     ORFA3750
C
300 CONTINUE                                                         ORFA3760
IF(IYP.GT.NYR) GO TO 302                                           ORFA3770
C * * * IF ANNUAL TABLES ARE NOT WANTED, SKIP PAGE HEADINGS
C
IF (ANNUAL.LE.0.) GO TO 304                                         ORFA3780
302 CONTINUE                                                         ORFA3790
PRINT 8030                                                         ORFA3800
PRINT 8230,L0C                                                      ORFA3810
PRINT 8110,ICOUNT(1)                                               ORFA3820
PRINT 8120,ICOUNT(2)                                               ORFA3830
ORFA3840
ORFA3850
ORFA3860
ORFA3870
ORFA3880

```

```

      PRINT 8130,ICOUNT(3)
      PRINT 8140,ICOUNT(4)
      PRINT 8150,ICOUNT(5)
304 CONTINUE
C
C      DISTRIBUTE RESULTS FOR CALMS TO WIND DIRECTIONS
      IF(IYR.GT.NYR) GO TO 360
      SUMCP=0.
      DO 310 IDIR=1,16
310 SUMCP=SUMCP+CP(IDIR)
      CP17=1.+CP(17)/SUMCP
      DO 350 IX=1,NDIS
      IFRX=IFR(17,IX)
      DRIX=DRIFT(17,IX)
      ICEX=ICE(17,IX)
      SALX=SALT(17,IX)
      DO 330 IDIR=1,16
      CPOSUM=CP(IDIR)/SUMCP
      IFR(IDIR,IX)=IFR(IDIR,IX)+CPOSUM*IFRX
      DRIFT(IDIR,IX)=DRIFT(IDIR,IX)+CPOSUM*DRIX
      ICE(IDIR,IX)=ICE(IDIR,IX)+CPOSUM*ICEX
      SALT(IDIR,IX)=1.E6*(SALT(IDIR,IX)+CPOSUM*SALX)/ISUM
      DO 320 M=1,NALT
320 FOG(M,IX,IDIR)=FOG(M,IX,IDIR)+CPOSUM*FOG(M,IX,17)
330 CONTINUE
      IFR(17,IX)=0.
      DRIFT(17,IX)=0.
      ICE(17,IX)=0.
      SALT(17,IX)=0.
      DO 340 M=1,NALT
340 FOG(M,IX,17)=0.
350 CONTINUE
C
C      PRINT TABLES OF RESULTS
360 CONTINUE
      DO 370 IDIR=1,16
370 CP(IDIR)=CP(IDIR)*CP17
      IF(IYR.GT.NYR) GO TO 374
C * * IF ANNUAL TABLES ARE NOT WANTED, SKIP TABLE PRINTOUTS.
      IF (ANNUAL.LE.0.) GO TO 385
      PRINT 8240, START
372 CONTINUE
      PRINT 8160
      CALL TABLE(IFR)
      IFOG=ISUM-ICOUNT(1)-ICOUNT(2)-ICOUNT(3)
      PRINT 8180,IFOG
      GO TO 376
374 PRINT 8170, NYR
      GO TO 372
376 CONTINUE
      PRINT 8220
      IF(IYR.GT.NYR) PRINT 8170,NYR
      IF(IYR.LE.NYR) PRINT 8240,START
      PRINT 8190
      CALL TABLE(DRIFT)
      SUMDRF=0.
      DO 380 IX=1,NDIS
      AREA=AREAS(IX)
      DO 380 IDIR=1,16
380 SUMDRF=SUMDRF+DRIFT(IDIR,IX)*AREA
      PRINT 8000,SUMDRF,Q2
      PRINT 8220
      IF(IYR.GT.NYR) PRINT 8170,NYR
      IF(IYR.LE.NYR) PRINT 8240,START
      PRINT 8200
      CALL TABLE(ICE)
      PRINT 8220
      IF(IYR.GT.NYR) PRINT 8170,NYR
      IF(IYR.LE.NYR) PRINT 8240,START
      PRINT 8210,HSALT
      CALL TABLE(SALT)
      PRINT 8180,ISUM
385 CONTINUE
      CP(17)=0.
      START=START+1.
      IF(IYR.GT.NYR) GO TO 460
C
C      ACCUMULATE NYR TOTALS
      DO 400 IDIR=1,17
      CPTOT(IDIR)=CPTOT(IDIR)+CP(IDIR)
      DO 400 IX=1,NDIS
      TOTDRF(IDIR,IX)=TOTDRF(IDIR,IX)+DRIFT(IDIR,IX)
      ICETOT(IDIR,IX)=ICETOT(IDIR,IX)+ICE(IDIR,IX)
      SALTOT(IDIR,IX)=SALTOT(IDIR,IX)+SALT(IDIR,IX)
      IFRTOT(IDIR,IX)=IFRTOT(IDIR,IX)+IFR(IDIR,IX)
      DO 390 M=1,NALT
390 FOGTOT(M,IX,IDIR)=FOGTOT(M,IX,IDIR)+FOG(M,IX,IDIR)
400 CONTINUE
      DO 410 I=1,5
410 JCOUNT(I)=JCOUNT(I)+ICOUNT(I)
      JSUM=JSUM+ISUM
      IF(IYR-NYR) 50,420,460
C
C      END YEAR LOOP
C
C      OBTAIN AVERAGE FOR NYR YEARS
420 FAC1=JSUM/JCOUNT(5)
      FAC2=JSUM
      FAC3=FAC1/FAC2/NYR
      DO 440 IDIR=1,16
      CP(IDIR)=CPTOT(IDIR)*FAC3
      DO 440 IX=1,NDIS
      FAC4=IFRTOT(IDIR,IX)
      DRIFT(IDIR,IX)=TOTDRF(IDIR,IX)*FAC3

```

```

ORFA3890
ORFA3900
ORFA3910
ORFA3920
ORFA3930
ORFA3940
ORFA3950
ORFA3960
ORFA3970
ORFA3980
ORFA3990
ORFA4000
ORFA4010
ORFA4020
ORFA4030
ORFA4040
ORFA4050
ORFA4060
ORFA4070
ORFA4080
ORFA4090
ORFA4100
ORFA4110
ORFA4120
ORFA4130
ORFA4140
ORFA4150
ORFA4160
ORFA4170
ORFA4180
ORFA4190
ORFA4200
ORFA4210
ORFA4220
ORFA4230
ORFA4240
ORFA4250
ORFA4260
ORFA4270
ORFA4280
ORFA4290
ORFA4300
ORFA4310
ORFA4320
ORFA4330
ORFA4340
ORFA4350
ORFA4360
ORFA4370
ORFA4380
ORFA4390
ORFA4400
ORFA4410
ORFA4420
ORFA4430
ORFA4440
ORFA4450
ORFA4460
ORFA4470
ORFA4480
ORFA4490
ORFA4500
ORFA4510
ORFA4520
ORFA4530
ORFA4540
ORFA4550
ORFA4560
ORFA4570
ORFA4580
ORFA4590
ORFA4600
ORFA4610
ORFA4620
ORFA4630
ORFA4640
ORFA4650
ORFA4660
ORFA4670
ORFA4680
ORFA4690
ORFA4700
ORFA4710
ORFA4720
ORFA4730
ORFA4740
ORFA4750
ORFA4760
ORFA4770
ORFA4780
ORFA4790
ORFA4800
ORFA4810
ORFA4820
ORFA4830
ORFA4840
ORFA4850
ORFA4860
ORFA4870
ORFA4880
ORFA4890

```

```

SALT(I DIR,IX)=SALTOT(I DIR,IX)*FAC3
ICE(I DIR,IX)=ICETOT(I DIR,IX)*FAC3
DO 430 M=1,NALT
430 GOF(IX,M,I DIR)=FOGTOT(M,IX,I DIR)*FAC3
440 IFP(I DIR,IX)=FAC4*FAC3
IADD=NYR/2
IYR=NYR+2
ISUM=(JSUM+IADD)/NYR
DO 450 J=1,5
450 ICOUNT(J)=(JCOUNT(J)+IADD)/NYR
GO TO 300
C
C      DEFINE PARAMETERS FOR CONTOUR MAPS
460 CONTINUE
IF (IPLOT.LE.0) GO TO 510
IMAX=MIN0(20,NDIS+1)
ID1=20
IMAXM1=IMAX-1
JMAX=17
ID2=JMAX
XI1=0.
DO 470 IX=1,IMAXM1
470 XI(IX)=XMI(IX)
DO 480 I DIR=1,17
480 TH(I DIR)=(I DIR-1)*3.1415926/8.
C
C      CONTOUR MAPS
IF (DNUM.LE.0.) GO TO 485
CALL PREP(DNUM,IMAX,FF,F,DRIFT,TOPS)
JQ=1
IF(TOPS.GT.0.) CALL CONPLT(X,TH,F,IMAX,JMAX,ID1,ID2)
485 CONTINUE
NUMBER=XNUM
IF (XNUM.LE.0.) GO TO 510
CALL PREP(XNUM,IMAX,FF,F,IFR,TOPS)
IF(TOPS.LE.0.) GO TO 490
JQ=2
CALL CONPLT(X,TH,F,IMAX,JMAX,ID1,ID2)
490 CALL PREP(XNUM,IMAX,FF,F,ICE,TOPS)
IF(TOPS.LE.0.) GO TO 500
JQ=3
CALL CONPLT(X,TH,F,IMAX,JMAX,ID1,ID2)
500 CALL PREP(XNUM,IMAX,FF,F,SALT,TOPS)
IF(TOPS.LE.0.) GO TO 510
JQ=4
CALL CONPLT(X,TH,F,IMAX,JMAX,ID1,ID2)
C
C      CONTOUR MAPS IN VERTICAL PLANE
510 CONTINUE
IF(VPLT.LE.0.) GO TO 10
PRINT 8030
K1=7
NF=K1
NSYMBL=1
DO 520 I DIR=1,16
CALL FIXPLT(0,XMI(NDIS),ALT(1),ALT(NALT),'LINEAR','MECH',-1,-1,
1 BUFFER,3000,'E.C.LONGS')
CALL RCONTR(K1,C,GOF(1,1,I DIR),19,XMI,1,NCIS,1,ALT,1,NALT,1)
QUAD(4)=COMP(I DIR)
CALL TITLE(0.4,QUAD,'$','*)
CALL LEGEND('LEGEND$',SYMBL,7,DESCR,2,-1.0,1.5)
CALL PLTD
520 CONTINUE
IF ((IPLOT.GT.0).OR.(VPLT.GT.0)) CALL ADVANS
GO TO 10
530 STOP 69
8000 FORMAT('TOTAL DRIFT = ',1PE12.3/
1 ' TOTAL SALTS OUT =' E12.3)
8010 FORMAT(8E10.3)
8020 FORMAT(18A4,F8.0)
8030 FORMAT(1H1,50X'PROGRAM ORFAD'/1X)
8040 FORMAT('COOLING TOWERS:/'
1 6X,'HEIGHT (METERS) 'F8.2/
2 6X,'RANGE (DEGREES F) 'F8.2/
3 6X,'WATER/AIR RATIO 'F8.2/
4 6X,'INNER RADIUS (METERS) 'F8.2/
5 6X,'EFFLUX SPEED (METERS/SEC) 'F8.2/
6 6X,'HEAT OUT (MEGACAL/SEC) 'F8.2/
7 6X,'DRIFT FRACTION '1PE13.3/
8 6X,'CONCENTRATION '1PE13.3/
9 6X,'LATITUDE (DEGREES N) '0PF9.3/
A 6X,'LONGITUDE (DEGREES W) 'F9.3/
B 6X,'TIME ZONE 'F6.0/
C 6X,'ELEVATION (FEET) 'F8.2)
8050 FORMAT('DRIFT DIAM(MICRONS)'8F10.2)
8055 FORMAT('O* * * INPUT WEIGHT FRACTIONS DID NOT SUM TO 1.0./'
1 8X'REVISED VALUES FOLLOW:/'
8060 FORMAT('WEIGHT FRACTION '8F10.3)
8070 FORMAT('NUMBER OF TOWERS 'F8.2/
1 ' TOWERS/CLUSTER 'F8.2/
2 ' CLUSTER SIZE (METERS)'F8.2/
3 ' FRACTION CONDENSED 'F8.2/
4 ' SALT AT HEIGHT (METERS)'F8.2)
8075 FORMAT('ANALYZES ',I2,' YEAR STARTING 19',I2)
8080 FORMAT('ANALYZES 'I2,' YEARS STARTING 19',I2)
8090 FORMAT('DRIFT CONCENTRATION BY MONTH -'/4X'JAN'7X'FEB'7X'MAR'7X,
1 'APR'7X'MAY'7X'JUN'7X'JUL'7X'AUG'7X'SEP'7X'OCT'7X'NOV'7X'DEC'/'
2 1P12E10.3)
8100 FORMAT('OALL INPUT READ')
8110 FORMAT(1H0,I4,' HOURS OF FCG REPORTED')
8120 FORMAT(15,' HOURS OF ICE FCG REPORTED')
8130 FORMAT(15,' HOURS OF GROUND FCG REPORTED')

```

ORFA4900
 ORFA4910
 ORFA4920
 ORFA4930
 ORFA4940
 ORFA4950
 ORFA4960
 ORFA4970
 ORFA4980
 ORFA4990
 ORFA5000
 ORFA5010
 ORFA5020
 ORFA5030
 ORFA5040
 ORFA5050
 ORFA5060
 ORFA5070
 ORFA5080
 ORFA5090
 ORFA5100
 ORFA5110
 ORFA5120
 ORFA5130
 ORFA5140
 ORFA5150
 ORFA5160
 ORFA5170
 ORFA5180
 ORFA5190
 ORFA5200
 ORFA5210
 ORFA5220
 ORFA5230
 ORFA5240
 ORFA5250
 ORFA5260
 ORFA5270
 ORFA5280
 ORFA5290
 ORFA5300
 ORFA5310
 ORFA5320
 ORFA5330
 ORFA5340
 ORFA5350
 ORFA5360
 ORFA5370
 ORFA5380
 ORFA5390
 ORFA5400
 ORFA5410
 ORFA5420
 ORFA5430
 ORFA5440
 ORFA5450
 ORFA5460
 ORFA5470
 ORFA5480
 ORFA5490
 ORFA5500
 ORFA5510
 ORFA5520
 ORFA5530
 ORFA5540
 ORFA5550
 ORFA5560
 ORFA5570
 ORFA5580
 ORFA5590
 ORFA5600
 ORFA5610
 ORFA5620
 ORFA5630
 ORFA5640
 ORFA5650
 ORFA5660
 ORFA5670
 ORFA5680
 ORFA5690
 ORFA5700
 ORFA5710
 ORFA5720
 ORFA5730
 ORFA5740
 ORFA5750
 ORFA5760
 ORFA5770
 ORFA5780
 ORFA5790
 ORFA5800
 ORFA5810
 ORFA5820
 ORFA5830
 ORFA5840
 ORFA5850
 ORFA5860
 ORFA5870
 ORFA5880
 ORFA5890
 ORFA5900


```

8140 FORMAT(15,' HOURS WHEN DRY BULB=WET BULB')
8150 FORMAT(15,' HOURS INCOMPLETE DATA')
8160 FORMAT(1H0,39X,'HOURS OF ADDITIONAL FOG PER YEAR')
8170 FORMAT(1H ,47X,12,' YEAR AVERAGE')
8180 FORMAT(10',33X, 'HOURS ANALYZED = ',110)
8190 FORMAT(44X, 'DRIFT, GM/YR PER SQ METER')
8200 FORMAT(1H0,39X,'HOURS OF ADDITIONAL ICE PER YEAR')
8210 FORMAT(40X,'SALT AV MICROGM/CU.METER AT HEIGHT' F5.1,' M')
8220 FORMAT(1H1)
8230 FORMAT(1X,20A4)
8240 FORMAT(1H0,49X,'YEAR 19',F3.0)
8250 FORMAT(1H+,82X,'DATE: ',A8,' HASP NO.: ',I4,' JOB NO.: ',A8/
1 99X,'RUN ON MODEL 360',I2)
END

```

```

ORFA5910
ORFA5920
ORFA5930
ORFA5940
ORFA5950
ORFA5960
ORFA5970
ORFA5980
ORFA5990
ORFA6000
ORFA6010
ORFA6020
ORFA6030
ORFA6040

```

/ MAIN / SIZE OF PROGRAM 01249C HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
C SFA	C	R**	000000	E SFA	R**	0009E0		F SFA	R**	0008B8		H SFA	R**	0009E4	
I SF		I**	0009F8	J SF	I**	0009EC		K SF	I**	0009F0		M SFA	I**	0009F4	
Q SF		R**	0009F8	R SFA	R**	0009FC		U SF	C	R**	000014	X SFA	R**	001108	
AB S	ASF	R**	000000	BP F	XF	R**	000000	CP SF	R**	001158		DD SFA	R**	000A00	
DF F	C	R**	0000C8	FF SFA	C	R**	000018	HE		N.R.		HI SF	R**	000A04	
HT SF	C	R**	000000	ID C	I**	N.R.		IX SF	I**	000A08		JQ S	C	I**	000144
K1 SFA		I**	000A0C	NC S	C	R**	000070	NM	C	I**	N.R.	OR SF	R**	000A10	
PF F		R**	00119C	PR SFA	R**	000A14		PV F	XF	R**	000000	QM SF	R**	000A18	
Q1 SF	C	R**	000000	Q2 SF	R**	000A1C		RA SF	R**	000A20		RH SF	R**	000A24	
RD SF	C	R**	000008	SD S	C	R**	0000AC	SY SFA	P**	000A28		SZ SFA	R**	000A2C	
TE		R**	N.R.	TH SFA	R**	0011D0		TS SFA	R**	000A30		VF F	C	R**	000000
VI F	C	R**	0001F4	VP SF	R**	000A34		WO SF	C	R**	000004	XR SF	R**	000A38	
ALT SFA		R**	001214	APP SF	R**	000A3C		BAR		N.R.		CHI S	R**	000A40	
CRT SF	XF	R**	000000	DBT SFA	R**	000A44		DIA SF	R**	000A48		DPR SF	R**	000A4C	
FOG SF	E	R**	00C028	GOF SFA	E	R**	00C028	ICC S	C	I**	000008	ICE SFA	R**	00123C	
ICL S	C	I**	00000C	ID1 SFA	I**	000A50		ID2 SFA	I**	000A54		IFR SFA	R**	001748	
IHR S	C	I**	000018	IRH SF	I**	000A58		IST SFA	I**	000A5C		IWD SF	I**	000A60	
IWS S	C	I**	000014	IYR SF	I**	000A64		IZ1 SF	I**	000A68		JAT SFA	I**	001C54	
JCL SFA		I**	001C6C	JDB SFA	I**	001C84		JHR SFA	I**	001C9C		JRH SFA	I**	001C84	
JWB SFA		I**	001CCC	JWD SFA	I**	001CE4		JWS SFA	I**	001CF4		KGO SFA	C	I**	00001C
LAT S	C	R**	000000	LOC S	C	I**	000000	NYR SFA	I**	000A6C		OPR SF	R**	000A70	
PVS F	XF	R**	000000	Q10 SF	R**	000A74		SDH S	C	R**	0000FC	TEO S	C	R**	000010
TGT F		R**	001D14	TPO SF	C	R**	00001C	VPH SF	R**	000A78		WBD SFA	R**	000A7C	
WBI SFA		R**	000A80	XME SF	C	R**	000018	XMI SFA	C	R**	000000	YRS SF	R**	000A84	
ABDB SF		R**	000A88	AREA SFA	R**	000A8C		BUFF SFA	R**	001D2C		CHI2 SF	R**	000A90	
COMP F		R**	004C0C	CONC SFA	R**	000A94		CP17 SF	R**	000A98		DCDD SF	R**	000A9C	
DCON		R**	N.R.	DDR SF	R**	000A9A		DEIQ S	C	R**	000020	DIAM S	C	R**	00000C
DNUM SFA		R**	000AAA	DRIX SF	R**	000A98		DVDR SF	R**	000AAC		DXME SF	R**	000A80	
ELEV SFA	C	P**	000008	EXIT SF	XF	R**	000000	FAC1 SF	R**	000A84		FAC2 SF	R**	000A88	
FAC3 SF		R**	000ABC	FAC4 SF	R**	000AC0		IADD SF	I**	000AC4		ICEX SF	I**	000A8C	
ICON SFA	C	I**	00000C	IDAY SF	XF	I**	000000	IDIA SF	I**	000ACC		IDIR SFA	I**	000A90	
IDUM C		I**	N.R.	IFOG S	I**	000AD4		IFRX SF	I**	000AD8		IGTJ F	XF	I**	000000
IMAX SFA		I**	000ADC	INCR SF	I**	000AE0		INMO SFA	I**	000AE4		IUM SF	I**	000AE8	
IYRA S		I**	000AEC	JDM C	I**	N.R.		JEND SFA	I**	00QAF0		JFQG SFA	I**	004C4C	
JMAX SFA		I**	000AF4	JSUM SF	I**	000AF8		KDAY	C	I**	N.R.	LDIR	I**	N.R.	
LONG SF	C	R**	000004	MOLD S	I**	000AFC		NALT SFA	I**	000B00		NDIS SFA	C	I**	000054
QXME SF		R**	000B04	PLID SF	XF	R**	000000	PREP SF	XF	R**	000000	QUAD SFA	R**	004C64	
RAPP SFA		R**	000B08	SALT SFA	R**	004C74		SALX SF	R**	000B0C		SAMP S		R**	000B10
SKIP S		R**	000B14	SYZ SF	XF	R**	000000	TEMP SFA	R**	000B18		TOPS SFA	R**	000B1C	
TRAJ SF	XF	R**	000000	VFAL	R**	N.R.		VPLT S	R**	000B20		XDIM	C	R**	N.R.
XNUM SFA		R**	000B24	YDIM	C	R**	N.R.	ZONE SF	R**	000B28		ANNUM S	R**	000B2C	
AREAS SFA		R**	005180	CHECK S	R**	000B30		CONCM SFA	R**	0051CC		CPTOT SF	R**	0051FC	
CUMUL F	C	R**	000190	DELQ1 SFA	R**	000B34		DELQ2 SF	R**	000B38		DESCR SFA	C	R**	00001C
DRIFT SFA		R**	005240	EDABC SFA	C	R**	000020	HEATT SF	R**	000B3C		HSALT S	R**	000B40	
ICARD SF		I**	000B44	IDAYS SFA	C	I**	000010	IDRCL SF	C	I**	000004	IHASP S	I**	000B48	
INDEX SF		I**	000B4C	IPLOT S	I**	000B50		IZONE SF	I**	000B54		JOBNO SFA	R**	000B58	
KSTAT	C	I**	N.R.	KYEAR	C	I**	N.R.	MODEL F	XF	I**	000000	NTAPE SFA	I**	000B64	
QAREA SF		R**	000B5C	PRISE SF	XF	R**	000000	PVSAB SF	R**	000B60		QSAVE SF	R**	000B70	
RHFAC SF		R**	000B68	SOLAR SF	XF	P**	000000	START SF	R**	000B6C		SUMCP SF	R**	000B74	
SYMBL SFA	C	R**	000054	TABLE SF	XF	R**	000000	TAPEN SF	R**	000B74		TITLE SF	XF	R**	000000
TODAY SFA		R**	000B80	VFALL SFA	R**	000B78		VFAL4	R**	N.R.		WTSUM SFA	R**	000B7C	
XNDIS SF		R**	000B80	SORT	XF	R**	000000	EXP	XF	R**	000000	FRXPR#	XF	R**	000000
ADVANS SF	XF	R**	000000	BPELEV S	R**	00574C		BUFFER SFA	R**	005774		CLUSIZ S	C	R**	00002C
CONPLT SF	XF	R**	000000	CPOSUM SF	R**	000B84		DELFOG SF	R**	000B88		DRCLAS SF	R**	000B8C	
DRFRAC SF	C	R**	00005C	ENTHAL SF	R**	000B90		ERRSET SF	XF	R**	000000	FIXPLT SF	XF	R**	000000
FOGTOT SF		R**	008654	FRACDR SF	R**	000B94		FRACON SF	C	R**	000024	IBCOM# F	XF	I**	000000
ICE TOT SF		R**	008B00	ICOUNT SF	I**	000BDC		IFRTO SF	R**	008DF0		IMAXM1 SF	I**	000B98	
JCOUNT SF		I**	00C2FC	JOBNUM SF	XF	I**	000000	KMONTH F	C	I**	000008	LEGEND SF	XF	I**	000000
MDD360 S		I**	000B9C	NSYMBL S	C	I**	000074	NUMBER S	C	I**	000014	RCONTR SF	XF	R**	000000
READIN SF	XF	R**	000000	SALTOT SF	R**	00C310		SAMPLE SF	XF	R**	000000	STACON SF	XF	R**	000000
SUMDRF SF		R**	000B80	TAPCHK SF	XF	R**	000000	TOTDRF SF	R**	00C81C		TOTTWR SF	R**	000B44	
TOWERS S	C	R**	000028												

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * * SIZE OF BLOCK 000030 HEXADECIMAL BYTES

VAR. NAME	HT	TYPE	REL. ADDR.	VAR. NAME	HT	TYPE	REL. ADDR.	VAR. NAME	HT	TYPE	REL. ADDR.	VAR. NAME	HT	TYPE	REL. ADDR.
		R**	000000			R**	000004			R**	000008			R**	00000C

TED	R*4	000010	U	R*4	000014	XME	R*4	000018	TPD	R*4	00001C
DELQ	R*4	000020	FRACON	R*4	000024	TOWERS	R*4	000028	CLUSIZ	R*4	00002C

NAME OF COMMON BLOCK * LGND* SIZE OF BLOCK 000078 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
C	R*4	000000	DESCR	R*4	00001C	SYMBL	R*4	000054	NC	I*4	000070
NSYMBL	I*4	000074									

NAME OF COMMON BLOCK * TABUL* SIZE OF BLOCK 000058 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XMI	R*4	000000	NM	I*4	N.R.	NDIS	I*4	000054			

NAME OF COMMON BLOCK * STAB* SIZE OF BLOCK 000034 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
LAT	R*4	000000	LONG	R*4	000004	ICC	I*4	000008	ICL	I*4	00000C
IDAYS	I*4	000010	IWS	I*4	000014	IHR	I*4	000018	KGO	I*4	00001C
EDABC	R*4	000020									

NAME OF COMMON BLOCK * MAINC* SIZE OF BLOCK 000148 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XDIM	R*4	N.R.	YDIM	R*4	N.R.	IDUM	I*4	N.R.	JDUM	I*4	N.R.
ID	I*4	N.R.	NUMBER	I*4	000014	FF	R*4	000018	JQ	I*4	000144

NAME OF COMMON BLOCK * SAMP* SIZE OF BLOCK 00014C HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
Q1	R*4	000000	IDRCL	I*4	000004	ELEV	R*4	000008	DIAM	R*4	00000C
DRFRAC	R*4	00005C	SD	R*4	0000AC	SDH	R*4	0000FC			

NAME OF COMMON BLOCK * TITLER* SIZE OF BLOCK 000048 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
LOC	I*4	000000									

NAME OF COMMON BLOCK * DROPS* SIZE OF BLOCK 000258 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
VF	R*4	000000	DF	R*4	0000C8	CUMUL	R*4	000190	VI	R*4	0001F4

NAME OF COMMON BLOCK * TAPE* SIZE OF BLOCK 000010 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
KSTAT	I*4	N.R.	KYEAR	I*4	N.R.	KMONTH	I*4	000008	KDAY	I*4	N.R.

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
10	0101C0	20	01029A	24	010480	25	010492
26	01049A	27	01068C	28	0106C6	29	010724
35	010880	37	0109C2	30	010A9A	40	01083A
50	0108CA	60	010C58	70	010CEC	80	010024
90	010D72	100	010DFA	110	010EF2	120	010F1C
130	010F78	140	010F9C	150	010FAC	160	010FFC
200	0111D6	205	011462	210	01146E	220	0114A4
230	011486	240	011596	250	0115D2	45	0115FC
48	01163A	260	01166E	270	0116B4	280	0116F2
290	01173A	300	011768	302	01177E	304	011840
310	01185C	320	011A22	330	011A3E	340	011A8C
350	011ACA	360	011AE6	370	011AEE	372	011848
374	01189C	376	0118BC	380	011C96	385	011E14
390	011EE2	400	011EF2	410	011F32	420	011F76
430	0120C6	440	0120E0	450	012188	460	01218C
470	01221A	480	012242	485	012280	490	012304
500	01232F	510	012358	520	012418	530	012460

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 563 ,PROGRAM SIZE = 74908

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE READIN(IHR,IWS,IDB,IWB,IRH,IAT,ICL,IST,IWD,IFOG,IEND) READ 1
C * * * XREF DATE = 28 AUG 1975 * * *
COMMON /TAPE/ KSTAT,KYEAR,KMONTH,KDAY
DIMENSION IHR(6),IWD(6),IWDC(6),IWS(6),IWSC(6),IFOG(6),
1 IDB(6),IDBC(6),IWB(6),IWBC(6),IAT(6) READ 2
DIMENSION ICL(6),ICLC(6),IRH(6),IRHC(6) READ 3
100 READ(8,8000,END=115,ERR=120)KSTAT,KYEAR,KMONTH,KDAY,(IHR(I), READ 4
1 ICL(I),ICLC(I),IWD(I),IWDC(I) READ 5
2 ,IWS(I),IWSC(I),IDB(I),IDBC(I), READ 6
3 IWB(I),IWBC(I),IRH(I),IRHC(I),IAT(I),IFOG(I),I=1,6) READ 7
8000 FORMAT(4X,I5,3I2,6(I2,1X,I2,A1,4X, READ 8
1 I1,A1,3(I2,A1),4X,I2,A1,14X,A1,29X,A1,7X) ) READ 9
IF(KYEAR.LT.IST)GO TO 100 READ 10
DO 105 I=1,6 READ 11
CALL SIGNCK(IWD(I),IWDC(I)) READ 12
CALL SIGNCK(IWS(I),IWSC(I)) READ 13
CALL SIGNCK(IDB(I),IDBC(I)) READ 14
CALL SIGNCK(IWB(I),IWBC(I)) READ 15
CALL SIGNCK(IRH(I),IRHC(I)) READ 16
CALL SIGNCK(ICL(I),ICLC(I)) READ 17
IDUM=0 READ 18
CALL SIGNCK(IDUM,IAT(I)) READ 19
IAT(I)=IDUM READ 20
IDUM=0 READ 21
CALL SIGNCK(IDUM,IFOG(I)) READ 22
IFOG(I)=IDUM READ 23
105 CONTINUE READ 24
IF(KMONTH.EQ.12.AND.KDAY.EQ.31) GO TO 110 READ 25
RETURN READ 26
110 IF(IHR(1).LT.18) RETURN READ 27
IEND=1 READ 28
RETURN READ 29
115 IEND=2 READ 30
RETURN READ 31
120 READ(8,8000) READ 32
DO 125 I=1,6 READ 33
125 IWS(I)=9999 READ 34
RETURN READ 35
END READ 36

```

/ READIN / SIZE OF PROGRAM 000582 HEXADECEMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	
I SFA	XR	I*	0000E0	IAT SFA	XR	I*	000000	ICL SFA	XR	I*	000000	IDB SFA	XR	I*	000000	
IHR S	XR	I*	000000	IRH SFA	XR	I*	000000	IST	I*	I*	0000E4	IWB SFA	XR	I*	000000	
IWD SFA	XR	I*	000000	IWS SFA	XR	I*	000000	ICLC SFA	I*	I*	0000F4	IDBC SFA	I*	I*	00010C	
IDUM SFA	I*	I*	0000E8	IEND S	I*	I*	0000EC	IFOG SFA	XR	I*	000000	IRHC SFA	I*	I*	000124	
IWBC SFA	I*	I*	00013C	IWDC SFA	I*	I*	000154	IWSC SFA	I*	I*	00016C	KDAY S	C	I*	00000C	
KSTAT S	C	I*	000000	KYEAR S	C	I*	000004	IBCOM#	F	XF	I*	000000	KMONTH S	C	I*	000008
READIN	R*	I*	0000F0	SIGNCK SF	XF	R*	000000									

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * TAPE* SIZE OF BLOCK 000010 HEXADECEMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
KSTAT	I*	000000	KYEAR	I*	000004	KMONTH	I*	000008	KDAY	I*	00000C

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0001F8	105	00040C	110	00043A	115	000462
120	000472	125	00049C				

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 36 ,PROGRAM SIZE = 1458

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

125K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE SIGNCK(IFLD,ISGN) SIGN 1
C THIS SUBROUTINE FURNISHED BY NATIONAL CLIMATIC CENTER, ASHEVILLE SIGN 2
C WILL TEST ANY PSYCHROMETRIC WITH A SIGN OVER UNITS POSITION READ ASGN 3
C AND THE HIGH ORDER POSITION AS AN I SPECIFICATION OF PROPER WIDTH SIGN 4
C THE SIGN SHOULD ENTER THE PARAMETER LIST AS ISGN, THE REMAINING SIGN 5
C PORTION AS IFLD. UPON RETURN FROM THE SUBROUTINE THE VALUE OF IFLD SIGN 6
C WILL BE AN INTEGER WITH PROPER SIGN. IT WILL BE THE USER RESPONSIB SIGN 7
C CONVERT THIS TO DECIMAL FORM WITH PROPER DECIMAL ALIGNMENT. SIGN 8
C INVALID CONDITION CAUSES IFLD TO BE SET TO 9999 SIGN 9
C DIMENSION IP(10),MIN(10),NUM(10) SIGN 10
C DIMENSION INUM(10) SIGN 11
DATA INUM/'1','2','3','4','5','6','7','8','9','0' / SIGN 12
DATA IP/'A','B','C','D','E','F','G','H','I',' ' / SIGN 13
DATA MIN/'J','K','L','M','N','O','P','Q','R','S' / SIGN 14
DATA NUM/1,2,3,4,5,6,7,8,9,0 / SIGN 15
DATA IAST/'*'/ SIGN 16
DATA MINUS/'-'/ SIGN 17
IF(ISGN.EQ.IAST) GO TO 105 SIGN 18
IF(ISGN.EQ.MINUS) GO TO 110 SIGN 19
DO 100 K=1,10 SIGN 20
IF(ISGN.EQ.IP(K)) GO TO 115 SIGN 21
IF(ISGN.EQ.MIN(K)) GO TO 120 SIGN 22
IF(ISGN.EQ.INUM(K)) GO TO 115 SIGN 23
100 CONTINUE SIGN 24
105 IFLD=9999 SIGN 25
RETURN SIGN 26
110 IFLD=-1 SIGN 27
RETURN SIGN 28
115 IFLD=IFLD*10+NUM(K) SIGN 29
RETURN SIGN 30
120 IFLD=-(IFLD*10+NUM(K)) SIGN 31
RETURN SIGN 32
END SIGN 33

```

/ SIGNCK / SIZE OF PROGRAM 000254 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
K	SF	I*4	000084	IP		I*4	00009C	MIN		I*4	0000C4	NUM	F	I*4	0000EC
IAST		I*4	000088	IFLD	SF	I*4	00008C	INUM		I*4	000114	ISGN		I*4	000090
MINUS		I*4	000094	SIGNCK		R*4	000098								

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0001B2	105	0001BC	110	0001CC	115	0001DA
120	0001F8						

OPTIONS IN EFFECT NAME= MATN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 30 ,PROGRAM SIZE = 596

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILEATION *****

133K BYTES OF CORE NOT USED

LEVEL 21.6

OS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE TAPCHK(NTAPE,NYR,IST)
COMMON /TAPE/ KSTAT,KYEAR,KMONTH,KDAY
C * * TAPCHK ARRAYS AS OF 4 NOV 75
DIMENSION NOSTAT(15),NOTAPE(15),NOIST(15),NOLAST(15)
DATA NOSTAT/13891,14703,14714,14735,14922,11641,14719,14768,
1 13743,13897,13881,93807,93814,0,0/
DATA NOTAPE/ 9987,967,2088,15900,13404,4184,9427,11498,14139,
1 14619,14781,14782,11595,0,0/
DATA NOIST/55,58,59,65,49,65,60,59,55,65,55,55,65,0,0/
DATA NOLAST/64,67,68,74,58,73,69,68,64,74,64,64,74,0,0/
C * * LIST IS THE CURRENT NUMBER OF VALID ENTRIES IN NOTAPE. * * *
DATA LIST/13/
IF (NTAPE.GT.0) GO TO 10
PRINT 100
RETURN
10 CONTINUE
DO 20 I=1,LIST
IF (NTAPE.NE.NOTAPE(I)) GO TO 20
N=I
GO TO 30
20 CONTINUE
PRINT 110,NTAPE
RETURN
30 CONTINUE
NSTAT=NOSTAT(N)
NOI=NOIST(N)
NOL=NOLAST(N)
MOD=0
IOLD=IST
NOLD=NYR
IF (KSTAT.NE.NSTAT) PRINT 120,NTAPE,NSTAT,KSTAT
IF (IST.GE.NOI) GO TO 40
MOD=1
IST=NOI
40 CONTINUE
IF ((IST+NYR-1).LE.NOL) GO TO 50
MOD=1
NYR=NOL-IST+1
50 CONTINUE
IF (MOD.GT.0) PRINT 130,NOLD,IOLD,NYR,IST
100 FORMAT('TAPE CHECK NOT REQUESTED.',/)
110 FORMAT('TAPE X-',I5,' NOT IN CHECKLIST.',/)
120 FORMAT('TAPE X-',I5,' STATION ',I5,' REQUESTED.',/
1 ' TAPE FOR STATION ',I5,' MOUNTED.',/)
130 FORMAT('DATES CORRECTED TO CONFORM TO TAPE DATA:/'
1 ' REQUESTED: ',I2,' YEARS STARTING IN 19',I2/
2 ' WILL USE : ',I2,' YEARS STARTING IN 19',I2/
RETURN
END

```

/ TAPCHK / SIZE OF PROGRAM 000494 HEXADECEMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
I SF	I*4	000198		N SF	I*4	00019C		IST SF	I*4	0001A0		MOD S	I*4	0001A4	
NOI SF	I*4	0001A8		NOL SF	I*4	0001AC		NYR SF	I*4	0001B0		IOLD S	I*4	0001B4	
KDAY	C	I*4	N.R.	LIST F	I*4	0001B8		NOLD S	I*4	0001BC		KSTAT S	C	I*4	000000
KYEAR	C	I*4	N.R.	LIST F	I*4	0001CC		NSTAT S	I*4	0001C0		NTAPE S	I*4	0001C4	
IBCOM#	XF	I*4	000000	KMONTH C	I*4	N.R.		NOLAST F	I*4	000208		NOSTAT F	I*4	000244	
NJTAPE	I*4	000280		TAPCHK	R*4	0001C8									

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * TAPE* SIZE OF BLOCK 000010 HEXADECEMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
KSTAT	I*4	000000	KYEAR	I*4	N.R.	KMONTH	I*4	N.R.	KDAY	I*4	N.R.

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
10	000300	20	00032C	30	00035C	40	0003D6
50	0003F4						

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 48 ,PROGRAM SIZE = 1172

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

125K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE TRAJ(CONC,DD)
C * * * XREF DATE = 27 JAN 1975 * * *
C CALCULATES QUANTITIES USED IN DRIFT CALCULATION IN MAIN PROGRAM
C FOR FORMULAS SEE HOSLER, PENA, & PENA REFERENCE
C VI=VELOCITY OF FALL BEFORE EVAPORATION
C VF(-, -) IS FINAL VELOCITY OF FALL AFTER EVAPORATION
C DF(-, -) IS EFFECTIVE DISTANCE OF FALL AFTER EVAPORATION
C 2ND SUBSCRIPT: 1 FOR EVAP TO DRYNESS; 2 FOR EVAP TO SATURATION
C CUMUL IS CUMULATIVE FREQUENCY DISTRIBUTION OF DROPS
COMMON/DROPS/ VF(25,2),DF(25,2),CUMUL(25),VI(25)
COMMON/SAMP/Q1,IDRCL,ELEV,DIAM(20),DRFRAC(20),SD(20),SDH(20)
DIAMAX=DIAM(IDRCL)*1.5-0.5*DIAM(IDRCL-1)
DIAM(IDRCL+1)=DIAMAX
D=0.0
DD=DIAMAX/25.
F=0.
X1=0.
X2=0.5*(DIAM(1)+DIAM(2))
K=1
FAC=0.0001*(1+.7*CONC)*CCNC/.3112)**0.333333
DO 40 J=1,25
D=D+DD
DIM=FAC*D
VFJ2=3519.18*DIM*DIM
VFJ1=0.49633*VFJ2
C * * * 0.49633 = (.26*.26*2.165/1.197)**0.333333
VIJ=D*0.73414.
IF(D,GT,74.361)VIJ=.004451*(D-37.18)
DFJ=7.4166E-6*D**2.6667
DFJ1=DFJ*(VIJ-VFJ1)/(VIJ+VFJ1)
DFJ2=DFJ*(VIJ-VFJ2)/(VIJ+VFJ2)
VF(J,1)=VFJ1
VF(J,2)=VFJ2
VI(J)=VIJ
DF(J,1)=DFJ1
DF(J,2)=DFJ2
10 IF(D-X2)20,20,30
20 CUMUL(J)=F+DRFRAC(K)*(D-X1)/(X2-X1)
GO TO 40
30 F=F+DRFRAC(K)
X1=X2
K=K+1
X2=0.5*(DIAM(K)+DIAM(K+1))
IF(K-IDRCL) 10,35,32
32 K=IDRCL
F=DRFRAC(IDRCL)
35 X2=DIAMAX
IF(J,LT,25) GO TO 10
CUMUL(J)=1.
40 CONTINUE
DO 50 J=1,24
50 CUMUL(26-J)=CUMUL(26-J)-CUMUL(25-J)
C PRINT9000,{VF(J,1),VF(J,2),DF(J,1),DF(J,2),CUMUL(J),VI(J),J=1,25)
9000 FORMAT(1P6E12.3)
RETURN
END

```

TRAJ 10
TRAJ 20
TRAJ 30
TRAJ 40
TRAJ 50
TRAJ 60
TRAJ 70
TRAJ 80
TRAJ 90
TRAJ 100
TRAJ 110
TRAJ 120
TRAJ 130
TRAJ 140
TRAJ 150
TRAJ 160
TRAJ 170
TRAJ 180
TRAJ 190
TRAJ 200
TRAJ 210
TRAJ 220
TRAJ 230
TRAJ 240
TRAJ 250
TRAJ 260
TRAJ 270
TRAJ 280
TRAJ 290
TRAJ 300
TRAJ 310
TRAJ 320
TRAJ 330
TRAJ 340
TRAJ 350
TRAJ 360
TRAJ 370
TRAJ 380
TRAJ 390
TRAJ 400
TRAJ 410
TRAJ 420
TRAJ 430
TRAJ 440
TRAJ 450
TRAJ 460
TRAJ 470
TRAJ 480
TRAJ 490
TRAJ 500
TRAJ 510
TRAJ 520
TRAJ 530
TRAJ 540
TRAJ 550
TRAJ 560

/ TRAJ / SIZE OF PROGRAM 0003F6 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.		
D	SF	P*	0000F4	F	SF	R*	0000F8	J	SF	I*	0000FC	K	SF	I*	000100		
DD	SF	R*	000104	DF	S	C	R*	0000C8	Q1	C	R*	N.R.	SD	C	R*	N.R.	
VF	S	C	000000	VI	S	C	R*	0001F4	X1	SF	R*	000108	X2	SF	R*	00010C	
DFJ	SF	R*	000110	DIM	SF	R*	000114	FAC	SF	R*	000118	SDH	C	R*	N.R.		
VIJ	SF	R*	00011C	CONC	F	R*	000120	DFJ1	SF	R*	000124	DFJ2	SF	R*	000128		
DIAM	SF	C	00000C	ELEV	C	R*	N.R.	TRAJ	R*	00012C	VFJ1	SF	R*	000130			
VFJ2	SF	R*	000134	CUMUL	SF	C	R*	000190	IDRCL	F	C	I*	000004	FRXPR#	XF	R*	000000
DIAMAX	SF	P*	000138	DRFRAC	F	C	R*	00005C									

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * DROPS* SIZE OF BLOCK 000258 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
VF	R*	000000	DF	P*	0000C8	CUMUL	R*	000190	VI	R*	0001F4

NAME OF COMMON BLOCK * SAMP* SIZE OF BLOCK 00014C HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
Q1	R*	N.R.	IDRCL	I*	000004	ELEV	R*	N.R.	DIAM	R*	00000C
DRFRAC	P*	00005C	SD	R*	N.R.	SDH	R*	N.R.			

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
10	0002DA	20	0002EE	30	000318	32	000348
35	00034E	40	00036C	50	00038E		

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
 STATISTICS SOURCE STATEMENTS = 48 ,PROGRAM SIZE = 1014
 STATISTICS NO DIAGNOSTICS GENERATED
 ***** END OF COMPILATION ***** 125K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72) OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

```

SUBROUTINE SAMPLE(DELQ1,DD,RAPP)
C * * * XREF DATE = 28 JAN 1976 * * *
DIMENSION XM(11),UX(3,6),DRIFT(10),AREA(10),PRR(10),IK(10),DR(10)
COMMON HT,WO,RO,ICON,TEO,U,XME,TPD,DELQ,FRACTION,TOWERS,CLUSIZ
COMMON/DROPS/ VF(25,2),DF(25,2),CUMUL(25),VI(25)
COMMON/SAMP/Q1,IDRCL,ELEV,DIA(20),DRERAC(20),SD(20),SDH(20)
DATA UX/1.,2.,3.,4.,6.,7.,8.,10.,12.,8.,12.,16.,4.,6.,7.,1.,2.,3./SAMP 70
DATA XM/1.,2.,5,1.,1.5,2.,2.5,3.,4.,5.,6./SAMP 80
AB(X)=255.37*.55555*X
XM(11)=2.*XM(10)-XM(9)
RAD1=XM(1)
QAREA=0.
DO 1 I=1,10
RAD2=XM(I+1)
AREA1=0.25*(RAD1+RAD2)**2
AREA(I)=AREA1-QAREA
RAD1=RAD2
QAREA=AREA1
1 CONTINUE
INCR=1
IER=0
DO 80 IDBT=1,3
DBT=20.*20.*IDBT
TEO=AB(DBT)
WBT=DBT*1.1-1.
DO 80 IWB=1,3
PRINT 8060,(XM(IG),IG=1,10)
PRINT 8010
WBT=WBT-0.1*DBT
RH=PV(DBT,WBT,ELEV)/PVS(DBT)
RHFAC=(1.0-RH)**1.079
IRH=2
IF (IRH.LT.0.5) IRH=1
C CALCULATE TOWER EFFLUENT TEMPERATURE
IF (WBT.LT.80.) ENTHAL=(WBT+4.3050)/(3.917-0.024846*WBT)
IF (WBT.GE.80.) ENTHAL=(WBT-13.8501)/(2.766-0.015652*WBT)
ENTHAL=ENTHAL+RAPP
IF (ENTHAL.GT.43.697)TS=(2.766*ENTHAL+13.851)/(1.+0.015652*ENTHAL)
IF (ENTHAL.LE.43.697)TS=(3.917*ENTHAL-4.3051)/(1.+0.024846*ENTHAL)
TPD=AB(TS)
DELQ=DELQ1*TPD
DO 80 ICON=1,6
DO 80 IU=1,3
V=UX(IU,ICON)
U=V*.51444
K=25
QR=0.
QPR=0.
OXME=0.
DO 60 IX=1,10
XME=XM(IX)*1609.344
CALL PRISE(PR)
DRIFT(IX)=0.
PRR(IX)=PR
DPR=PR-QPR
DXME=XME-OXME
QPR=PR
OXME=XME
IF (IRH.LT.0.76) GOTO 10
NO EVAPORATION
VFALL=(HT+PR)*U/XME
DIA=37.18*VFALL/.004451
IF (VFALL.LT.0.16548) DIA=SQRT(33414.*VFALL)
IDIA=DIA/DD+1.
IK(IX)=IDIA
IF (IDIA.GT.25)GO TO 50
DVDR=(VFALL-U*DPR/DXME)/XME
DDDR=DVDR/0.004451
IF (VFALL.LT.0.16548) DDDR=0.5*DIA*DVDR/VFALL
DCDD=CUMUL(IDIA)/DD
GO TO 40
10 CONTINUE

```

```

H=HT*PR
20 R=DF(K,IRH)/RHFAC
IF(H.LT,R) GO TO 45
XR=U*(H-R)/VF(K,IRH)
GO TO 48
45 XR=2.*U*P*(1.-SQRT(1.-H/R))/VI(K)
48 CONTINUE
C ITERATIVE SOLUTION FOR DIAMETER OF DROP FALLING AT THIS DISTANCE
IF(XR.GT,XME) GO TO 30
K=K-1
OP=XR
IF(K) 50,50,20
30 DCDD=CUMUL(K)
IK(IX)=K
IF(K.GE.25) GO TO 50
VFALL=VF(K,IRH)
DDDR=1./(XR-OR)
40 CH12=Q1*DDDR*DCDD*INCR*8./XME
IF (CH12.GE.0.) GO TO 90
IER=IER+1
PRINT 8000, IER,K,IRH,IDIA,R,OR,XME,CH12,Q1,DDDR,DCDD,PR
IF (IER.GT.50) STOP
90 CONTINUE
DRIFT(IX)=CH12
50 CONTINUE
60 CONTINUE
PRINT 8020,DBT,WBT,ICON,V,PRR
PRINT 8040, RH
SUM=0.
DO 70 IX=1,10
DPIX=DRIFT(IX)*AREA(IX)
DR(IX)=508543.*DPIX
C * * 508543.=1609.344**2*PI/16.
70 SUM=SUM+DPIX
SUM=SUM* 161874./Q1
C * * 161874.=1609.344**2/16.
PRINT 8030, DRIFT,DR
PRINT 8040,SUM
80 CONTINUE
8000 FORMAT(15,3I3,1P9E12.3)
8010 FORMAT(65X,'PLUME RISE - METERS',41X,'REL HUM'/
1 ' DRY WET STAB. WIND',40X,'DRIFT - GM/HR SQ M'/
2 ' BULB BULB CLASS KNOTS',43X,'DRIFT - GM/HR',44X,'FRAC SOL')
8020 FORMAT(1X,F4.1,F6.1,I5,F8.1,10F10.2)
8030 FORMAT(24X,1P10E10.3)
8040 FORMAT(1H,123X,F7.4)
8060 FORMAT(1H1,53X,'SAMPLE PLUME RISE AND DRIFT'/
1 ' DEPOSITION DISTANCES, MILES',F6.2,9F10.2)
RETURN
END

```

```

SAMP 730
SAMP 740
SAMP 750
SAMP 760
SAMP 770
SAMP 780
SAMP 790
SAMP 800
SAMP 810
SAMP 820
SAMP 830
SAMP 840
SAMP 850
SAMP 860
SAMP 870
SAMP 880
SAMP 890
SAMP 900
SAMP 910
SAMP 920
SAMP 930
SAMP 940
SAMP 950
SAMP 960
SAMP 970
SAMP 980
SAMP 990
SAMP 1000
SAMP 1010
SAMP 1020
SAMP 1030
SAMP 1040
SAMP 1050
SAMP 1060
SAMP 1070
SAMP 1080
SAMP 1090
SAMP 1100
SAMP 1120
SAMP 1130
SAMP 1140
SAMP 1150
SAMP 1160
SAMP 1170
SAMP 1180
SAMP 1190
SAMP 1200
SAMP 1210
SAMP 1220
SAMP 1230

```

/ SAMPLE / SIZE OF PROGRAM 000BCE HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
H SFA	R**	000260		I SF	I**	000264		K SF	I**	000268		R SFA	R**	00026C	
U SF	C	000014		V SF	R**	000270		AB S	R**	000000		DD F	R**	000274	
OF F	C	000008		OR S	R**	00030C		HT F	C	000000		IG F	I**	000278	
IK S	I**	000334		IU SF	I**	00027C		IX SF	I**	00028Q		OR SF	R**	000284	
PR SFA	R**	000288		PV F	XF	000000		Q1 SF	C	000000		QH SF	R**	00028C	
PO	C	N.R.		SD	C	N.R.		TS SFA	R**	000290		UX F	R**	00035C	
VF F	C	000000		VI F	C	0001F4		WO	C	N.R.		XM SF	R**	0003A4	
XR SF	R**	000294		DBT SFA	R**	000298		DIA SF	R**	00029C		DPR SF	R**	0002A0	
IER SF	I**	0002A4		IRH SF	I**	0002A8		OPR SF	R**	0002AC		PRR S	R**	0003D0	
PVS F	XF	000000		SDH	C	N.R.		SUM SF	R**	0002B0		TED S	C	000010	
TPO SF	C	00001C		WBT SFA	R**	0002B4		XME SF	C	000018		AREA SF	R**	0003F8	
CH12 SF	R**	0002B8		DCDD SF	R**	0002BC		DDDR SF	R**	0002C0		DELQ S	C	000020	
DIAM	C	N.R.		DR1X SF	R**	0002C4		DVDR SF	R**	0002C8		DXME SF	R**	0002CC	
ELEV FA	C	000008		ICON SF	C	00000C		IDBT SF	I**	0002D0		IDIA SF	I**	0002D4	
INCR SF	I**	0002D8		IWBT SF	I**	0002DC		OXME SF	R**	0002E0		RAD1 SF	R**	0002E4	
RAD2 SF	R**	0002E8		RAPP F	R**	0002EC		AREAL SF	R**	0002F0		CUMUL F	C	000190	
DELQ1 F	R**	0002F4		DRIFT SF	R**	000420		IDRCL	C	N.R.		QAREA SF	R**	0002F8	
PRISE SF	XF	000000		RHFAC SF	R**	0002FC		VFALL SFA	R**	000300		SQRT	XF	000000	
FRXPR#	XF	000000		CLUS1Z	C	N.R.		DRFRAC	C	N.R.		ENTHAL SF	R**	000304	
FRACON	C	N.R.		IBCON#	XF	000000		SAMPLE	R**	000308		TOWERS	C	N.R.	

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * * SIZE OF BLOCK 000030 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
HT	R**	000000	WO	R**	N.R.	RO	R**	N.R.	ICON	I**	00000C
TEO	R**	000010	U	R**	000014	XME	R**	000018	TPC	R**	00001C
DELQ	R**	000020	FRACON	R**	N.R.	TOWERS	R**	N.R.	CLUS1Z	R**	N.R.

NAME OF COMMON BLOCK * DROPS* SIZE OF BLOCK 000258 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
HT	R**	000000	WO	R**	N.R.	RO	R**	N.R.	ICON	I**	00000C
TEO	R**	000010	U	R**	000014	XME	R**	000018	TPC	R**	00001C
DELQ	R**	000020	FRACON	R**	N.R.	TOWERS	R**	N.R.	CLUS1Z	R**	N.R.

VF R*4 000000 DF R*4 0000C8 CUMUL R*4 000190 VI R*4 0001F4

NAME OF COMMON BLOCK * SAMP* SIZE OF BLOCK 00014C HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
Q1	R*4	000000	IDRCL	I*4	N.R.	ELEV	R*4	000008	DIAM	R*4	N.R.
DRFRAC	R*4	N.R.	SD	R*4	N.R.	SDH	R*4	N.R.			

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
1	000506	10	000870	20	0008A6	45	0008D0
48	00090E	30	000942	40	000982	90	000A3E
50	000A46	60	000A46	70	000AD8	80	000B40

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 127 ,PROGRAM SIZE = 3022

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILEATION *****

109K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

05/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

FUNCTION PV(DBT,WBT,ELEV)

VAPOR PRESSURE INCHES OF MERCURY

PV=PVS(WBT)-(0.000367*BP(ELEV)*(DET-WBT)*(1.+(WBT-32.)/1571.))

100 RETURN

END

PV 1
PV 2
PV 3
PV 4
PV 5
PV 6

/ PV / SIZE OF PROGRAM 000156 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
BP	F	XF	R*4 000000	PV	S	R*4 000090		DBT	F	R*4 000094		PVS	F	XF	R*4 000000
WBT	FA		R*4 000098	ELEV	FA	R*4 00009C									

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0000FA NR						

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 4 ,PROGRAM SIZE = 342

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILEATION *****

133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

C	FUNCTION PVS(A)	PVS	1
C	A = TEMPERATURE, DEGREES F	PVS	2
C	PVS = SATURATED VAPOR PRESSURE, INCHES OF MERCURY	PVS	3
C	PVSF= SATURATED VAPOR PRESSURE, PSI	PVS	4
	B=.555555*A+255.37	PVS	5
	PVS=PVSF(BI*2.036	PVS	6
	RETURN	PVS	7
	END	PVS	8

/ PVS / SIZE OF PROGRAM 000102 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	
A	F	R*4	000084	B	SFA	R*4	000088	PVS	S	R*4	00008C	PVSF	F	XF	R*4	000000

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 5, PROGRAM SIZE = 258

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

C	FUNCTION BP(ELEV)	BP	1
	NOMINAL BAROMETRIC PRESSURE FOR ALTITUDE IN FEET	BP	2
	BP=29.8411-(0.993523E-3)*ELEV	BP	3
	RETURN	BP	4
	END	BP	5

/ BP / SIZE OF PROGRAM 00000E HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
BP	S	P*4	000080	ELEV	F	R*4	000084								

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 4, PROGRAM SIZE = 206

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
FUNCTION PVSF(T) PVSF 10
C FORMULAS FROM J.A.GOFF, ASHRAE FUNDAMENTALS HANDBOOK 1972, P. 98. PVSF 20
C T IN DEGREES KELVIN PVSF= SATURATED VAPOR PRESSURE, PSI PVSF 30
DIMENSION A(6),B(4),P(4) PVSF 40
DATA A /-7.90298,5.02808,-1.3816E-7,11.344,8.1328E-3,-3.49149/ PVSF 50
DATA B /-9.09718,-3.56654,0.876793,0.0060273/ PVSF 60
IF (T,LT,273.16) GO TO 100 PVSF 70
Z=373.16/T PVSF 80
P(1)=A(1)*(Z-1) PVSF 90
P(2)=A(2)*ALOG10(Z) PVSF 100
Z1=A(4)*(1.-1./Z) PVSF 110
P(3)=A(3)*(10**Z1-1) PVSF 120
Z1=A(6)*(Z-1) PVSF 130
P(4)=A(5)*(10**Z1-1) PVSF 140
GO TO 105 PVSF 150
100 Z=273.16/T PVSF 160
P(1)=B(1)*(Z-1) PVSF 170
P(2)=B(2)*ALOG10(Z) PVSF 180
P(3)=B(3)*(1.-1./Z) PVSF 190
P(4)=ALOG10(B(4)) PVSF 200
105 SUM=0. PVSF 210
DO 110 I=1,4 PVSF 220
110 SUM=SUM+P(I) PVSF 230
PVSF=14.696*10**SUM PVSF 240
RETURN PVSF 250
END PVSF 260

```

/ PVSF / SIZE OF PROGRAM 0002C4 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
A	F	R#4	0000E4	B	FA	R#4	0000FC	I	SF	I#4	0000CC	P	SF	R#4	00010C
T	F	R#4	0000D0	Z	SFA	R#4	0000D4	Z1	SF	R#4	0000D8	SUM	SF	R#4	0000DC
PVSF	S	P#4	0000E0	FRXPR#	XF	R#4	000000	ALOG10	XF	R#4	000000				

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0001F4	105	00025C	110	00026A		

```

*OPTIONS IN EFFECT* NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
*OPTIONS IN EFFECT* SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
*STATISTICS* SOURCE STATEMENTS = 25 ,PROGRAM SIZE = 708
*STATISTICS* NO DIAGNOSTICS GENERATED
***** END OF COMPILATION *****

```

133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE SOLAR(IDAY,KGO,EDABC) SOLA 1
THIS SUBROUTINE SIMPLY INTERPOLATES IN TABLES SOLA 3
C EDABC(1)=EQUATION OF TIME, MIN SOLA 4
C EDABC(2)= DECLINATION ( DEGREES) SOLA 5
C EDABC(3-5) ARE FOR CALCULATING SOLAR RADIATION INTENSITIES AND SOLA 6
C ARE NOT USED IN OREAD SOLA 7
C SOLA 8
C SOLA 9
DIMENSION TABLE(6,13),EDABC(5) SOLA 10
DATA TABLE/21.0,-11.3,-20.00,390.0,0.142,0.058, SOLA 11
1 52.0,-13.5,-10.80,385.0,0.144,0.060, SOLA 12
2 80.0,-7.3, 0.00,376.0,0.156,0.071, SOLA 13
3 111.0, 0.1, 11.60,360.0,0.180,0.097, SOLA 13

```

```

4      141.0, 3.5, 20.00,350.0,0.196,0.121, SOLA 14
5      172.0, -1.8, 23.45,345.0,0.205,0.134, SOLA 15
6      202.0, -6.4, 20.60,344.0,0.207,0.136, SOLA 16
7      233.0, -1.3, 12.30,351.0,0.201,0.122, SOLA 17
8      264.0, 7.5, 0.00,365.0,0.177,0.092, SOLA 18
9      294.0, 15.1, -10.50,378.0,0.160,0.073, SOLA 19
A      325.0, 13.9, -19.80,387.0,0.149,0.063, SOLA 20
B      355.0, 1.5, -23.45,391.0,0.142,0.057, SOLA 21
C      386.0, -11.3, -20.00,390.0,0.142,0.058/ SOLA 22
      DAY=IDAY
      IF(DAY.GT.TABLE(1,1)) GO TO 100
      DAY=DAY+365.
      GO TO 110
100 DO 105 K=KGO,12
      IF(TABLE(1,K).LE.DAY) GO TO 105
      KEYP1=K
      KEY=K-1
      KGO=KEY
      GO TO 115
105 CONTINUE
      KGO=12
110 KEY=12
      KEYP1=13
115 CONTINUE
      DO 120 K=2,3
      EDABC(K-1)=TABLE(K,KEY)+(TABLE(K,KEYP1)-TABLE(K,KEY))*
1      (DAY-TABLE(1,KEYP1))/(TABLE(1,KEYP1)-TABLE(1,KEY))
120 CONTINUE
      RETURN
      END

```

SOLA 14
SOLA 15
SOLA 16
SOLA 17
SOLA 18
SOLA 19
SOLA 20
SOLA 21
SOLA 22
SOLA 23
SOLA 24
SOLA 25
SOLA 26
SOLA 27
SOLA 28
SOLA 29
SOLA 30
SOLA 31
SOLA 32
SOLA 33
SOLA 34
SOLA 35
SOLA 36
SOLA 37
SOLA 38
SOLA 39
SOLA 40
SOLA 41
SOLA 42
SOLA 43

NAME TAG TYPE ADD.				NAME TAG TYPE ADD.				NAME TAG TYPE ADD.				NAME TAG TYPE ADD.				
K	SF	I*4	0000A4	DAY	SF	R*4	0000A8	KEY	SF	I*4	0000AC	KGO	SF	I*4	0000B0	
IDAY	F	I*4	0000B4	EDABC	S	XR	R*4	000000	KEYP1	SF	I*4	0000B8	SOLAR		R*4	0000BC
TABLE	F	R*4	0000C0													

```

LABEL ADDR LABEL ADDR LABEL ADDR LABEL ADDR
100 000270 105 0002B8 110 0002CA 115 0002D2
120 000344

*OPTIONS IN EFFECT* NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
*OPTIONS IN EFFECT* SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
*STATISTICS* SOURCE STATEMENTS = 25 ,PROGRAM SIZE = 932
*STATISTICS* NO DIAGNOSTICS GENERATED
***** END OF COMPILEATION ***** 125K BYTES OF CORE NOT USED

```

```

LEVEL 21.6 (DEC 72) OS/360 FORTRAN H
COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE STACON(ISTACO)
REAL*4 LAT, LONG
DIMENSION NSTACO(9,7)
COMMON/STAB/LAT, LONG, ICC, ICL, IDAY, IWS, IHR, KGO, EDABC(5)
C
C TABLE FROM FINAL PAGE OF INSTRUCTION FOR PROGRAM 'STAR' BY NOAA
DATA NSTACO/1,1,1,2,2,2,3,3,3,
1 1,2,2,2,2,3,3,3,4,
2 2,2,3,3,3,3,4,4,4,
3 3,3,4,4,4,4,4,4,4,
4 4,4,4,4,4,4,4,4,4,

```

STAC 1
STAC 2
STAC 3
STAC 4
STAC 5
STAC 6
STAC 7
STAC 8
STAC 9
STAC 10
STAC 11

```

5          6,6,5,5,4,4,4,4,4,
6          7,7,6,6,5,5,5,4,4,
C          STAC 12
C          STAC 13
C          STAC 14
C          STAC 15
C          STAC 16
C          STAC 17
C          STAC 18
C          STAC 19
C          STAC 20
C          STAC 21
C          STAC 22
C          STAC 23
C          STAC 24
C          STAC 25
C          STAC 26
C          STAC 27
C          STAC 28
C          STAC 29
C          STAC 30
C          STAC 31
C          STAC 32
C          STAC 33
C          STAC 34
C          STAC 35
C          STAC 36
C          STAC 37
C          STAC 38
C          STAC 39
C          STAC 40
C          STAC 41
C          STAC 42
C          STAC 43
C          STAC 44
C          STAC 45
C          STAC 46
C          STAC 47
C          STAC 48
C          STAC 49
C          STAC 50
C          STAC 51
C          STAC 52
C          STAC 53
C          STAC 54
C          STAC 55
C          STAC 56
C          STAC 57
C          STAC 58

```

/ STACON / SIZE OF PROGRAM 0004CC HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
H SFA	R**	R**	0000EC	DT SF	R**	R**	0000F0	HR SFA	R**	R**	0000F4	NR SF	I**	I**	0000F8
SN SFA	R**	R**	0000FC	ALT S	R**	R**	000100	DEC SFA	R**	R**	000104	ICC C	I**	I**	000008
ICL C	I**	I**	00000C	ICN SF	I**	I**	000108	IHR F C	I**	I**	000018	IWS F C	I**	I**	000014
KGO C	I**	N.R.		LAT F C	R**	R**	000000	NRI SF	I**	I**	00010C	XAT SFA	R**	R**	000110
COSZ SFA	R**	R**	000114	IDAY C	I**	N.R.		LONG FA C	R**	R**	000004	NCOL SF	I**	I**	000118
EDABC F C	R**	R**	000020	ARCOS XF	R**	R**	000000	COS XF	R**	R**	000000	SIN XF	R**	R**	000000
ISTACO S	I**	I**	00011C	NSTACO F	I**	I**	000124	STACON	R**	R**	000120				

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * STAB* SIZE OF BLOCK 000034 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL.	ADDR.	VAR. NAME	TYPE	REL.	ADDR.	VAR. NAME	TYPE	REL.	ADDR.	VAR. NAME	TYPE	REL.	ADDR.
LAT	R**		000000	LONG	R**		000004	ICC	I**		000008	ICL	I**		00000C
IDAY	I**		N.R.	IWS	I**		000014	IHR	I**		000018	KGO	I**		N.R.
EDABC	R**		000020												

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	00038A	105	0003AA	110	0003C4	115	000400
120	000416	125	00046A	130	000472		

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 57 ,PROGRAM SIZE = 1228

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

125K BYTES OF CORE NOT USED

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
                   SUBROUTINE PRISE(PRI)

```

	SUBROUTINE PRISE(IPR)	PRIS 1
C	*****	PRIS 20
C	*****	PRIS 30
C	*****	PRIS 40
C	*****	PRIS 50
C	*****	PRIS 60
C	*****	PRIS 70
C	*****	PRIS 80
C	*****	PRIS 90
C	*****	PRIS 100
	COMMON HT,W0,R0,ICON,TEG,U,XME,TPO,CELQ,FRACON,TOWERS,CLUSIZ	PRIS 120
	DIMENSION TGI(6)	PRIS 130
	DATA G,CURT/9.8066,0.33333333/	PRIS 140
	DATA TGI/-0.0263,-0.0173,-0.01457,-0.01,0.00455,0.0263/	PRIS 150
	TG= TGI(ICON)	PRIS 160
	TEHT=TPO+TG*HT	PRIS 170
C	***** ATMOSPHERIC STABILITY PARAMETER, S. EQU. 5, REF. 1.	PRIS 180
	S = G*(TG+.01)/TEO	PRIS 190
	100 CONTINUE	PRIS 200
C	***** BUOYANCY FLUX, FBO. EQU. 3, REF. 1.	PRIS 210
	FBO=G*W0*R0*R0*(1.-TEHT/TPO+DELQ*(.61+2454.*FRACON/TPO))	PRIS 220
	IF(FBO.GE.0.) GO TO 110	PRIS 230
	PRINT 8000,TPO,TEHT	PRIS 240
8000	FORMAT('NEGATIVE BUOYANCY FLUX, TPO=','F12.5,' TEHT= 'F12.5)	PRIS 250
	TEHT=TPO	PRIS 260
	GO TO 100	PRIS 270
	110 CONTINUE	PRIS 280
	IF(U.LE.0.) GO TO 130	PRIS 280
	IF (ICON.GT.4) GO TO 160	PRIS 300
	FBO4=FBO**0.4	PRIS 310
	H=AMIN1(HT,30.48)	PRIS 320
	XS=2.16*FBO4*H**0.6	PRIS 330
	X=AMIN1(XME+3.0*XS)	PRIS 340
	120 CONTINUE	PRIS 350
C	***** EQU. 4.32, REF. 2.	PRIS 360
	H=1.6*(FBO**X)**CURTJU	PRIS 370
C	***** PR = PLUME RISE, METERS.	PRIS 380
	PR=H	PRIS 390
	GO TO 140	PRIS 400
	130 CONTINUE	PRIS 410
C	***** EQU. 4.25, REF. 1.	PRIS 420
	PR=5.0*SQRT(SQRT(FBO/(S*SQRT(S))))	PRIS 430
	140 CONTINUE	PRIS 440
	IF (PR.GT.0.) GO TO 150	PRIS 450
	PRINT 8010, PR	PRIS 460
8010	FORMAT('NEGATIVE OR ZERO PLUME RISE: PR =',1PE12.4)	PRIS 470
	PETURN	PRIS 480
	150 CONTINUE	PRIS 490
	PATIO=CLUSIZ/PR	PRIS 500
C	***** EQU. 12, PEF. 3.	PRIS 510
	FACT=6.*RATIO*SQRT(RATIO/TOWERS)	PRIS 520
C	***** EQU. 13, REF. 3.	PRIS 530
	PR=PR*((FACT+TOWERS)/(FACT+1.0))**CURT	PRIS 540
	PETURN	PRIS 550
160	X=AMIN1(XME+2.4*U/SQRT(S))	PRIS 560
	GO TO 120	PRIS 570
	END	PRIS 580

[illegible][illegible]

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
HT	R#4	000000	WO	R#4	000004	RO	R#4	000008	ICON	I#4	00000C
TEQ	R#4	000010	U	R#4	000014	XME	R#4	000018	TPD	R#4	00001C
DELQ	R#4	000020	FRACON	R#4	000024	TOWERS	R#4	000028	CLUSIZ	R#4	00002C

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	00022C	110	000280	120	0002E8	130	00031A
140	000362	150	000390	160	0003F2		

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
 STATISTICS SOURCE STATEMENTS = 45 ,PROGRAM SIZE = 1116
 STATISTICS NO DIAGNOSTICS GENERATED
 ***** END OF COMPILATION ***** 129K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72) OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

SUBROUTINE	SYSZ	(SY,SZ)	SYSZ	1
COMMON	HT,WD,RO,ICON,TEO,U,XME,TPC,DELQ,FRACON,TOWERS,CLUSIZ		SYSZ	2
DIS	= XME/SQRT(1.0+0.0001*XME)		SYSZ	3
GO TO	(100,105,110,115,120,125), ICON		SYSZ	4
100	SY = .22*DIS		SYSZ	5
	SZ = 0.2*XME		SYSZ	6
	RETURN		SYSZ	7
105	SY = 0.16*DIS		SYSZ	8
	SZ = 0.12*XME		SYSZ	9
	RETURN		SYSZ	10
110	SY = 0.11*DIS		SYSZ	11
	SZ = 0.08*XME/SQRT(1.0 + .0002*XME)		SYSZ	12
	RETURN		SYSZ	13
115	SY = .08*DIS		SYSZ	14
	SZ = 0.06*XME/SQRT(1.0+0.0015*XME)		SYSZ	15
	RETURN		SYSZ	16
120	SY = 0.06*DIS		SYSZ	17
	SZ = 0.03*XME/(1.0+.0003*XME)		SYSZ	18
	RETURN		SYSZ	19
125	SY = 0.04*DIS		SYSZ	20
	SZ = 0.02*XME/(1.0+.0003*XME)		SYSZ	21
	RETURN		SYSZ	22
	END		SYSZ	23

/ SYSZ / SIZE OF PROGRAM 0002D0 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
U	C	R**	N.R.	HT	C	R**	N.R.	RO	C	R**	N.R.	SY S		R**	00000C
SZ S		R**	0000E0	WD	C	R**	N.R.	DIS SF		R**	0000E4	TEO	C	R**	N.R.
TPO	C	R**	N.R.	XME FA	C	R**	000018	DELQ	C	R**	N.R.	ICON F	C	I**	00000C
SYSZ	R**	R**	0000E8	SQRT	XF	R**	000000	CLUSIZ	C	R**	N.R.	FRACON	C	R**	N.R.
TOWERS	C	R**	N.R.												

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK *	SIZE OF BLOCK	000030 HEXADECIMAL BYTES
VAR. NAME TYPE REL. ADDR.	VAR. NAME TYPE REL. ADDR.	VAR. NAME TYPE REL. ADDR.
HT R** N.R.	WD R** N.R.	RO R** N.R.
TEO R** N.R.	U R** N.R.	XME R** 000018
DELQ R** N.R.	FRACON R** N.R.	TOWERS R** N.R.
		CLUSIZ R** N.R.

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	000158	105	000178	110	000198	115	0001E2
120	00022C	125	00025A				

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 23 ,PROGRAM SIZE = 720
 STATISTICS NO DIAGNOSTICS GENERATED
 ***** END OF COMPILEATION ***** 129K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 721) OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

C	*** XREF DATE = 28 JAN 1976 ***	TABL 10
C		TABL 20
C	PRINTS TABLES OF RESULTS	TABL 30
C		TABL 40
	COMMON/TABUL/XMI(20),NM,NDIS	TABL 50
	DIMENSION LDIR(17),DRIFT(17,1)	TABL 60
	DATA LDIR/' N',' NNE',' NE',' ENE',' E',' ESE',' SE',' SSE',	TABL 70
1	' S',' SSW',' SW',' WSW',' W',' WNW',' NW',' NNW',	TABL 80
2	' CALM'/	TABL 90
	NM=MINO(NDIS,10)	TABL 100
	PRINT 8000,{XMI{IX},IX=1,NM}	TABL 110
	PRINT 8005	TABL 120
	DO 100 IDIR=1,16	TABL 130
100	PRINT 8010,LDIR(IDIR),(DRIFT(IDIR,IX),IX=1,NM)	TABL 140
	IF(NDIS.LE.10) RETURN	TABL 150
105	I1=NM+1	TABL 160
	NM=NM+10	TABL 170
	I2=MINO(NDIS,NM)	TABL 180
	PRINT 8015	TABL 190
	PRINT 8000,{XMI{IX},IX=I1,I2}	TABL 200
	PRINT 8005	TABL 210
	DO 110 IDIR=1,16	TABL 220
110	PRINT 8010,LDIR(IDIR),(DRIFT(IDIR,IX),IX=I1,I2)	TABL 230
	IF(I2.LT.NDIS) GO TO 105	TABL 240
8000	FORMAT(/,IX,'MILES',3X,10(F6.2,4X))	TABL 250
8005	FORMAT(' WIND FROM')	TABL 260
8010	FORMAT(2H0 ,A4,1X,1P10E10.3)	TABL 270
8015	FORMAT(1H1,60X'PROGRAM DRFAD'/1X)	TABL 280
	RETURN	TABL 290
	END	TABL 300
		TABL 310

/ TABLE / SIZE OF PROGRAM 0003A0 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	
IX	F	I*4	0000D8	I1	SF	I*4	0000DC	I2	SF	I*4	0000E0	NM	SFA	C	I*4	000050
XMI	S	C	R*4	000000	IDIR	SF	I*4	0000E4	LDIR	S	I*4	NDIS	FA	C	I*4	000054
DRIFT	S	XR	R*4	000000	TABLE		R*4	0000E8	IBCOM#	XF	I*4					

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * TABUL* SIZE OF BLOCK 000058 HEXADECIMAL BYTES

VAR.	NAME	TYPE	REL.	ADDR.	VAR.	NAME	TYPE	REL.	ADDR.	VAR.	NAME	TYPE	REL.	ADDR.	VAR.	NAME	TYPE	REL.	ADDR.
	XMI	P*4		000000		NM	I*4		000050		NDIS	I*4		000054					

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0001F4	105	000248	110	000310		

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 27 ,PROGRAM SIZE = 928

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILEATION ***** 129K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

```

      BLOCK DATA
      C  SYMBL IS ARRAY OF NUMBERS FOR ORGRAPH SYMBOL PLOTTING
      C  DESCR IS ARRAY FOR DESCRIBING CHARACTERS IN LEGEND
      COMMON/LGND/C(7),DESCR(14),SYMBL(7),NC,NSYMBL
      COMMON/TITLER/COMENT
      INTEGER*4 SYMBL
      DATA C/4.0,6.0,8.0,10.0,25.0,50.0,100.0/
      REAL COMENT(20)/20*' '/
      DATA DESCR/'C=4','$C=6','$C=','8.$C','10','$C=2','5.$C',
1      '=50.','$C=1','00.$',' ',' ',' ',' ',' ' /
      DATA SYMBL/0,1,2,3,4,5,9/
      END

```

```

      BLOK0001
      BLOK0002
      BLOK0003
      BLOK0004
      BLOK0005
      BLOK0006
      BLOK0007
      BLOK0008
      BLOK0009
      BLOK0010
      BLOK0011
      BLOK0012

```

/ MAIN / SIZE OF PROGRAM 000008 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
C	C	R*4	N.R.	NC	C	I*4	N.R.	DESCR	C	R*4	N.R.	SYMBL	C	I*4	N.R.
COMENT	C	R*4	N.R.	NSYMBL	C	I*4	N.R.								

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * LGND* SIZE OF BLOCK 000078 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
C	R*4	N.R.	DESCR	R*4	N.R.	SYMBL	I*4	N.R.	NC	I*4	N.R.
NSYMBL	I*4	N.R.									

NAME OF COMMON BLOCK *TITLER* SIZE OF BLOCK 000050 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
C	R*4	N.R.									
COMENT	R*4	N.R.									

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 9 ,PRCGRAM SIZE = 8

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

```

      SUBROUTINE PREP(XNUM,IMAX,FF,F,DRIFT,TOPS)
      C  DETERMINES CONTOUR LEVELS TO BE USED AND SUPPLIES DATA FOR NORTH
      C  AS DIRECTION 17
      C
      DIMENSION FF(1),F(20,17),DRIFT(17,19)
      NUMBER=XNUM
      TOPS=0.
      SUM=0.
      DO 100 I=1,16
100  SUM=SUM+DRIFT(I,1)
      SUM=SUM/16.
      DO 110 IDIR=1,16
      F(1,IDIR)=SUM
      IDDX=IDIR+8
      IF(IDIR.GT.8) IDDX=IDIR-8
      DO 105 IX=2,IMAX
      TOPS=AMAX1(TOPS,DRIFT(IDDX,IX-1))
105  F(IX,IDIR)=DRIFT(IDDX,IX-1)
110  CONTINUE
      IF(TOPS.LE.0.0) RETURN
      DO 115 IX=1,IMAX
115  F(IX,17)=F(IX,1)
      K=IFIX(ALOG10(TOPS))
      IF(K.LE.0) K=K-1
      XTOPS=10.**K
      K=IFIX(TOPS/XTOPS)
      TOPS=K*XTOPS

```

```

      PREP 1
      PREP 2
      PREP 3
      PREP 4
      PREP 5
      PREP 6
      PREP 7
      PREP 8
      PREP 9
      PREP 10
      PREP 11
      PREP 12
      PREP 13
      PREP 14
      PREP 15
      PREP 16
      PREP 17
      PREP 18
      PREP 19
      PREP 20
      PREP 21
      PREP 22
      PREP 23
      PREP 24
      PREP 25
      PREP 26
      PREP 27

```

```

      FF(1)=TOP5
      DO 120 I=2,NUMBER
120  FF(I)=0.5*FF(I-1)
      PRINT 8000,(FF(I),I=1,NUMBER)
8000  FORMAT('CONTOURS AT',1P10E11.2)
      PUNCH 8005,((F(IX,IDIR),IX=1,IMAX),IDIR=1,17)
8005  FORMAT(10F8.2)
      RETURN
      END

```

```

PREP 28
PREP 29
PREP 30
PREP 31
PREP 32
PREP 33
PREP 34
PREP 35
PREP 36

```

/ PREP / SIZE OF PROGRAM 00048E HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
F	SF	XR	R*4 000000	I	SF	I*4 00000C		K	SF	I*4 0000E0		FF	SF	XR	R*4 000000
IX	SFA		I*4 0000E4	SUM	SF	R*4 0000E8		IDDX	SFA	I*4 0000EC		IDIR	SF		I*4 0000F0
IMAX	F		I*4 0000F4	PREP		R*4 0000F8		TOPS	SFA	R*4 0000FC		XNUM	F		R*4 000100
DRIFT	FA	XR	R*4 000000	XTOPS	SFA	R*4 000104		FRXPI#	XF	R*4 000000		ALOG10	XF	R*4	000000
IBCOM#	XF	I*4	000000	NUMBER	SF	I*4 000108									

```

      LABEL  ADDR
      100  0001C0
      120  00036A

      LABEL  ADDR
      105  00025E

      LABEL  ADDR
      110  000268

      LABEL  ADDR
      115  00029E

*OPTIONS IN EFFECT*      NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
*OPTIONS IN EFFECT*      SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
*STATISTICS*      SOURCE STATEMENTS =      36 ,PROGRAM SIZE =      1166
*STATISTICS*      NO DIAGNOSTICS GENERATED
***** END OF COMPILEATION *****

```

125K BYTES OF CORE NOT USED

```

LEVEL 21.6 (DEC 72)      CS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE COMPLIT(X,TH,F,IMAX,JMAX,ID1,ID2)
THIS CALLS CONTOUR PLOT PACKAGE
-----
C      ARGUMENTS--
C      X = ARRAY CONTAINING X'S FOR F(X,THETA) FUNCTION
C      (PLOTTER ASSUMES X FROM 0 TO POSITIVE X)
C      TH = ARRAY CONTAINING THETA'S FOR F(X,THETA) FUNCTION
C      (PLOTTER ASSUMES WITHIN RANGE OF 0 TO PI)
C      F = FUNCTION F(X,THETA) TO BE PLOTTED
C      IMAX = DIMENSION OF ARRAY X
C      JMAX = DIMENSION OF ARRAY TH
C      ID1,ID2 = DIMENSIONS OF ARRAY F
C      THE FOLLOWING MUST BE PASSED THROUGH COMMON BLOCKS--
C      XDIM = LENGTH OF X-AXIS IN INCHES
C      YDIM = LENGTH OF Y-AXIS IN INCHES
C      JQ = POSITION ON CONTOUR AT WHICH CONTOUR IS IDENTIFIED
C      IRTES = OPTION TO PRINT CONTOURS IN OUTPUT (=1 FOR PRINT)
C      NUMBER = NUMBER OF CONTOURS TO BE PLOTTED
C      COMMENT(20) = ARRAY CONTAINING TITLE OF PLOT
C      DIMENSION F(ID1,ID2),X(IMAX),TH(JMAX)
C      COMMON/MAINC/XDIM,YDIM,JDUM,JQ,PLOT,NUMBER,FF(175),JQ
C      COMMON/TITLER/COMMENT(20)
C      COMMON/PLWILS/FMAX,FMIN
C      IRITE=0
C      KUPPER=1000
C      XDIM=8.
C      YDIM=XDIM
C      CALL PLOT PACKAGE TO PLOT CONTOURS FF
C      CALL SCAN(F,ID1,ID2,KUPPER,IRITE,X,TH,IMAX,JMAX)
C      RETURN
C      END

```

```

CONP 1
CONP 2
CONP 3
CONP 4
CONP 5
CONP 6
CONP 7
CONP 8
CONP 9
CONP 10
CONP 11
CONP 12
CONP 13
CONP 14
CONP 15
CONP 16
CONP 17
CONP 18
CONP 19
CONP 20
CONP 21
CONP 22
CONP 23
CONP 24
CONP 25
CONP 26
CONP 27
CONP 28
CONP 29
CONP 30
CONP 31
CONP 32
CONP 33
CONP 34

```

/ CONPLT / SIZE OF PROGRAM 0001F2 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	
F	SFA	XR	R*4 000000	X	SFA	XR	R*4 000000	FF		C	R*4 N.R.	JQ		C	I*4 N.R.	
TH	SFA	XR	R*4 000000	ID1	SFA		I*4 0000A4	ID2	SFA		I*4 0000A8	FMAX		C	R*4 N.R.	
FMIN		C	R*4 N.R.	IDUM		C	I*4 N.R.	IMAX	SFA		I*4 0000AC	JDUM		C	I*4 N.R.	
JMAX	SFA		I*4 0000B0	SCAN	SF	XF	R*4 000000	XDIM	SF		C	R*4 000000	YDIM	S	C	R*4 000004
IRITE	SFA		I*4 0000B4	COMENT		C	R*4 N.R.	CONPLT			R*4 0000B8	IDPLOT		C	I*4 N.R.	
KUPPER	SFA		I*4 0000BC	NUMBER		C	I*4 N.R.									

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK *MAINC* SIZE OF BLOCK 000148 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XDIM	R*4	000000	YDIM	R*4	000004	IDUM	I*4	N.R.	JDUM	I*4	N.R.
IDPLOT	I*4	N.R.	NUMBER	I*4	N.R.	FF	R*4	N.R.	JQ	I*4	N.R.

NAME OF COMMON BLOCK *TITLER* SIZE OF BLOCK 000050 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
COMENT	R*4	N.R.									

NAME OF COMMON BLOCK *PLWILS* SIZE OF BLOCK 000008 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
FMAX	R*4	N.R.	FMIN	R*4	N.R.						

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 12 ,PRCGRAM SIZE = 498

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILEATION *****

133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

SUBROUTINE RCONTRK1,C,A,MAX,X,IMIN,IMAX,ISTEP,Y,JMIN,JMAX,JSTEP) RCON 1

C THE CONTOUR PLOTTING ROUTINE USES THE "ORGRAPH" PLOTTING PACKAGE CNTR 2

C ORNL-4596 CNTR 3

C EACH CALL TO "RCONTR" MUST BE PRECEDED BY A CALL TO "FIXPLT" CNTR 4

C SEE "ORGRAPH" MANUAL FOR USE OF "FIXPLT" CNTR 5

C ARRAYS: CNTR 6

C X(NX) & Y(NY) DEFINE THE GRID POINTS FROM WHICH CNTR 7

C XY(NX,NY) DATA POINTS WILL HAVE A CONTOUR PLOT GENERATED CNTR 8

C C(NC) CONTAINS THE CONTOUR LINE VALUES WHICH WILL BE PLOTTED CNTR 9

C IN THE CALL TO "RCONTR": CNTR 10

C CALL RCONTR(NC,C,XY,NX,X,NXF,NX,NDLTX,Y,NYF,NY,NDLTY) CNTR 11

C VALUES OF X(I), Y(I), & XY(I,X,IY) WHICH WILL BE USED ARE CNTR 12

C DETERMINED BY DO LOOPS CNTR 13

C DO --- IX=NXF,NX,NDLTX & CNTR 14

C DO --- IY=NYF,NY,NDLTY CNTR 15

C VALUES OF C(NC) ARE SET UP IN THE BLOCK DATA ROUTINE CNTR 16

C IF A LEGEND IS DESIRED SYMBL(NC) & DESCR(--) MUST ALSO BE CNTR 17

C SET UP IN THE BLOCK DATA ROUTINE (SEE INCLUDED EXAMPLE & CNTR 18

C "ORGRAPH" MANUAL CNTR 19

C DESCR IS ARRAY FOR DEFINING SYMBOLS IN THE LEGEND CNTR 20

C DESCR MUST BE DIMENSIONED LARGE ENOUGH TO HOLD CNTR 21

C NC TITLES (EACH FOLLOWED BY "\$") FOR THE LEGEND CNTR 22

C SYMBL IS ARRAY OF NUMBERS FOR ORGRAPH SYMBOL PLOTTING CNTR 23

C SYMBL MUST BE DIMENSIONED AT LEAST NC CNTR 24

C IF NO TITLES ARE DESIRED, THE CALL TO "TITLE" MAY BE REMOVED CNTR 25

C SEE "ORGRAPH" MANUAL FOR USE OF "TITLE" CNTR 26

C A LEGEND IS PRODUCED IF "NSYMBL" IS GREATER OR EQUAL TO 0 CNTR 27

C SEE "ORGRAPH" MANUAL FOR USE OF "LEGEND" CNTR 28

C "PLID" IDENTIFIES PLOT WITH DATE, HASP LOG NUMBER, & THE CNTR 29

C TIME AT WHICH JOB WAS EXECUTED CNTR 30

C "PLID" USES "GTJN" (AN ASSEMBLY LANGUAGE ROUTINE) CNTR 31

C USUALLY SUPPLIED AS A HEX DECK CNTR 32

C CNTR 33

C CNTR 34

C EXAMPLE OF DATA AS SET UP IN BLOCK DATA CNTR 35

C DATA C/20.0,40.0,80.0,160.0,320.0,640.0,1280.0/ CNTR 36

C DATA DESCR/'C=20.0\$C=40.0\$C=80.0\$C=160.0\$C=320.0\$C=640.0\$C=1280.0\$ CNTR 37

C 1/ CNTR 38

C DATA SYMBL/0,1,2,3,4,5,9/ CNTR 39

C CNTR 40

C ADAPTED FROM LAWRENCE RADIATION LAB REPORT CIC-NC.3-003 RCON 2

C ASSUMES THAT A(I,J)=FCN(X(I),Y(J)) RCON 3

C DIMENSION A(MAX,1),C(1),X(1),Y(1) RCON 4

C COMMON/Q7QUAD/XC(2),YC(2),ZC(4),ZMIN,ZMAX,KK1 RCON 5

```

      KKI=KI
      CALL QQQCPA(48,0.1)
C     BEGIN LOGIC FOR SWEEPING THROUGH GRID
      IMA=JMAX-ISTEP
      JMA=JMAX-JSTEP
      DO 105 I=JMIN,IMA,ISTEP
        XC(1)=X(I)
        XC(2)=X(I+1STEP)
        DO 100 J=JMIN,JMA,JSTEP
          YC(1)=Y(J)
          YC(2)=Y(J+JSTEP)
C     ELEMENT(I,JMIN)
          ZC(1)=A(I,J)
C     ELEMENT(I+1STEP,JMIN)
          ZC(2)=A(I+1STEP,J)
C     ELEMENT(I,J+JSTEP)
          ZC(3)=A(I,J+JSTEP)
C     ELEMENT(I+1STEP,J+JSTEP)
          ZC(4)=A(I+1STEP,J+JSTEP)
          ZMAX=AMAX1(ZC(1),ZC(2),ZC(3),ZC(4))
          ZMIN=AMIN1(ZC(1),ZC(2),ZC(3),ZC(4))
          CALL Q7PLOT(C)
100 CONTINUE
105 CONTINUE
      RETURN
      END

```

```

RCON 6
RCON 7
RCON 8
RCON 9
RCON 10
RCON 11
RCON 12
RCON 13
RCON 14
RCON 15
RCON 16
RCON 17
RCON 18
RCON 19
RCON 20
RCON 21
RCON 22
RCON 23
RCON 24
RCON 25
RCON 26
RCON 27
RCON 28
RCON 29
RCON 30
RCON 31

```

/ RCONTR / SIZE OF PROGRAM 00037C HEXADECEMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
A	F	XR	R*4 000000	C	SFA	XR	R*4 000000	I	SF	I*4 000098	J	SF	I*4 00009C		
X	F	XR	R*4 000000	Y	F	XR	R*4 000000	KI	F	I*4 0000A0	XC	S	C R*4 000000		
YC	S	C	R*4 000008	ZC	SFA	C	R*4 000010	IMA	SF	I*4 0000A4	JMA	SF	I*4 0000A8		
KKI	S	C	I*4 000028	MAX		I*4 0000AC	IMAX	F	I*4 0000B0	IMIN	F	I*4 0000B4			
JMAX	F	I*4 000098	JMIN	F	I*4 0000BC	ZMAX	S	C R*4 000024	ZMIN	S	C R*4 000020				
ISTEP	F	I*4 0000C0	JSTEP	F	I*4 0000C4	QQQCPA	SF	XF R*4 000000	Q7PLOT	SF	XF R*4 000000				
RCONTR		P*4 0000C8													

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK *Q7QUAD* SIZE OF BLOCK 00002C HEXADECEMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XC	R*4	000000	YC	R*4	000008	ZC	R*4	000010	ZMIN	R*4	000020
ZMAX	R*4	000024	KKI	I*4	000028						

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	00027C	105	000286				

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,FBCDIC,NOLIST,NODECK,LOAD,MAP,NODEIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 24 ,PROGRAM SIZE = 892

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 SOURCE,FBCDIC,NOLIST,NODECK,LOAD,MAP,NODEIT,NOID,NOXREF
 SUBROUTINE LTRIS(Z,C,XINC,YINC,KM,KN,KNCL)
 COMMON/CONT/11,ISAVE,JSAVE,KSAVE,X(2,50),Y(2,50),CL
 DIMENSION Z(KM,KN),C(KNCL)
 K=KSAVE
 I=ISAVE
 J=JSAVE

LTRI 1
 LTRI 2
 LTRI 3
 LTRI 4
 LTRI 5
 LTRI 6

```

      IF (C(K).LE.Z(I,J+1)) GO TO 100
      IF (C(K).LE.Z(I,J)) GO TO 105
      GO TO 115
100  IF (C(K).LT.Z(I,J)) GO TO 115
      ZSAVE=Z(I,J+1)-Z(I,J)
      IF (ZSAVE.EQ.0.0) ZSAVE=1.0
      Y(I,K)=(C(K)-Z(I,J))/ZSAVE+FLOAT(J)
      X(I,K)=I
      GO TO 110
105  IF (C(K).LT.Z(I,J+1)) GO TO 115
      ZSAVE=Z(I,J)-Z(I,J+1)
      IF (ZSAVE.EQ.0.0) ZSAVE=1.0
      Y(I,K)=(Z(I,J)-C(K))/ZSAVE+FLOAT(J)
      X(I,K)=I
110  II=II+1
115  IF (C(K).LE.Z(I,J)) GO TO 120
      IF (C(K).LE.Z(I+1,J)) GO TO 125
      GO TO 135
120  IF (C(K).LT.Z(I+1,J)) GO TO 135
      ZSAVE=Z(I,J)-Z(I+1,J)
      IF (ZSAVE.EQ.0.0) ZSAVE=1.0
      Y(I,K)=J
      X(I,K)=(Z(I,J)-C(K))/ZSAVE+FLOAT(I)
      GO TO 130
125  IF (C(K).LT.Z(I,J)) GO TO 135
      ZSAVE=Z(I+1,J)-Z(I,J)
      IF (ZSAVE.EQ.0.0) ZSAVE=1.0
      Y(I,K)=J
      X(I,K)=(C(K)-Z(I,J))/ZSAVE+FLOAT(I)
130  II=II+1
      IF (II.EQ.3) GO TO 155
135  IF (C(K).LE.Z(I+1,J)) GO TO 140
      IF (C(K).LE.Z(I,J+1)) GO TO 145
      RETURN
140  IF (C(K).LT.Z(I,J+1)) RETURN
      ZSAVE=Z(I+1,J)-Z(I,J+1)
      IF (ZSAVE.EQ.0.0) ZSAVE=1.0
      DX=(C(K)-Z(I,J+1))/ZSAVE+FLOAT(I)
      DY=(Z(I+1,J)-C(K))/ZSAVE+FLOAT(J)
      II=II+1
      IF (II.EQ.3) GO TO 150
      RETURN
145  IF (C(K).LT.Z(I+1,J)) RETURN
      ZSAVE=Z(I,J+1)-Z(I+1,J)
      IF (ZSAVE.EQ.0.0) ZSAVE=1.0
      DX=(Z(I,J+1)-C(K))/ZSAVE+FLOAT(I)
      DY=(C(K)-Z(I+1,J))/ZSAVE+FLOAT(J)
      II=II+1
      IF (II.NE.3) RETURN
150  X(2,K)=DX
      Y(2,K)=DY
155  CALL SUBPLT(C(K))
      CL=C(K)
      RETURN
      END

```

```

      LTRI 7
      LTRI 8
      LTRI 9
      LTRI 10
      LTRI 11
      LTRI 12
      LTRI 13
      LTRI 14
      LTRI 15
      LTRI 16
      LTRI 17
      LTRI 18
      LTRI 19
      LTRI 20
      LTRI 21
      LTRI 22
      LTRI 23
      LTRI 24
      LTRI 25
      LTRI 26
      LTRI 27
      LTRI 28
      LTRI 29
      LTRI 30
      LTRI 31
      LTRI 32
      LTRI 33
      LTRI 34
      LTRI 35
      LTRI 36
      LTRI 37
      LTRI 38
      LTRI 39
      LTRI 40
      LTRI 41
      LTRI 42
      LTRI 43
      LTRI 44
      LTRI 45
      LTRI 46
      LTRI 47
      LTRI 48
      LTRI 49
      LTRI 50
      LTRI 51
      LTRI 52
      LTRI 53
      LTRI 54
      LTRI 55
      LTRI 56
      LTRI 57
      LTRI 58
      LTRI 59
      LTRI 60
      LTRI 61

```

/ LTRIS / SIZE OF PROGRAM 0006E8 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	
C	SFA	XR	R** 000000	I	SFA	I** 0000A0	J	SFA	I** 0000A4	K	SFA	I** 0000A8				
X	S	C	R** 000010	Y	S	C	R** 00001A0	Z	F	XR	R** 000000	CL	S	C	R** 000030	
DX	SF	R**	0000AC	DY	SF	R**	000080	II	SF	C	I** 000000	KM			I** 0000B4	
KN		I**	000088	KNCL		I**	00008C	XINC		R**	0000C0	YINC		R**	0000C4	
ISAVE	F	C	I** 000004	JSAVE	F	C	I** 000008	KSAVE	F	C	I** 00000C	LTRIS		I**	0000C8	
ZSAVE	SF	R**	0000CC	SUBPLT	SF	XF	R** 000000									

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * CONT* SIZE OF BLOCK 000334 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL.	ADDR.	VAR. NAME	TYPE	REL.	ADDR.	VAR. NAME	TYPE	REL.	ADDR.	VAR. NAME	TYPE	REL.	ADDR.	
II	I**		000000	ISAVE	I**	000004	JSAVE	I**	000008	KSAVE	I**	00000C				
X	R**		000010	Y	R**	00001A0	CL	R**	000030							

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0001A4	105	000248	110	0002DC	115	0002E8
120	00032E	125	0003DA	130	00046E	135	000482
140	0004B8	145	00056C	150	000620	155	000638

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

```

*OPTIONS IN EFFECT*      SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
*STATISTICS*      SOURCE STATEMENTS =      82 ,PROGRAM SIZE =      1768
*STATISTICS*      NO DIAGNOSTICS GENERATED
***** END OF COMPILATION *****                                117K BYTES OF CORE NOT USED

```

LEVEL 21.6 (DEC 72) OS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINFCNT=60,SIZE=0000K,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE UTRIS(Z,C,XINC,YINC,KM,KN,KNCL) UTRI 1
COMMON/CONT/II,ISAVE,JSAVE,KSAVE,X(2,50),Y(2,50),CL UTRI 2
DIMENSION Z(KM,KN),C(KNCL) UTRI 3
I=ISAVE UTRI 4
J=JSAVE UTRI 5
K=KSAVE UTRI 6
IF (C(K).LE.Z(I,J+1)) GO TO 100 UTRI 7
IF (C(K).LE.Z(I+1,J+1)) GO TO 105 UTRI 8
GO TO 110 UTRI 9
100 IF (C(K).LT.Z(I+1,J+1)) GO TO 110 UTRI 10
ZSAVE=Z(I,J+1)-Z(I+1,J+1) UTRI 11
IF (ZSAVE.EQ.0.0) ZSAVE=1.0 UTRI 12
X(II,K)=(Z(I,J+1)-C(K))/ZSAVE+FLOAT(I) UTRI 13
Y(II,K)=J+1 UTRI 14
II=II+1 UTRI 15
GO TO 110 UTRI 16
105 IF (C(K).LT.Z(I,J+1)) GO TO 110 UTRI 17
ZSAVE=Z(I+1,J+1)-Z(I,J+1) UTRI 18
IF (ZSAVE.EQ.0.0) ZSAVE=1.0 UTRI 19
Y(II,K)=J+1 UTRI 20
X(II,K)=(C(K)-Z(I,J+1))/ZSAVE+FLOAT(I) UTRI 21
II=II+1 UTRI 22
110 IF (C(K).LE.Z(I+1,J+1)) GO TO 115 UTRI 23
IF (C(K).LE.Z(I+1,J)) GO TO 120 UTRI 24
GO TO 125 UTRI 25
115 IF (C(K).LT.Z(I+1,J)) GO TO 125 UTRI 26
ZSAVE=Z(I+1,J+1)-Z(I+1,J) UTRI 27
IF (ZSAVE.EQ.0.0) ZSAVE=1.0 UTRI 28
X(II,K)=I+1 UTRI 29
Y(II,K)=FLOAT(J+1)-(Z(I+1,J+1)-C(K))/ZSAVE UTRI 30
II=II+1 UTRI 31
IF (II.EQ.3) GO TO 130 UTRI 32
GO TO 125 UTRI 33
120 IF (C(K).LT.Z(I+1,J+1)) GO TO 125 UTRI 34
ZSAVE=Z(I+1,J)-Z(I+1,J+1) UTRI 35
IF (ZSAVE.EQ.0.0) ZSAVE=1.0 UTRI 36
X(II,K)=I+1 UTRI 37
Y(II,K)=(Z(I+1,J)-C(K))/ZSAVE+FLOAT(J) UTRI 38
II=II+1 UTRI 39
IF (II.EQ.3) GO TO 130 UTRI 40
125 IF (II.NE.2) RETURN UTRI 41
IF (CL.NE.C(K)) RETURN UTRI 42
CALL SUBPLT(C(K)) UTRI 43
RTURN UTRI 44
130 CALL SUBPLT(C(K)) UTRI 45
RETURN UTRI 46
END UTRI 47

```

/ UTRIS / SIZE OF PROGRAM 00059A HEXADECEMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	
C	SFA	XR	R*4 000000	I	SFA	I*4 0000A0	J	SFA	I*4 0000A4	K	SFA	I*4 0000A8				
X	S	C	R*4 000010	Y	S	C R*4 0001A0	Z	F	XR R*4 000000	CL	C	R*4 000330				
II	SF	C	I*4 000000	KM		I*4 0000AC	KN		I*4 0000B0	KNCL		I*4 0000B4				
XINC		R*4	0000B8	YINC		R*4 0000BC	ISAVE	F	C I*4 000034	JSAVE	F	C I*4 000008				
KSAVE	F	C	I*4 00000C	UTRIS		R*4 0000C0	ZSAVE	SF	C R*4 0000C4	SUBPLT	SF	XF R*4 000000				

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * CONT* SIZE OF BLOCK 000334 HEXADECEMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
II	I*4	000000	ISAVE	I*4	000004	JSAVE	I*4	000008	KSAVE	I*4	00000C
X	R*4	000010	Y	R*4	0001A0	CL	R*4	000330			

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	000180	105	000266	110	000306	115	00034A
120	000408	125	0004B4	130	0004FE		

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
 STATISTICS SOURCE STATEMENTS = 63 ,PROGRAM SIZE = 1434
 STATISTICS NO DIAGNOSTICS GENERATED
 ***** END OF COMPILATION ***** 121K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72) CS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

SUBROUTINE Q7PLOT(CN)	Q7PL 1
DIMENSION CN(1),C(50)	Q7PL 2
COMMON/Q7QUAD/X(2),Y(2),Z(2,2),ZMIN,ZMAX,K1	Q7PL 3
IF (ZMAX.EQ.ZMIN) RETURN	Q7PL 4
IF (CN(1).GT.ZMAX) RETURN	Q7PL 5
IF (CN(K1).LT.ZMIN) RETURN	Q7PL 6
DO 100 I=1,K1	Q7PL 7
IF (CN(I).GE.ZMIN) GO TO 105	Q7PL 8
100 CONTINUE	Q7PL 9
105 DO 110 J=1,K1	Q7PL 10
IF (CN(J).GT.ZMAX) GO TO 115	Q7PL 11
110 CONTINUE	Q7PL 12
J=K1+1	Q7PL 13
115 J=J-1	Q7PL 14
CALL CONTUR(Z,CN(I),X(1),X(2),Y(1),Y(2),2,2,J-(I-1),1,2,1,2)	Q7PL 15
RETURN	Q7PL 16
END	Q7PL 17

/ Q7PLOT / SIZE OF PROGRAM 000250 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.				
C		R*4	N.R.	I	SFA	I*4	0000B4	J	SFA	I*4	0000B8	X	SFA	C	R*4	000000			
Y	SFA	C	R*4	000008	Z	SFA	C	R*4	000010	CN	SFA	XR	R*4	000000	K1	F	C	I*4	000028
ZMAX		C	R*4	000024	ZMIN		C	R*4	000020	CONTUR	SF	XF	R*4	000000	Q7PLOT		R*4	0000BC	

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK *Q7QUAD*				SIZE OF BLOCK				00002C HEXADECIMAL BYTES						
VAR. NAME	TYPE	REL. ADDR.		VAR. NAME	TYPE	REL. ADDR.		VAR. NAME	TYPE	REL. ADDR.		VAR. NAME	TYPE	REL. ADDR.
X	R*4	000000		Y	R*4	000008		Z	R*4	000010		ZMIN	R*4	000020
ZMAX	R*4	000024		K1	I*4	000028								

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	000168	105	000172	110	0001A8	115	0001BE

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
 STATISTICS SOURCE STATEMENTS = 22 ,PROGRAM SIZE = 592
 STATISTICS NO DIAGNOSTICS GENERATED
 ***** END OF COMPILATION ***** 133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

OS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,MODECK,LOAD,MAP,NOEDIT,NOIO,NOXREF
SUBROUTINE CONTUR(Z,C,P1MIN,P1MAX,P2MIN,P2MAX,M,N,NCL,MMIN,
1 MMAX,NMIN,NMAX)
COMMON/CONT/II,ISAVE,JSAVE,KSAVE,X(2,50),Y(2,50),CL
COMMON/SUB/XINC,YINC,PMIN1,PMIN2
DIMENSION Z(M,N),C(NCL)
KM=M
KN=N
KNCL=NCL
XINC=(P1MAX-P1MIN)/FLOAT(MMAX-MMIN)
YINC=(P2MAX-P2MIN)/FLOAT(NMAX-NMIN)
PMIN1=P1MIN
PMIN2=P2MIN
MM=MMAX-1
NN=NMAX-1
DO 190 J=NMIN,NN
DO 185 I=MMIN,MM
K=1
II=1
100 IF (Z(I,J).GE.Z(I+1,J)) GO TO 110
AMAX=Z(I+1,J)
105 IF (AMAX.LT.Z(I,J+1)) AMAX=Z(I,J+1)
GO TO 115
110 AMAX=Z(I,J)
GO TO 105
115 IF (Z(I,J).LE.Z(I+1,J)) GO TO 125
AMIN=Z(I+1,J)
120 IF (AMIN.GT.Z(I,J+1)) AMIN=Z(I,J+1)
GO TO 130
125 AMIN=Z(I,J)
GO TO 120
130 IF (C(K).GT.AMAX) GO TO 135
IF (C(K).LT.AMIN) GO TO 135
JSAVE=J
ISAVE=I
KSAVE=K
GO TO 175
135 IF (Z(I,J+1).GE.Z(I+1,J+1)) GO TO 145
AMAX=Z(I+1,J+1)
140 IF (AMAX.LT.Z(I+1,J)) AMAX=Z(I+1,J)
GO TO 150
145 AMAX=Z(I,J+1)
GO TO 140
150 IF (Z(I,J+1).LE.Z(I+1,J+1)) GO TO 160
AMIN=Z(I+1,J+1)
155 IF (AMIN.GT.Z(I+1,J)) AMIN=Z(I+1,J)
GO TO 165
160 AMIN=Z(I,J+1)
GO TO 155
165 IF (C(K).LT.AMIN) GO TO 170
JSAVE=J
ISAVE=I
KSAVE=K
GO TO 180
170 K=K+1
IF (K.LE.NCL) GO TO 100
GO TO 185
175 CALL LTRIS(Z,C,XINC,YINC,KM,KN,KNCL)
II=1
GO TO 135
180 CALL UTRIS(Z,C,XINC,YINC,KM,KN,KNCL)
II=1
GO TO 170
185 CONTINUE
190 CONTINUE
RETURN
END

```

```

CONT 1
CONT 2
CONT 3
CONT 4
CONT 5
CONT 6
CONT 7
CONT 8
CONT 9
CONT 10
CONT 11
CONT 12
CONT 13
CONT 14
CONT 15
CONT 16
CONT 17
CONT 18
CONT 19
CONT 20
CONT 21
CONT 22
CONT 23
CONT 24
CONT 25
CONT 26
CONT 27
CONT 28
CONT 29
CONT 30
CONT 31
CONT 32
CONT 33
CONT 34
CONT 35
CONT 36
CONT 37
CONT 38
CONT 39
CONT 40
CONT 41
CONT 42
CONT 43
CONT 44
CONT 45
CONT 46
CONT 47
CONT 48
CONT 49
CONT 50
CONT 51
CONT 52
CONT 53
CONT 54
CONT 55
CONT 56
CONT 57
CONT 58
CONT 59
CONT 60
CONT 61
CONT 62
CONT 63
CONT 64
CONT 65
CONT 66

```

/ CONTUR / SIZE OF PROGRAM 000558 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	
C	SFA	XR	R*4 000000	I	SF	I*4 0000A8	J	SF	I*4 0000AC	K	SF	I*4 0000B0				
M	F		I*4 0000B4	N	F	I*4 0000B8	X	C	R*4 N.R.	Y	C	R*4 N.R.				
Z	SFA	XR	R*4 000000	CL	C	R*4 N.R.	II	S	C I*4 000000	KM	SFA	I*4 0000BC				
KN	SFA		I*4 0000C0	MM	SF	I*4 0000C4	NN	SF	I*4 0000C8	NCL	F	I*4 0000CC				
AMAX	S		R*4 0000D0	AMIN	S	R*4 0000D4	KNCL	SFA	I*4 0000D8	MMAX	F	I*4 0000DC				
MMIN	FA		I*4 0000E0	NMAX	FA	I*4 0000E4	NMIN	FA	I*4 0000E8	XINC	SFA	C R*4 000000				
YINC	SFA	C	R*4 000004	ISAVE	S	C I*4 000004	JSAVE	S	C I*4 000008	KSAVE	S	C I*4 00000C				
LTRIS	SF	XF	I*4 000000	PMIN1	S	C R*4 000008	PMIN2	S	C R*4 00000C	P1MAX	F	R*4 00000E				
P1MIN	F		R*4 0000F0	P2MAX	F	R*4 0000F4	P2MIN	F	R*4 0000F8	UTRIS	SF	XF R*4 000000				
CONTUR			R*4 0000FC													

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * CONT* SIZE OF BLOCK 000334 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
II	I*4	000000	ISAVE	I*4	000004	JSAVE	I*4	000008	KSAVE	I*4	00000C
X	R*4	N.R.	Y	R*4	N.R.	CL	R*4	N.R.			

NAME OF COMMON BLOCK * SUB* SIZE OF BLOCK 000010 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XINC	R*4	000000	YINC	R*4	000004	PMIN1	R*4	000008	PMIN2	R*4	00000C

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0002C2	105	0002E4	110	0002FC	115	000308
120	00031C	125	000334	130	000340	135	000368
140	000386	145	00039E	150	0003AA	155	00038E
160	0003D6	165	0003E2	170	0003FE	175	000414
180	000426	185	000438	190	000448		

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 77 ,PROGRAM SIZE = 1368

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

117K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

QS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

```

SUBROUTINE SUBPLT(CC)
  DIMENSION V(2),W(2),VP(2),WP(2)
  COMMON/SUB/XINC,YINC,PMIN1,PMIN2
  COMMON/CONT/II,ISAVE,JSAVE,KSAVE,X(2,50),Y(2,50),CL
  COMMON/LGND/C(7),DESCR(14),SYMBL(7),NC,NSYMBL
  SYMB=-1.0
  IF (NSYMBL.LT.0) GO TO 110
  DO 100 ISYM=1,NC
    IF (CC.EQ.C(IISYM)) GO TO 105
  100 CONTINUE
  105 CONTINUE
  SYMB=SYMBL(IISYM)
  110 K=KSAVE
  JJ=2
  IF (II.EQ.2) JJ=1
  DO 115 I=1,JJ
    X(I,K)=(X(I,K)-1.0)*XINC+PMIN1
    Y(I,K)=(Y(I,K)-1.0)*YINC+PMIN2
    V(I)=X(I,K)
    W(I)=Y(I,K)
  115 CONTINUE
  IF (V(1).EQ.V1.AND.V(2).EQ.V2.AND.W(1).EQ.W1.AND.W(2).EQ.W2)
  1 RETURN
  N=2
  IF (V(1).EQ.V(2).AND.W(1).EQ.W(2)) N=1
  V1=V(1)
  V2=V(2)
  W1=W(1)
  W2=W(2)
  IF (V(2).GE.V(1)) GO TO 120
  VP(1)=V(2)
  VP(2)=V(1)
  WP(1)=W(2)
  WP(2)=W(1)
  CALL LINPLT(VP,WP,N,SYMB,0)
  PRINT 8000,VP,WP,SYMB
8000 FORMAT (' V(1)=' ,1PE10.3, ' V(2)=' ,E10.3, ' W(1)=' ,E10.3,
  1 ' W(2)=' ,E10.3, ' SYMB=' ,I5)
  RETURN
  120 CALL LINPLT(V,W,N,SYMB,0)
  PRINT 8000,V,W,SYMB
  RETURN
END

```

SUBP 1
SUBP 2
SUBP 3
SUBP 4
SUBP 5
SUBP 6
SUBP 7
SUBP 8
SUBP 9
SUBP 10
SUBP 11
SUBP 12
SUBP 13
SUBP 14
SUBP 15
SUBP 16
SUBP 17
SUBP 18
SUBP 19
SUBP 20
SUBP 21
SUBP 22
SUBP 23
SUBP 24
SUBP 25
SUBP 26
SUBP 27
SUBP 28
SUBP 29
SUBP 30
SUBP 31
SUBP 32
SUBP 33
SUBP 34
SUBP 35
SUBP 36
SUBP 37
SUBP 38
SUBP 39
SUBP 40
SUBP 41
SUBP 42
SUBP 43

/ SURPLT / SIZE OF PROGRAM 0003C0 HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.			
C	C	R*4	000000	I	SF	I*4	0000F4	K	SF	I*4	0000F8	N	SFA	I*4	0000FC			
V	SFA	R*4	000124	W	SFA	R*4	00012C	X	SF	C	R*4	000010	Y	SF	C	R*4	0001A0	
CC		R*4	000100	CL	C	R*4	N.R.	II	C	I*4	000000	JJ	SF	I*4	000104			
NC	F	C	I*4	000070	VP	SFA	R*4	000134	V1	S	R*4	000108	V2	S	R*4	00010C		
WP	SFA	R*4	00013C	W1	S	R*4	000110	W2	S	R*4	000114	ISYM	SF	I*4	000118			
SYMB	SFA	R*4	00011C	XINC	F	C	R*4	000000	YINC	F	C	R*4	000004	DESCR	C	R*4	N.R.	
ISAVE	C	I*4	N.R.	JSAVE	C	I*4	N.R.	KSAVE	F	C	I*4	00000C	PMIN1	F	C	R*4	000008	
PMIN2	F	C	R*4	00000C	SYMBL	F	C	R*4	000054	IBCOM#	XF	I*4	000000	LNPLT	SF	XF	I*4	000000
NSYMBL	C	I*4	000074	SUBPLT		R*4	000120											

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * SUB* SIZE OF BLOCK 000010 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XINC	R*4	000000	YINC	R*4	000004	PMIN1	R*4	000008	PMIN2	R*4	00000C

NAME OF COMMON BLOCK * CONT* SIZE OF BLOCK 000334 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
II	I*4	000000	ISAVE	I*4	N.R.	JSAVE	I*4	N.R.	KSAVE	I*4	00000C
X	R*4	000010	Y	R*4	0001A0	CL	R*4	N.R.			

NAME OF COMMON BLOCK * LGND* SIZE OF BLOCK 000078 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
C	R*4	000000	DESCR	R*4	N.R.	SYMBL	P*4	000054	NC	I*4	000070
NSYMBL	I*4	000074									

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0001C8	105	0001D2	110	0001E2	115	00026A
120	000350						

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 47 ,PROGRAM SIZE = 960

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

125K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

CS/360 FORTRAN H

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

```

      SUBROUTINE BOUNDS(X,Y,IL,IR,JL,JU,IMAX,JMAX)
      C BOUNDS FINDS THE VERTICAL & HORIZONTAL LINES WHICH ENCLOSE A
      C GIVEN POINT (X,Y)
      COMMON/MAINC/XDIM,YDIM,IDUM,JDUM,TDPLT,NUMBER,FF(75),JQ
      IL=X
      IF(FLOAT(IL).EQ.X) GO TO 100
      IR=IL+1
      GO TO 105
100  IL=IL-1
      IR=IL+2
      C NOW IL IS THE 'LEFT' VERTICAL LINE & IR IS THE 'RIGHT' VERTICAL LINE
105  JL=Y
      IF(FLOAT(JL).EQ.Y) GO TO 110
      JU=JL+1
      GO TO 115
110  JL=JL-1
      JU=JL+2
      C NOW JL IS THE LOWER HORIZONTAL LINE & JU IS THE UPPER HORIZONTAL LINE
115  IF(IL.LT.1) IL=1
      IF(IR.GT.IMAX) IR=IMAX
      IF(JL.LT.1) JL=1
      IF(JU.GT.JMAX) JU=JMAX
      RETURN
      FND
      BOUN 1
      BOUN 2
      BOUN 3
      BOUN 4
      BOUN 5
      BOUN 6
      BOUN 7
      BOUN 8
      BOUN 9
      BOUN 10
      BOUN 11
      BOUN 12
      BOUN 13
      BOUN 14
      BOUN 15
      BOUN 16
      BOUN 17
      BOUN 18
      BOUN 19
      BOUN 20
      BOUN 21
      BOUN 22
      BOUN 23
      BOUN 24

```

/ BOUNDS / SIZE OF PROGRAM 000258 HEXADEC

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
X	F	R*4	000090	Y	F	R*4	000094	FF	C	R*4	N.R.	IL	SFA	I*4	000098
IR	S	I*4	00009C	JL	SFA	I*4	0000A0	JO	C	I*4	N.R.	JU	S	I*4	0000A4
IDUM	C	I*4	N.R.	IMAX	F	I*4	0000A8	JDUM	C	I*4	N.R.	JMAX	F	I*4	0000AC
XDIM	C	R*4	N.R.	YDIM	C	R*4	N.R.	BOUNDS	C	R*4	0000B0	IDPLOT	C	I*4	N.R.
NUMBER	C	I*4	N.R.												

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * MAINC* SIZE OF BLOCK 000148 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XDIM	R*4	N.R.	YDIM	R*4	N.R.	IDUM	I*4	N.R.	JOUM	I*4	N.R.
IDPLOT	I*4	N.R.	NUMBER	I*4	N.R.	FF	R*4	N.R.	JQ	I*4	N.R.

LABEL ADDR LABEL ADDR LABEL ADDR LABEL ADDR
 100 00011E 105 00012E 110 000180 115 000190
 OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
 STATISTICS SOURCE STATEMENTS = 26 ,PROGRAM SIZE = 600
 STATISTICS NO DIAGNOSTICS GENERATED
 ***** END OF COMPILATION ***** 133K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

CS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
C   SUBROUTINE SCAN(PSI,MD,ND,KUPPER,IRITE,V,THETA,IMAX,JMAX)
C   ***** VERSION 'D' *****
C   THIS IS PART OF A CONTOUR PLOTTING PACKAGE WHICH FINDS CONTOURS
C   IN V,THETA (POLAR) COORDINATES AND CONVERTS THEM TO (X,Y)
C   COORDINATES FOR PLOTTING, WHERE -
C   X=V*SIN(THETA)
C   Y=V*COS(THETA)
C   LABELS ON PLOT ARE IN (V,THETA) COORDINATES
C   V(IMAX) IS ARRAY OF GRID VALUES USED IN 'HORIZONTAL' SCAN FOR
C   INTERSECTIONS
C   THETA(JMAX) IS ARRAY OF GRID VALUES USED IN 'VERTICAL' SCAN FOR
C   INTERSECTIONS
C   KUPPER IS THE MAXIMUM NUMBER OF POINTS TO BE PLOTTED FOR EACH
C   CONTOUR. KUPPER CANNOT EXCEED 1000.
C   XDIM CANNOT EXCEED 20. YDIM CANNOT EXCEED 11.
C   LOGICAL*1 LPAR/'(/,RPAR/')/'
C   DIMENSION PSI(MD,ND),ISTART(100),IEND(100),V(IMAX),THETA(JMAX)
C   COMMON/TITLER/COMENT(20)
C   COMMON/MAINC/XDIM,YDIM,IDUM,JDUM,IDPLOT,NUMBER,FF(75),JQ
C   COMMON/SCANC/VI(1000),VJ(1000),K,N
C   COMMON/IBREAK/IEND,LINE
C   IF(XDIM.LE.20..AND.YDIM.LE.11.)GO TO 100
C   PRINT 8000
C   8000 FORMAT('THE DIMENSIONS OF THE GRAPH CANNOT BE GREATER THAN 11X20')
C   RETURN
C   CALL PLOTT1 TO SET UP GRAPH AND LABELS FOR PLOT
C   100 CALL PLOTT1(V,THETA,IMAX,JMAX)
C
C   IMAXM1=IMAX-1
C   JMAXM1=JMAX-1
C   DX=ABS(V(2)-V(1))
C   DY=ABS(THETA(2)-THETA(1))
C   ARRAY FF CONTAINS CONTOUR VALUES
C   NUMBER OF CONTOURS = NUMBER
C
C   DO 290 N=1,NUMBER
C   PSIVAL=FF(N)
C   K=0
C   INITIALLY ALL RESULTS ARE EXPRESSED IN TERMS OF THE I & J SUBSCRIPTS

```

SCAN 1
 SCAN 2
 SCAN 3
 SCAN 4
 SCAN 5
 SCAN 6
 SCAN 7
 SCAN 8
 SCAN 9
 SCAN 10
 SCAN 11
 SCAN 12
 SCAN 13
 SCAN 14
 SCAN 15
 SCAN 16
 SCAN 17
 SCAN 18
 SCAN 19
 SCAN 20
 SCAN 21
 SCAN 22
 SCAN 23
 SCAN 24
 SCAN 25
 SCAN 26
 SCAN 27
 SCAN 28
 SCAN 29
 SCAN 30
 SCAN 31
 SCAN 32
 SCAN 33
 SCAN 34
 SCAN 35
 SCAN 36
 SCAN 37
 SCAN 38
 SCAN 39
 SCAN 40
 SCAN 41
 SCAN 42
 SCAN 43

```

C      K IS THE NUMBER OF INTERSECTIONS FOUND          SCAN 44
C      SCAN FOR INTERSECTIONS ALONG HORIZONTAL LINES BETWEEN  SCAN 45
C      EVERY 2 GRID POINTS                               SCAN 46
      DO 135 J=1,JMAX                                     SCAN 47
      B=PSIVAL-PSI(I,J)                                   SCAN 48
      DO 135 I=1,IMAXM                                    SCAN 49
      A=B                                                  SCAN 50
      B=PSIVAL-PSI(I+1,J)                                 SCAN 51
      IF(A) 105,110,120                                    SCAN 52
105    IF(B) 135,135,125                                  SCAN 53
110    K=K+1                                               SCAN 54
      IF(K-KUPPER) 115,115,175                             SCAN 55
115    VI(K)=I                                             SCAN 56
      VJ(K)=J                                              SCAN 57
      GO TO 135                                           SCAN 58
120    IF(B) 125,135,135                                  SCAN 59
125    K=K+1                                               SCAN 60
      IF(K-KUPPER) 130,130,175                             SCAN 61
130    VI(K)=FLOAT(I)+A/(A-B)                             SCAN 62
      VJ(K)=J                                              SCAN 63
135    CONTINUE                                           SCAN 64
C      SCAN FOR INTERSECTIONS ALONG VERTICAL LINES BETWEEN  SCAN 65
C      EVERY 2 GRID POINTS                               SCAN 66
      DO 170 I=1,IMAX                                     SCAN 67
      B=PSIVAL-PSI(I,1)                                   SCAN 68
      DO 170 J=1,JMAXM                                    SCAN 69
      A=B                                                  SCAN 70
      B=PSIVAL-PSI(I,J+1)                                 SCAN 71
      IF(A) 140,145,155                                    SCAN 72
140    IF(B) 170,170,160                                  SCAN 73
145    K=K+1                                               SCAN 74
      IF(K-KUPPER) 150,150,175                             SCAN 75
150    VI(K)=I                                             SCAN 76
      VJ(K)=J                                              SCAN 77
      GO TO 170                                           SCAN 78
155    IF(B) 160,170,170                                  SCAN 79
160    K=K+1                                               SCAN 80
      IF(K-KUPPER) 165,165,175                             SCAN 81
165    VI(K)=I                                             SCAN 82
      VJ(K)=FLOAT(J)+A/(A-B)                             SCAN 83
170    CONTINUE                                           SCAN 84
175    IF (K-1) 180,180,185                               SCAN 85
C      IF NO INTERSECTIONS HAVE BEEN FOUND, SKIP PLOTTING  SCAN 86
180    GO TO 290                                           SCAN 87
C                                                         SCAN 88
C                                                         SCAN 89
C                                                         SCAN 90
C      ORDERING POINTS                                     SCAN 91
185    LINE=1                                              SCAN 92
C      ISTART & IEND LABEL THE BEGINNING AND END OF A CONTOUR  SCAN 93
      ISTART(LINE)=1                                       SCAN 94
      IEND(LINE)=K                                         SCAN 95
C                                                         SCAN 96
      DO 210 M=2,K                                         SCAN 97
      SMALL=2000.                                          SCAN 98
C      FIND THE LINES WHICH ENCLOSE THE POINT VI(M-1),VJ(M-1)  SCAN 99
      CALL BOUNDS(VI(M-1),VJ(M-1),IL,IR,JL,JU,IMAX,JMAX)  SCAN 100
      IBROKE=0                                             SCAN 101
C      FIND THE POINT NEXT TO VI(M-1),VJ(M-1)             SCAN 102
      DO 190 LT=M,K                                       SCAN 103
      TEST=(VI(M-1)-VI(LT))**2+(VJ(M-1)-VJ(LT))**2      SCAN 104
      IF(SMALL.LT.TEST) GO TO 190                         SCAN 105
C      THE CONTOUR IS BROKEN IF ANY OF THE FOLLOWING TESTS ARE TRUE  SCAN 106
      IF(VI(LT).LT.IL.OR.VI(LT).GT.IR.OR.VJ(LT).LT.JL.OR.VJ(LT).GT.JU)  SCAN 107
1      GO TO 190                                           SCAN 108
      IBROKE=1                                             SCAN 109
      SMALL=TEST                                           SCAN 110
      NEXT=LT                                              SCAN 111
190    CONTINUE                                           SCAN 112
      IF(IBROKE.NE.0) GO TO 205                             SCAN 113
C      IF IBROKE=0 CONTOUR IS BROKEN                       SCAN 114
C      FIND THE SMALLEST VJ FOR THE STARTING POINT OF THE NEXT CONTOUR  SCAN 115
      AMIN=VJ(M)                                           SCAN 116
      NFXT=M                                               SCAN 117
      DO 200 IB=M,K                                       SCAN 118
      IF(VJ(IB).LT.AMIN) GO TO 195                         SCAN 119
      GO TO 200                                           SCAN 120
195    AMIN=VJ(IB)                                         SCAN 121
      NFXT=IB                                              SCAN 122
200    CONTINUE                                           SCAN 123
      IEND(LINE)=M-1                                       SCAN 124
      LINE=LINE+1                                          SCAN 125
      IF(LINE.GT.100) GO TO 205                             SCAN 126
      ISTART(LINE)=M                                       SCAN 127
      IEND(LINE)=K                                         SCAN 128
C      INTERCHANGE VI(M),VJ(M) & VI(NEXT),VJ(NEXT)        SCAN 129
205    STORE=VI(M)                                         SCAN 130
      VI(M)=VI(NEXT)                                       SCAN 131
      VI(NEXT)=STORE                                       SCAN 132
      STORE=VJ(M)                                         SCAN 133
      VJ(M)=VJ(NEXT)                                       SCAN 134
      VJ(NEXT)=STORE                                       SCAN 135
210    CONTINUE                                           SCAN 136
C                                                         SCAN 137
C                                                         SCAN 138
C                                                         SCAN 139
C      TEST TO SEE IF CONTOUR SHOULD BE CLOSED           SCAN 140
      DO 230 LINEI=1,LINE                                  SCAN 141
      IS=ISTART(LINEI)                                     SCAN 142
      IE=IEND(LINEI)                                       SCAN 143
      IF((IE-IS).LE.1) GO TO 230                          SCAN 144

```

```

CALL BOUNDS(VI(1),VJ(1),IL,IR,JL,JU,IMAX,JMAX) SCAN 145
CONTOUR SHOULD NOT BE CLOSED IF ANY OF THE FOLLOWING TEST ARE TRUE SCAN 146
IF (VI(1E).LT.IL.OR.VI(1E).GT.IR.OR.VJ(1E).LT.JL.OR.VJ(1E).GT.JU) SCAN 147
1 GO TO 230 SCAN 148
K=K+1 SCAN 149
IF (K.GT.KUPPER) GO TO 265 SCAN 150
IF (LINE1.EQ.LINE) GO TO 225 SCAN 151
IF LINE1 IS NOT THE LAST CONTOUR ANOTHER POINT MUST BE INSERTED AND SCAN 152
C VI,VJ,ISTART,IEND MUST BE INCREASED & THE POINTS RELABELED SCAN 153
C IEP2=IEP2 SCAN 154
DO 215 I1=IEP2,K SCAN 155
I2=K-I1+IEP2 SCAN 156
VJ(I2)=VJ(I2-1) SCAN 157
215 VJ(I2)=VJ(I2-1) SCAN 158
LIP1=LINE1+1 SCAN 159
DO 220 I1=LIP1,LINE SCAN 160
ISTART(I1)=ISTART(I1)+1 SCAN 161
220 IEND(I1)=IEND(I1)+1 SCAN 162
225 IEND(LINE1)=IEND(LINE1)+1 SCAN 163
VI(IE+1)=VI(1) SCAN 164
VJ(IE+1)=VJ(1) SCAN 165
230 CONTINUE SCAN 166
IF CONTOUR IS CONTINUOUS, CALL PLCT ROUTINE SCAN 167
IF (LINE.EQ.1) GO TO 270 SCAN 168
ICOUNT=0 SCAN 169
235 LINEML=LINE-1 SCAN 170
C IF A CONTOUR THAT REALLY SHOULD BE CONTINUOUS IS BROKEN, THE FOLLOWING SCAN 171
C DO LOOP MAKES IT INTO A CONTINUOUS CONTOUR SCAN 172
DO 245 LINE1=1,LINEML SCAN 173
IS1=ISTART(LINE1) SCAN 174
CALL BOUNDS(VI(IS1),VJ(IS1),IL,IR,JL,JU,IMAX,JMAX) SCAN 175
IS2=ISTART(LINE1+1) SCAN 176
IF (VI(IS2).LT.IL.OR.VI(IS2).GT.IR.OR.VJ(IS2).LT.JL.OR.VJ(IS2).GT. SCAN 177
JU) GO TO 245 SCAN 178
C REVERSE THE ORDER OF LINE1 OF THIS CONTOUR SCAN 179
IE1=IEND(LINE1) SCAN 180
I1UP=(IE1-IS1+1)/2+IS1-1 SCAN 181
DO 240 I1=IS1,I1UP SCAN 182
I2=IE1-I1+IS1 SCAN 183
DUM=VI(I2) SCAN 184
VJ(I2)=VI(I1) SCAN 185
VI(I1)=DUM SCAN 186
DUM=VJ(I2) SCAN 187
VJ(I2)=VJ(I1) SCAN 188
240 VJ(I1)=DUM SCAN 189
245 CONTINUE SCAN 190
C POINTS ARE NOW COMPLETELY ORDERED.... SCAN 191
C CORRECT ANY BREAKS WHICH ARE NOT 'REAL' SCAN 192
LINE=1 SCAN 193
ISTART(LINE)=1 SCAN 194
IEND(LINE)=K SCAN 195
DO 255 M=2,K SCAN 196
CALL BOUNDS(VI(M-1),VJ(M-1),IL,IR,JL,JU,IMAX,JMAX) SCAN 197
IF (VI(M).LT.IL.OR.VI(M).GT.IR.OR.VJ(M).LT.JL.OR.VJ(M).GT.JU) SCAN 198
1 GO TO 250 SCAN 199
GO TO 255 SCAN 200
250 IEND(LINE)=M-1 SCAN 201
LINE=LINE+1 SCAN 202
ISTART(LINE)=M SCAN 203
IEND(LINE)=K SCAN 204
255 CONTINUE SCAN 205
IF (LINE.EQ.1) GO TO 270 SCAN 206
IF (ICOUNT.EQ.0) ISAVE=LINE-1 SCAN 207
ICOUNT=ICOUNT+1 SCAN 208
IF (ICOUNT.GT.ISAVE) GO TO 260 SCAN 209
GO TO 235 SCAN 210
260 IF (LINE.GT.2) GO TO 270 SCAN 211
IF THE CONTOUR IS STILL BROKEN COMPARE THE START OF THE FIRST SCAN 212
C SEGMENT WITH THE END OF THE SECOND SEGMENT SCAN 213
IF = IEND(2) SCAN 214
CALL BOUNDS(VI(1),VJ(1),IL,IR,JL,JU,IMAX,JMAX) SCAN 215
IF (VI(1E).LT.IL.OR.VI(1E).GT.IR.OR.VJ(1E).LT.JL.OR.VJ(1E).GT.JU) SCAN 216
1 GO TO 270 SCAN 217
C ADD THE START OF THE FIRST SEGMENT TO THE END OF THE SECOND SEGMENT SCAN 218
K=K+1 SCAN 219
IF (K.GT.KUPPER) GO TO 265 SCAN 220
VI(K)=VI(1) SCAN 221
VJ(K)=VJ(1) SCAN 222
IEND(2)=IE+1 SCAN 223
GO TO 270 SCAN 224
C SCAN 225
C SCAN 226
265 PRINT 8005 SCAN 227
8005 FORMAT(1H,'TOO MANY POINTS TO PLOT') SCAN 228
C CONVERT INTEGER ARRAYS TO REAL SCAN 229
270 DO 275 KK=1,K SCAN 230
I=VI(KK) SCAN 231
J=VJ(KK) SCAN 232
VI(KK)=V(I)+(VI(KK)-I)*DX SCAN 233
VJ(KK)=THETA(J)+(VJ(KK)-J)*DY SCAN 234
275 CONTINUE SCAN 235
C NOW CONVERT VI,VJ FROM POLAR TO RECTANGULAR COORDINATES SCAN 236
DO 280 KK=1,K SCAN 237
VISTOR=VI(KK) SCAN 238
VJSTOR=VJ(KK) SCAN 239
VI(KK)=VISTOR*SIN(VJSTOR) SCAN 240
280 VJ(KK)=VISTOR*COS(VJSTOR) SCAN 241
C CALL PLOT ROUTINE TO PLOT CONTOURS SCAN 242
CALL PLOTT2(V,THETA,IMAX,JMAX) SCAN 243
IF (IRITE.EQ.0) GO TO 290 SCAN 244
PRINT 8010,N,PSIVAL,K SCAN 245

```

```

8010 FORMAT(1H0,'CONTOUR',I3.5X,'VALUE=',F9.5,'NUMBER OF POINTS=',I3)SCAN 246
1/1H0,'(X,Y)=')SCAN 247
DO 285 L1=1,K,6SCAN 248
  L2=6SCAN 249
  L3=L1-1SCAN 250
  IF(L3+6,GT,K) L2=K-L3SCAN 251
  285 PRINT 8015,L1,(LPAR,VI(L3+L4),VJ(L3+L4),PPAR,L4=1,L2)SCAN 252
8015 FORMAT(1H ,I3,6(A1,F8.4,' ',F8.4,A1))SCAN 253
  PRINT 8020,(I*START(L),L=1,LINE)SCAN 254
8020 FORMAT ('O*START='/(I*,25I5))SCAN 255
  PRINT 8025,(I*END(L),L=1,LINE)SCAN 256
8025 FORMAT ('O*END='/(I*,25I5))SCAN 257
290 CONTINUESCAN 258
CSCAN 259
CSCAN 260
CSCAN 261
CSCAN 262
CSCAN 263
C HAVE PLOTTED ALL CONTOURSSCAN 264
C CALL PLOT ROUTINE TO ADVANCE CRT FILM OR PAPERSCAN 265
C CALL PLOTT3(V,THETA,IMAX,JMAX)SCAN 266
  RETURNSCAN 267
  END

```

/ SCAN / SIZE OF PROGRAM 001666 HEXADECIMAL BYTES PAGE 006

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.			
A	SF	R*	0001C4	B	SF	R*	0001C8	I	SFA	I*	0001CC	J	SFA	I*	0001D0			
K	SF	C	001F40	L	F	I*	0001D4	M	SFA	I*	0001D8	N	SF	C	001F44			
V	SFA	XR	000000	DX	SF	R*	0001DC	DY	SF	R*	0001E0	FF	F	C	000018			
IB	SF	I*	0001E4	IE	SF	I*	0001E8	IL	SFA	I*	0001EC	IR	SFA	I*	0001F0			
IS	SFA	I*	0001F4	IL	SF	I*	0001F8	I2	SF	I*	0001FC	JL	SFA	I*	000200			
JQ	C	I*	N.R.	JU	SFA	I*	000204	KK	SF	I*	000208	LT	SF	I*	00020C			
LI	SF	I*	000210	L2	SF	I*	000214	L3	SF	I*	000218	L4	F	I*	00021C			
MD	I*	I*	000220	ND	I*	I*	000224	V1	SFA	C	R*	000000	VJ	SFA	C	R*	000F40	
DUM	SF	P*	000228	IEI	SF	I*	00022C	IS1	SFA	I*	000230	IS2	S	I*	000234			
PS1	F	XR	000000	AMIN	S	R*	000238	IDUM	C	I*	N.R.	IEND	SF	C	I*	000000		
IEP2	SF	I*	00023C	IMAX	SFA	I*	000240	I1UP	SF	I*	000244	JDUM	C	I*	N.R.			
JMAX	SFA	I*	000248	LINE	SF	C	I*	000190	LIP1	SF	I*	00024C	LPAR	S	L*	0001C0		
NEXT	SF	I*	000250	RPAR	S	L*	0001C1	SCAN	R*	I*	000254	TEST	SF	R*	000258			
XDIM	C	R*	000000	YDIM	C	R*	000004	IRITE	I*	I*	00025C	ISAVE	S	I*	000260			
LINE1	SF	I*	000264	SMALL	S	R*	000268	STORE	SF	R*	00026C	THETA	SFA	XR	R*	000000		
COS	XF	P*	000000	SIN	XF	R*	000000	BOUNDS	SF	XF	R*	000000	COMMENT	C	R*	N.R.		
IBCOM#	XF	I*	000000	IBROKE	S	I*	000270	ICOUNT	SF	I*	000274	IDPLOT	C	I*	N.R.			
IMAXM1	SF	I*	000278	ISTART	SF	I*	000294	JMAXM1	SF	I*	00027C	KUPPER	I*	I*	000280			
LINEM1	SF	I*	000284	NUMBER	F	C	I*	000014	PLOTT1	SF	XF	R*	000000	PLOTT2	SF	XF	R*	000000
PLOTT3	SF	XF	000000	PSIVAL	SF	R*	000288	VISTOR	SF	R*	00028C	VJSTOR	SFA	R*	000290			

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK *TITLER* SIZE OF BLOCK 000050 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
COMMENT	R*	N.R.									

NAME OF COMMON BLOCK *MAINC* SIZE OF BLOCK 000148 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XDIM	R*	000000	YDIM	R*	000004	IDUM	I*	N.R.	JDUM	I*	N.R.
IDPLOT	I*	N.R.	NUMBER	I*	000014	FF	R*	000018	JQ	I*	N.R.

NAME OF COMMON BLOCK *SCANC* SIZE OF BLOCK 001F48 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
VI	P*	000000	VJ	R*	000FA0	K	I*	001F40	N	I*	001F44

NAME OF COMMON BLOCK *IBPEAK* SIZE OF BLOCK 000194 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
IEND	I*	000000	LINE	I*	000190						

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	000528	105	00067C	110	00068E	115	00069E
120	0006D8	125	0006E2	130	0006F2	135	000738
140	000826	145	000838	150	000848	155	000882
160	00088C	165	00089F	170	0008E2	175	00091E
180	000936	185	00093A	190	000AF8	195	00085C

•

!

!

1

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK * MAINC*				SIZE OF BLOCK				000148 HEXADECIMAL BYTES						
VAR. NAME	TYPE	REL. ADDR.		VAR. NAME	TYPE	REL. ADDR.		VAR. NAME	TYPE	REL. ADDR.		VAR. NAME	TYPE	REL. ADDR.
XDIM	R*4	000000		YDIM	R*4	N.R.		IDUM	I*4	N.R.		JDUM	I*4	N.R.
IDPLOT	I*4	N.R.		NUMB	I*4	N.R.		FF	R*4	N.R.		JQ	I*4	N.R.

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0014F2	105	001504	110	001566	115	001592
120	0015C8	125	0015DE				

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
 OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
 STATISTICS SOURCE STATEMENTS = 50 ,PROGRAM SIZE = 6346
 STATISTICS NO DIAGNOSTICS GENERATED
 ***** END OF COMPILATION ***** 125K BYTES OF CORE NOT USED

LEVEL 21.6 (DEC 72)

CS/360 FORTRAN H

```

COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF
SUBROUTINE PLOTT1(V,THETA,IMAX,JMAX) PLOT 1
***** VERSION 'D' ***** PLOT 2
THIS IS PART OF A CONTOUR PLOTTING PACKAGE WHICH RECEIVES PLOT 3
COORDINATES WHICH 'SCAN' HAS CONVERTED FROM POLAR TO RECTANGULAR. PLOT 4
IT PLOTS COORDINATE VALUES IN (X,Y) UNITS WHERE - PLOT 5
X=V*COS(THETA) PLOT 6
Y=V*SIN(THETA) PLOT 7
XMIN = V*COS(PI) = -V(IMAX) PLOT 8
XMAX = V*COS(0) = V(IMAX) PLOT 9
YMIN = V*SIN(0) = 0 PLOT 10
YMAX = V*SIN(PI/2) = V(IMAX) PLOT 11
LABELS ARE POLAR, THETA=0 TO 360 DEGREES PLOT 12
CRT CALLS ARE CONVERTED TO COMMANDS FOR THE PEN AND INK PLOTTER PLOT 13
BY THE SUBROUTINE 'PLTINT' PLOT 14
COMMON/TITLER/COMMENT(20) PLOT 15
COMMON/MAINC/XDIM,YDIM,IDUM,JDUM,IDPLOT,NUMBER,FF(75),JQ PLOT 16
COMMON/SCANC/VI(1000),VJ(1000),K,NUM PLOT 17
COMMON/IBREAK/IENTD,LINE PLOT 18
DIMENSION IEND(100) PLOT 19
DIMENSION V(IMAX),THETA(JMAX) PLOT 20
DIMENSION VX(1000) PLOT 21
REAL*8 DATE PLOT 22
SET UP ORIGIN AND BEAM INTENSITY AT ORIGIN PLOT 23
CALL CRT(0.5,0.0,4,3) PLOT 24
CALL IDAY(0,DATE) PLOT 25
XLAST=0.0 PLOT 26
YLAST=0.0 PLOT 27
FIND INCHES/GRID UNIT FOR PLOT PLOT 28
UNITX=XDIM/(2.*(IMAX-1.0)) PLOT 29
UNITY=YDIM/(2.*(IMAX-1.0)) PLOT 30
FIND INCHES TO EACH LABELING UNIT PLOT 31
TUNITX=XDIM/10. PLOT 32
FIND CONVERSION FACTOR TO CONVERT USER'S UNITS TO INCHES FOR PLOT PLOT 33
XCONV=2.*V(IMAX)/XDIM PLOT 34
YCONV=2.*V(IMAX)/YDIM PLOT 35
PRINT BORDER PLOT 36
FIND NUMBER OF X LABELS PLOT 37
NIMAX=5 PLOT 38
VMAX=V(IMAX) PLOT 39
VLAB=VMAX/5. PLOT 40
DO 100 I=1,IMAX PLOT 41
VX(I)=V(I) PLOT 42
100 CONTINUE PLOT 43
IDIR=0 PLOT 44
AX=TUNITX*XDIM/2. PLOT 45
AYCORR=YDIM/2.-.25 PLOT 46
Ayy=YDIM/2. PLOT 47
NOPL=JQ PLOT 48
LABEL PLOT NUMBER PLOT 49
CALL CRTNUM(-0.4,-.66,.2,NCPL,0.0,'(I2)') PLOT 50
IF(NOPL-2) 105,110,115 PLOT 51

```



```

105 CALL CRTSYM(0.4,-.66,.2,'AMOUNT OF DRIFT',0.0,15)
GO TO 125
110 CALL CRTSYM(0.8,-.66,.2,'HOURS OF FOG',0.0,12)
GO TO 125
115 IF(NOPL.GT.3) GO TO 120
CALL CRTSYM(0.8,-.66,.2,'HCURS OF ICE',0.0,12)
GO TO 125
120 CALL CRTSYM(0.8,-.66,.2,'SALT IN AIR ',0.0,12)
125 NPLOT=0
C
C FIND LABEL AT ORIGIN (X LABEL) AND PLOT
AXPL=VX(1)
IF (IDIR.EQ.0) GO TO 135
130 AX=-TUNITX*XDIM/2.
IDIR=1
GO TO 140
135 XX=XDIM/2.-.11407
CALL CRTNUM(XX,AYCORR,0.1,AXPL,0.0,'(F5.2)')
140 XX=XDIM/2.
MOVE BEAM TO V=0
CALL CRT(XX,AYY,0,1)
DO 160 N=1,NIMAX
C DRAW LINE TO NEXT LABEL
CALL CRT(AX,AYY,20,1)
C DRAW TICK MARK AT POINT TO BE LABELLED
CALL CRTSYM(AX,AYY,0.1,3,0.0,-2)
AXPL=N*VLAB
IF (AXPL.GE.100.) GO TO 145
AXCORR=AX-.14257
PRINT LABEL UNDER TICK MARK
CALL CRTNUM(AXCORR,AYCORR,0.1,AXPL,0.0,'(F5.2)')
GO TO 150
145 AXCORR=AX-.17107
CALL CRTNUM(AXCORR,AYCORR,0.1,AXPL,0.0,'(F6.2)')
C MOVE BEAM BACK TO X-AXIS
150 CALL CRT(AX,AYY,0,1)
IF (IDIR.EQ.1) GO TO 155
AX=AX+TUNITX
GO TO 160
155 AX=AX-TUNITX
160 CONTINUE
C FINISH DRAWING X-AXIS
IF (IDIR.EQ.1) GO TO 165
CALL CRT(XDIM,AYY,20,1)
GO TO 130
165 CALL CRT(0.0,AYY,20,1)
CALL CRT(XDIM,AYY,0,1)
C LABEL 90 DEGREE LINE
IDGREE=90
XX=XDIM+.1
YY=AYY-.1
CALL CRTNUM(XX,YY,0.1,IDGREE,0.0,'(I2)')
C DRAW 0-180 DEGREE LINE
XX=.5*XDIM
CALL CRT(XX,0.0,0,1)
YY=YDIM
CALL CRT(XX,YY,20,1)
C LABEL 0-180 DEGREE LINE
XX=.5*XDIM-.11407
YY=YDIM+.1
IDGREE=0
CALL CRTNUM(XX,YY,0.1,IDGREE,0.0,'(I2)')
IDGREE=180
XL=XX
YL=-.2
CALL CRTNUM(XL,YL,0.1,IDGREE,0.0,'(I3)')
C DRAW 45 AND 225 DEGREE LINES
XX=.5*XDIM
CALL CRT(XX,AYY,0,1)
XRAD=V(IMAX)/XCONV
SIDE=SQRT(XRAD**2/2.)
XX=SIDE*XDIM/2.
YY=AYY+SIDE+.1
CALL CRT(XX,YY,20,1)
XX1=.5*XDIM
CALL CRT(XX1,AYY,0,1)
XX1=XDIM/2.-SIDE
YY1=AYY-SIDE
CALL CRT(XX1,YY1,20,1)
C LABEL 45,225 DEGREE LINES
IDGREE=45
XL=XX+.15
YL=YY+.1
CALL CRTNUM(XL,YL,0.1,IDGREE,0.0,'(I2)')
IDGREE=225
XL=XX1-.2
YL=YY1-.2
CALL CRTNUM(XL,YL,0.1,IDGREE,0.0,'(I3)')
C DRAW 135 DEGREE AND 315 DEGREE LINE
XX=.5*XDIM
CALL CRT(XX,AYY,0,1)
XX=XDIM/2.-SIDE
YY=AYY+SIDE
CALL CRT(XX,YY,20,1)
XX1=.5*XDIM
CALL CRT(XX1,AYY,0,1)
XX1=XDIM/2.+SIDE
YY1=AYY-SIDE
CALL CRT(XX1,YY1,20,1)
C LABEL 135,315 DEGREE LINES
IDGREE=315

```

```

PLOT 53
PLOT 54
PLOT 55
PLOT 56
PLOT 57
PLOT 58
PLOT 59
PLOT 60
PLOT 61
PLOT 62
PLOT 63
PLOT 64
PLOT 65
PLOT 66
PLOT 67
PLOT 68
PLOT 69
PLOT 70
PLOT 71
PLOT 72
PLOT 73
PLOT 74
PLOT 75
PLOT 76
PLOT 77
PLOT 78
PLOT 79
PLOT 80
PLOT 81
PLOT 82
PLOT 83
PLOT 84
PLOT 85
PLOT 86
PLOT 87
PLOT 88
PLOT 89
PLOT 90
PLOT 91
PLOT 92
PLOT 93
PLOT 94
PLOT 95
PLOT 96
PLOT 97
PLOT 98
PLOT 99
PLOT 100
PLOT 101
PLOT 102
PLOT 103
PLOT 104
PLOT 105
PLOT 106
PLOT 107
PLOT 108
PLOT 109
PLOT 110
PLOT 111
PLOT 112
PLOT 113
PLOT 114
PLOT 115
PLOT 116
PLOT 117
PLOT 118
PLOT 119
PLOT 120
PLOT 121
PLOT 122
PLOT 123
PLOT 124
PLOT 125
PLOT 126
PLOT 127
PLOT 128
PLOT 129
PLOT 130
PLOT 131
PLOT 132
PLOT 133
PLOT 134
PLOT 135
PLOT 136
PLOT 137
PLOT 138
PLOT 139
PLOT 140
PLOT 141
PLOT 142
PLOT 143
PLOT 144
PLOT 145
PLOT 146
PLOT 147
PLOT 148
PLOT 149
PLOT 150
PLOT 151
PLOT 152
PLOT 153

```

```

      XL=XX-.4
      YL=YY+.1
      CALL CRTNUM(XL,YL,0.1,IDGREE,0.0,'(I3)')
      IDGREE=135
      XL=XX1+.1
      YL=YY1-.2
      CALL CRTNUM(XL,YL,0.1,IDGREE,0.0,'(I3)')
C     LABEL 270 DEGREE LINE
      IDGREE=270
      XL=-.6
      YL=YY-.1
      CALL CRTNUM(XL,YL,0.1,IDGREE,0.0,'(I3)')
C     DRAW RADIUS=V LINES
      XORIG=XDIM/2.
      YORIG=YDIM/2.
C     FOR EACH LABELLED V, PLOT A CIRCLE OF 201 POINTS WITH
C     ORIGIN AT V=0, RADIUS=V
      PI2=2.*3.1415927
      DO 175 II=1,NIMAX
      RCIRC=II*VLAB
      TH1=0.
      DTHET=PI2/201.
      MODE=1
      DO 170 I=1,201
      MODE=6-MODE
      THET=TH1+(I-1)*DTHET
      X=RCIRC*COS(THET)
      Y=RCIRC*SIN(THET)
      XPLT=X/XCONV+XORIG
      YPLT=Y/YCONV+YORIG
      CALL CRT(XPLT,YPLT,18,MODE)
170  CONTINUE
175  CONTINUE
C     PLOT COMMENT CARD
      XA=-0.4
      YA=YDIM+.25
      CALL CRTSYM(XA,YA,.20,COMENT(1),0.0,80)
C     PLOT CONTOUR TABLE
180  YA=YDIM-.5
C     PRINT TABLE OF CONTOUR VALUES
      XD=XDIM+.5
      XA=XD+.165
      DO 185 N=1,NUMBER
      CALL CRTNUM(XD,YA,.097,N,0.0,'(I3)')
      CALL CRTNUM(XA,YA,.097,FF(N),0.0,'(F10.3)')
      YA=YA-.147
185  CONTINUE
C     PLOT DATE
      XA=XDIM-1.5
      CALL CRTSYM(XA,-.66,.20,DATE,0.0,8)
190  RETURN
C     ENTRY PLOTT2
      MODE=5
      TURN$ OFF BEAM
      MODE=5
      DO 220 NN=1,K
      PLOT POINTS OF CONTOUR
      DO 195 L=1,LINE
      IF (IEND(L)*1.EQ.NN) MODE=5
195  CONTINUE
      XP=(V(IMAX)+VJ(NN))/XCONV
      YP=(V(IMAX)+VJ(NN))/YCONV
200  CALL CRT(XP,YP,18,MODE)
C     IF(NN.NE.JQ)GO TO 190
      XCORR=XP-.035
      YCORR=YP-.05
      IF(NUM.GE.10)GO TO 205
C     LABEL CONTOUR AT POINT JQ WITH 'NUM'
      CALL CRTNUM(XCORR,YCORR,0.1,NUM,0.0,'(I1)')
      GO TO 210
205  CALL CRTSYM(XCORR,YCORR,0.1,NUM,0.0-1)
210  CALL CRT(XP,YP,18,5)
215  CONTINUE
      MODE=1
220  CONTINUE
      RETURN
C     ENTRY PLOTT3
      ADVANCE FILM OR PAPER FOR NEXT PLOT
      CALL CRT(0.0,0.0,0000,2)
      RETURN
      END

```

```

PLOT 154
PLOT 155
PLOT 156
PLOT 157
PLOT 158
PLOT 159
PLOT 160
PLOT 161
PLOT 162
PLOT 163
PLOT 164
PLOT 165
PLOT 166
PLOT 167
PLOT 168
PLOT 169
PLOT 170
PLOT 171
PLOT 172
PLOT 173
PLOT 174
PLOT 175
PLOT 176
PLOT 177
PLOT 178
PLOT 179
PLOT 180
PLOT 181
PLOT 182
PLOT 183
PLOT 184
PLOT 185
PLOT 186
PLOT 187
PLOT 188
PLOT 189
PLOT 190
PLOT 191
PLOT 192
PLOT 193
PLOT 194
PLOT 195
PLOT 196
PLOT 197
PLOT 199
PLOT 200
PLOT 201
PLOT 202
PLOT 203
PLOT 204
PLOT 205
PLOT 206
PLOT 207
PLOT 208
PLOT 209
PLOT 210
PLOT 211
PLOT 212
PLOT 213
PLOT 214
PLOT 215
PLOT 216
PLOT 217
PLOT 218
PLOT 219
PLOT 220
PLOT 221
PLOT 222
PLOT 223
PLOT 224
PLOT 225
PLOT 226
PLOT 227
PLOT 228
PLOT 229
PLOT 230
PLOT 231
PLOT 232
PLOT 233
PLOT 234

```

/ PLOTT1 / SIZE OF PROGRAM 001F6C HEXADECIMAL BYTES

NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.	NAME	TAG	TYPE	ADD.
I	SF	I*	000524	K	F	C	001F40	L	SF	I*	000528	N	SFA	I*	00052C
V	F	XP	000000	X	SF	R*	000530	Y	SF	R*	000534	AX	SFA	R*	000538
FF	SFA	C	000018	II	SF	I*	00053C	JQ	F	C	000144	NN	SF	I*	000540
VI	F	C	000000	VJ	F	C	000FA0	VX	SF	R*	000610	XX	SFA	R*	000544
XD	SFA	R*	000548	XL	SFA	R*	00054C	XP	SFA	R*	000550	XX	SFA	R*	000554
YA	SFA	R*	000558	YL	SFA	R*	00055C	YP	SFA	R*	000560	YY	SFA	R*	000564

AYY SFA	R**	000568	CRT SF	XF	R**	000000	NUM SFA	C	I**	001F44	PI2 SF	R**	00056C
TH1 SF	R**	000570	XX1 SFA	R**	000574	YY1 SFA	R**	000578	AXPL SFA	R**	00057C		
DATE SFA	R**	000608	IDAY SF	XF	I**	000000	IDIR S	I**	000580	IDUM	C	I**	N.R.
IEND	C	I**	IMAX F	I**	000584	JDUM	C	I**	N.R.	JMAX	I**	000588	
LINE F	C	I**	MODE SFA	I**	00058C	NOPL SFA	I**	000590	SIDE SF	R**	000594		
THET SFA	R**	000598	VLAB SF	R**	00059C	VMAX SF	P**	0005A0	XDIM SFA	C	R**	000000	
XPLT SFA	R**	0005A4	XRAD SFA	R**	0005A8	YDIM F	C	R**	000004	YPLT SFA	R**	0005AC	
DTHT SF	R**	0005B0	NIMAX SF	I**	0005B4	NPLT S	I**	0005B8	RCIRC SF	R**	0005BC		
THETA	XR	R**	UNITX S	R**	0005C0	UNITY S	R**	0005C4	XCONV SF	R**	0005C8		
XCORR SFA	R**	0005CC	XLAST S	R**	0005D0	XORIG SF	R**	0005D4	YCONV SF	R**	0005D8		
YCORR SFA	R**	0005DC	YLAST S	R**	0005E0	YORIG SF	R**	0005E4	SIN	XF	R**	000000	
COS	XF	R**	SQRT	XF	P**	000000	AYCORR SFA	R**	0005E8	AYCORR SFA	R**	0005EC	
COMMENT SFA	C	R**	CRTNUM SF	XF	R**	000000	CRTSYM SF	XF	R**	000000	IDGREE SFA	I**	0005F0
IDPLOT	C	I**	NUMBER F	C	I**	000014	PLOTT1	R**	0005F4	PLOTT2	R**	0005F8	
PLOTT3	P**	0005FC	TUNITX SF	R**	000600								

***** COMMON INFORMATION *****

NAME OF COMMON BLOCK *TITLER* SIZE OF BLOCK 000050 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
COMENT	R**	000000									

NAME OF COMMON BLOCK *MAINC* SIZE OF BLOCK 000148 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
XDIM	R**	000000	YDIM	R**	000004	IDUM	I**	N.R.	JDUM	I**	N.R.
IDPLOT	I**	N.R.	NUMBER	I**	000014	FF	R**	000018	JQ	I**	000144

NAME OF COMMON BLOCK *SCANC* SIZE OF BLOCK 001F48 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
VI	R**	000000	VJ	R**	000FA0	K	I**	001F40	NUM	I**	001F44

NAME OF COMMON BLOCK *IBREAK* SIZE OF BLOCK 000194 HEXADECIMAL BYTES

VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.	VAR. NAME	TYPE	REL. ADDR.
IEND	I**	000000	LINE	I**	000190						

LABEL	ADDR	LABEL	ADDR	LABEL	ADDR	LABEL	ADDR
100	0016F8	105	001764	110	001772	115	001780
120	00179A	125	0017A4	130	0017BE	135	0017DA
140	0017F4	145	001882	150	001898	155	0018BA
160	0018C6	165	0018EA	170	001C8E	175	001C92
180	001CC4 NR	185	001D22	190	001D4E NR	195	001D5C
200	001DEC NR	205	001E28	210	001E32	215	001E3C NR
220	001E40						

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,NOXREF

STATISTICS SOURCE STATEMENTS = 191,PROGRAM SIZE = 8044

STATISTICS NO DIAGNOSTICS GENERATED

***** END OF COMPILATION *****

97K BYTES OF CORE NOT USED

STATISTICS NO DIAGNOSTICS THIS STEP

F128-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED LIST,MAP
 DEFAULT OPTION(S) USED - SIZE=(149504,28672)
 SYSPRINT DEFAULT BLOCKING USED 1 - 1
 IEW0000 INCLUDE PLOTSUBS

MODULE MAP

CONTROL SECTION			ENTRY			
NAME	ORIGIN	LENGTH	NAME	LOCATION	NAME	LOCATION
MAIN	00	1249C				
READIN	124A0	582				

SIGNCK	12A58	254
TAPCHK	12C80	494
TRAJ	13148	3F6
SAMPLE	13540	RCE
PV	14110	156
PVS	14268	102
BP	14370	CE
PVSF	14440	2C4
SOLAR	14708	3A4
STACON	14A80	4CC
PRISE	14F80	45C
YSZ	153E0	2D0
TABLE	15680	3A0
LGND	15A50	78
TITLER	15AC8	50
PREP	15B18	48E
CONPLT	15FA8	1F2
PCONTR	161A0	37C
LTRIS	16520	6E8
UTRIS	16C08	59A
QTPLOT	171A8	250
CONTUR	173F8	558
SUBPLT	17950	3C0
BOUNDS	17D10	258
SCAN	17F68	1666
PLTINT	195D0	18CA
PLOTT1	1AEAO	1F6C
PLID	1CE10	1C4
GTJN	1CFD8	148
IGYJ	1D120	EC
ZYXWPRGC	1D210	80
TAB4ZYXW	1D290	104
PLOTS	1D398	51A
DISKZYXW	1D888	58
PLOT	1D910	7F6
NUMBER	1E108	72B
SYMBOL	1E838	DCA
XLIMIT	1F608	168
YLIMIT	1F770	168

CRT	1ACB8	CRTNUM	1AD3C	CRTSYM	1ADE8
PLOTT2	1CD7C	PLOTT3	1CDC4		

NAME	ORIGIN	LENGTH
OFFSET	1F8D8	124
FACTOR	1FA00	C4
WHERE	1FAC8	120
BUFPZYXW	1FBE8	F08
STOREL	20AF0	40
PICKSO	20B30	1C
INTL *	20B50	DC4
QQCPA *	21918	r 8
IHCFOPT *	219E0	304
IHCSEXIT*	21CE8	1C
IHCSEXP *	21D08	192
FIXPLT *	21EAO	376
IHCFRXPR*	22218	183
IDAY *	223A0	108
MODEL *	224A8	30
IHCSSQRT*	224D8	145
SETPLT *	22620	A40
IHCSLOG *	23060	186
IHCSASCN*	23218	10F
IHCSSCN *	233F8	109
IHCFRXPI*	235D8	141
IHCCEOMH*	23720	F65
IHCCEOMH2*	24688	6A5
JOBNUM *	24D30	98
LEGEND *	24DC8	AEC
LINPLT *	258B8	17E8
QQQCPA *	270A0	408
SCVRT23 *	27578	20
BCDTOINT*	27598	70
ICOMPARE*	27608	6C
DOUTBL *	27678	638
INTOBCD *	27C80	10E

NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
LODREL	20B10						
QQPORC	215C8	QQQSYM	21654	QQQNUM	21720	QQWHER	217F0
QQQORG	21860	ADVANS	218D0				
ERRSET	219E0	ERRSAV	218DA	ERRSTR	21C00		
EXIT	21CF8						
EXP	21D08						
FRXPR#	22218						
SQRT	224D8						
RAYPLT	22F00	TITLE	22FA4				
ALOG10	23060	ALOG	23078				
ARCOS	23218	AR SIN	2322E				
COS	233F8	SIN	23410				
FRXPI#	235D8						
IBCOM#	23720	IBCOM	23720	DOI#SV	2379C	FDIOCS#	237DC
OOERR904	23918	OOFLAG	245D4	INTSWTCH	2467E		
OOABND	2473E	SEQDASD	2489E				
SCVRT24	27578						
BCDTO1	27598	BCDTINT	27598	BCDTIN	27598		
ICOMPA	27608						
IHCUTBL	27678						

NAME	ORIGIN	LENGTH
LABEL	* 27DC0	26C
LOC	* 28030	A
QQNEWS	* 28040	868
REPLACE	* 288A8	50
TIME	* 288F8	74
AXIS	* 28970	2E8C
BOX	* 28830	32C
IHCFFIOS*	28860	157C
GRID	* 2D0E0	FEE
IHCERRM	* 2E0D0	730
QOUOPT	* 2E800	3C8
QQPRIN	* 2EBC8	34C
QQPRTS	* 2EF18	D42
QQROTE	* 2FC60	278
IHCFCVTH*	2FE08	119D
IHCENFTH*	31078	58A
LINEUP	* 31608	326
QOERM0	* 31930	190
QOSET0	* 31AC0	434
QOCODS	* 31EF8	30
RANGE	* 31F28	278
SCALE	* 321A0	A2E
IHCFLQAT*	328D0	50
IHCTRCH	* 32C20	2
LABEL2	* 32C28	E0C
QOSTUF	* 33A38	428
QQICON	* 33E60	100
QQLINE	* 34030	6A0
QQQMT	* 346D0	432
ROUND*	34808	19A
SIGN	* 34CA8	28
STEFF	* 34CD0	210
COREDUMP*	34EE0	6A4
IHCLOG	* 35588	200
NUMBCD	* 35788	F0
QODUMP	* 35878	213

NAME	ORIGIN	LENGTH
QOGADS	* 35A90	294
QQEDIT	* 35D28	2F8
\$8LANKCOM	36020	30
TABUL	36050	58
STAB	360A8	34
MAINC	360E0	148
SAMP	36228	14C
DROPS	36378	258
TAPE	36500	10
Q7QUAD	365E0	2C
PLWILS	36610	8
CONT	36618	334
SUB	36950	10
SCANC	36960	1F48
IBREAK	388A8	194
UNITSM*	38A40	4

ENTRY ADDRESS 00
TOTAL LENGTH 38A48

***NAMEX DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET

NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
INT0BC	27C80	INTBC0L	27CC4	INTBCD	27CC4		
REPLAC	288A8						
FIOCS#	2RB60	FIOCSBEP	28B66	QOSET0	2D054	QOEQVTBL	2D078
ERRMON	2E0D0	IHCERRE	2E0E8	ENTPY214	2E2D4		
IHCUOPT	2E800						
QQPOUT	2EED0						
QQPRTR	2FBD0						
ADCON#	2FED8	FCVAOUTP	2FF82	FCVLOUTP	30012	FCVZOUTP	30162
FCVIOUTP	30510	FCVEOUTP	30A12	FCVCOUTP	30C2C	INT6SWCH	30F12
ARITH#	31078	ADJSWTH	31444	QOA#SV	31488		
SETFAU	31AC0						
FLOAT	32BD6	DFLOAT	32BD6				
QOSAVE	33A38	QORSTR	33A4A	SETCHK	33A80	OPSEQTBL	33A00
UNITTTBLE	33D60	QOSYSN	33E28	SETFAULT	33E54		
CDUMP	34EE0						
DLOG10	35588	DLOG	355A0				

NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
IOXLOC	35B28	QOTIME	35BFA				

Appendix F

SAMPLE ORFAD OUTPUT

PROGRAM ORFAD

EXAMPLE COOLING TOWER CALCULATION - NATURAL DRAFT - CASE 1

DATE: 04-03-76 HASP NO.: 545 JOB NO.: MELF
RUN ON MODEL 360/91

COOLING TOWERS:

HEIGHT	(METERS)	137.00
RANGE	(DEGREES F)	25.00
WATER/AIR RATIO		2.67
INNER RADIUS	(METERS)	33.50
EFFLUX SPEED (METERS/SEC)		4.20
HEAT OUT (MEGACAL/SEC)		1128.10
DRIFT FRACTION		5.000E-05
CONCENTRATION		1.000E 00
LATITUDE	(DEGREES N)	41.270
LONGITUDE	(DEGREES W)	73.950
TIME ZONE		5.
ELEVATION	(FEET)	20.00

DRIFT DIAM(MICRONS)	50.00	100.00	150.00	200.00
WEIGHT FRACTION	0.200	0.460	0.240	0.100

NUMBER OF TOWERS	1.00
TOWERS/CLUSTER	1.00
CLUSTER SIZE (METERS)	67.00
FRACTION CONDENSED	0.0
SALT AT HEIGHT (METERS)	8.00

DRIFT CONCENTRATION BY MONTH -

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
5.400E-04	2.200E-03	3.600E-06	1.000E-07	4.600E-05	2.500E-03	8.000E-03	1.000E-02	9.000E-03	4.800E-03	6.000E-04	4.000E-04

ANALYZES 10 YEARS STARTING 1959

ALL INPUT READ

SAMPLE PLUME RISE AND DRIFT

DEPOSITION	DISTANCES, MILES	0.10	0.20	0.50	1.00	1.50	2.00	2.50	3.00	4.00	5.00	PEL HUM		
OPY	WET	STAB.	WIND,	PLUME RISE - METERS										
BULB	BULB	CLASS	KNOTS	DRIFT - GM/HR SQ M										
				DRIFT - GM/HR									FRAC SOL	
40.0	39.0	1	1.0	1862.42	2956.41	5445.74	8644.56	11327.58	13722.38	15923.42	17364.81	17364.81	17364.81	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	1	2.0	931.21	1478.20	2722.87	4322.29	5663.79	6861.19	7961.71	8682.41	8682.41	8682.41	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	1	3.0	620.81	985.47	1815.25	2881.52	3775.86	4574.13	5307.80	5788.27	5788.27	5788.27	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	2	4.0	462.18	733.66	1351.42	2145.24	2811.06	3405.36	3951.57	4283.87	4283.87	4283.87	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	2	6.0	308.12	489.11	900.95	1430.16	1874.04	2270.24	2634.38	2855.91	2855.91	2855.91	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	2	7.0	264.10	419.24	772.24	1225.85	1606.32	1945.92	2258.04	2447.92	2447.92	2447.92	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	3	8.0	230.56	366.00	674.17	1070.18	1402.34	1698.81	1971.29	2133.19	2133.19	2133.19	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	3	10.0	184.45	292.80	539.34	856.15	1121.87	1359.05	1577.04	1706.55	1706.55	1706.55	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	3	12.0	153.71	244.00	449.45	713.46	934.89	1132.54	1314.20	1422.13	1422.13	1422.13	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	4	8.0	229.68	364.60	671.59	1066.08	1396.97	1692.31	1963.75	2118.51	2118.51	2118.51	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	4	12.0	153.12	243.06	447.73	710.72	931.31	1128.21	1309.17	1412.34	1412.34	1412.34	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	4	16.0	114.84	182.30	335.80	533.04	698.48	846.15	981.88	1059.25	1059.25	1059.25	0.9173
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.0	39.0	5	4.0	453.64	555.09	555.09	555.09	555.09	555.09	555.09	555.09	555.09	555.09	0.9173
				0.0	0.0	0.0	0.0	3.603E-03	1.520E-03	1.492E-03	8.632E-04	3.642E-04	1.423E-04	
				0.0	0.0	0.0	0.0	2.748E-03	1.546E-03	1.896E-03	2.058E-03	1.482E-03	7.237E-02	0.8066
40.0	39.0	5	6.0	302.43	480.08	484.91	484.91	484.91	484.91	484.91	484.91	484.91	484.91	0.9173
				0.0	0.0	0.0	0.0	2.024E-03	1.385E-03	1.049E-03	6.071E-04	4.909E-04	2.512E-04	
				0.0	0.0	0.0	0.0	1.544E-03	1.409E-03	1.334E-03	1.447E-03	1.997E-03	1.278E-03	0.6951
40.0	39.0	5	7.0	259.22	411.49	460.63	460.63	460.63	460.63	460.63	460.63	460.63	460.63	0.9173
				0.0	0.0	0.0	0.0	9.571E-04	1.176E-03	6.806E-04	5.503E-04	2.818E-04		
				0.0	0.0	0.0	0.0	9.734E-02	1.495E-03	1.622E-03	2.239E-03	1.433E-03	0.5990	
40.0	39.0	6	1.0	637.04	637.04	637.04	637.04	637.04	637.04	637.04	637.04	637.04	637.04	0.9173
				0.0	0.0	2.720E-02	6.517E-03	1.476E-03	2.731E-04	1.563E-04	9.910E-05	4.828E-05	2.763E-05	
				0.0	0.0	6.086E-03	3.314E-03	1.126E-03	2.778E-02	1.987E-02	2.362E-02	1.964E-02	1.405E-02	0.8932
40.0	39.0	6	2.0	505.62	505.62	505.62	505.62	505.62	505.62	505.62	505.62	505.62	505.62	0.9173
				0.0	0.0	1.882E-02	5.645E-03	3.206E-03	1.353E-03	5.304E-04	1.277E-04	6.221E-05	3.561E-05	
				0.0	0.0	4.211E-03	2.871E-03	2.446E-03	1.376E-03	6.744E-02	3.044E-02	2.531E-02	1.811E-02	0.9503
40.0	39.0	6	3.0	441.70	441.70	441.70	441.70	441.70	441.70	441.70	441.70	441.70	441.70	0.9173
				0.0	0.0	0.0	0.0	7.626E-03	4.101E-03	1.827E-03	9.354E-04	4.132E-04	4.139E-05	
				0.0	0.0	0.0	0.0	3.878E-03	3.128E-03	1.858E-03	1.189E-03	9.850E-02	2.941E-02	0.8907

DEPOSITION DISTANCES, MILES			0.10	0.20	0.50	1.00	1.50	2.00	2.50	3.00	4.00	5.00	REL HUM	
DRY BULB	WET BULB	STAB. CLASS	WIND, KNOTS	PLUME RISE - METERS									REL HUM	
40.0	35.0	1	1.0	DRIFT - GM/HR									FRAC SOL	
				1857.32	2948.31	5430.83	8620.95	11296.63	13884.88	15879.92	17279.43	17279.43	17279.43	0.5997
			0.0	6.688E-02	1.593E-02	4.653E-03	1.991E-03	1.024E-03	3.542E-04	8.043E-04	4.078E-04	2.539E-04		
			0.0	3.401E-03	3.564E-03	2.367E-03	1.519E-03	1.041E-03	4.504E-02	1.917E-03	1.659E-03	1.291E-03	1.3279	
40.0	35.0	1	2.0	928.66	1474.16	2715.42	4310.48	5648.32	6842.45	7939.96	8639.72	8639.72	8639.72	0.5997
			0.0	7.286E-02	1.556E-02	4.584E-03	1.968E-03	1.014E-03	3.528E-04	4.702E-04	4.798E-04	2.519E-04		
			0.0	3.705E-03	3.482E-03	2.331E-03	1.501E-03	1.031E-03	4.485E-02	1.903E-03	1.646E-03	1.281E-03	1.3372	
40.0	35.0	1	3.0	619.11	982.77	1810.28	2873.65	3765.54	4561.63	5293.30	5759.81	5759.81	5759.81	0.5997
			0.0	7.012E-02	1.522E-02	5.339E-03	1.946E-03	1.004E-03	3.513E-04	7.921E-04	4.016E-04	2.500E-04		
			0.0	3.566E-03	3.405E-03	2.715E-03	1.484E-03	1.021E-03	4.466E-02	1.888E-03	1.634E-03	1.271E-03	1.3450	
40.0	35.0	2	4.0	460.88	731.60	1347.62	2139.22	2803.16	3395.79	3940.47	4262.24	4262.24	4262.24	0.5997
			0.0	1.499E-02	5.299E-03	1.938E-03	1.002E-03	3.524E-04	7.964E-04	4.037E-04	2.513E-04			
			0.0	3.353E-03	2.695E-03	1.478E-03	1.019E-03	4.480E-02	1.899E-03	1.643E-03	1.278E-03	1.0657		
40.0	35.0	2	6.0	307.25	487.73	898.42	1426.14	1868.78	2263.86	2626.98	2841.49	2841.49	2841.49	0.5997
			0.0	1.022E-02	5.150E-03	2.262E-03	1.187E-03	6.831E-04	7.844E-04	3.976E-04	2.475E-04			
			0.0	2.287E-03	2.619E-03	1.725E-03	1.207E-03	8.685E-02	1.870E-03	1.618E-03	1.259E-03	1.0380		
40.0	35.0	2	7.0	263.36	418.06	770.07	1222.41	1601.81	1940.45	2251.69	2435.57	2435.57	2435.57	0.5997
			0.0	1.001E-02	5.078E-03	2.237E-03	1.176E-03	6.777E-04	7.786E-04	3.946E-04	2.457E-04			
			0.0	2.240E-03	2.582E-03	1.706E-03	1.196E-03	8.616E-02	1.856E-03	1.605E-03	1.249E-03	1.0260		
40.0	35.0	3	8.0	229.91	364.96	672.27	1067.16	1398.37	1694.00	1965.72	2122.34	2122.34	2122.34	0.5997
			0.0	9.828E-03	5.019E-03	2.217E-03	1.168E-03	6.737E-04	7.758E-04	3.932E-04	2.448E-04			
			0.0	2.199E-03	2.552E-03	1.692E-03	1.188E-03	8.566E-02	1.849E-03	1.600E-03	1.245E-03	1.0170		
40.0	35.0	3	10.0	183.93	291.97	537.81	853.73	1118.70	1355.20	1572.58	1697.87	1697.87	1697.87	0.5997
			0.0	1.085E-02	5.726E-03	2.171E-03	1.147E-03	6.632E-04	7.644E-04	3.874E-04	2.411E-04			
			0.0	2.427E-03	2.912E-03	1.656E-03	1.166E-03	8.431E-02	1.822E-03	1.576E-03	1.226E-03	1.0516		
40.0	35.0	3	12.0	153.27	243.31	448.18	711.44	932.25	1129.34	1310.48	1414.89	1414.89	1414.89	0.5997
			0.0	1.045E-02	5.578E-03	2.126E-03	1.127E-03	6.529E-04	3.407E-04	3.818E-04	2.376E-04			
			0.0	2.338E-03	2.837E-03	1.621E-03	1.146E-03	8.301E-02	1.812E-02	1.553E-03	1.208E-03	0.9526		
40.0	35.0	4	8.0	229.02	363.55	669.66	1063.02	1392.96	1687.45	1958.10	2107.58	2107.58	2107.58	0.5997
			0.0	9.860E-03	5.036E-03	2.225E-03	1.172E-03	6.762E-04	7.809E-04	3.958E-04	2.464E-04			
			0.0	2.206E-03	2.561E-03	1.698E-03	1.192E-03	8.597E-02	1.862E-03	1.610E-03	1.253E-03	1.0217		
40.0	35.0	4	12.0	152.68	242.37	446.44	708.68	928.64	1124.97	1305.40	1405.05	1405.05	1405.05	0.5997
			0.0	1.048E-02	5.596E-03	2.133E-03	1.131E-03	6.552E-04	7.582E-04	3.842E-04	2.391E-04			
			0.0	2.345E-03	2.846E-03	1.627E-03	1.150E-03	8.330E-02	1.807E-03	1.563E-03	1.216E-03	1.0330		
40.0	35.0	4	16.0	114.51	181.77	334.83	531.51	696.48	843.73	979.05	1053.79	1053.79	1053.79	0.5997
			0.0	1.115E-02	5.320E-03	2.422E-03	1.092E-03	3.947E-04	4.963E-04	4.706E-04	2.323E-04			
			0.0	2.494E-03	2.706E-03	1.847E-03	1.111E-03	5.018E-02	1.183E-03	1.915E-03	1.181E-03	0.9983		
40.0	35.0	5	4.0	452.28	553.42	553.42	553.42	553.42	553.42	553.42	553.42	553.42	553.42	0.5997
			0.0	6.625E-02	3.055E-02	6.097E-03	6.230E-04	3.203E-04	1.663E-04	8.355E-05	3.404E-05	2.723E-05		
			0.0	3.363E-03	6.835E-03	3.100E-03	4.753E-02	2.258E-02	2.114E-02	1.992E-02	1.385E-02	1.385E-02	1.1414	
40.0	35.0	5	6.0	301.52	478.63	483.46	483.46	483.46	483.46	483.46	483.46	483.46	483.46	0.5997
			0.0	1.845E-02	5.951E-03	1.702E-03	3.467E-04	1.901E-04	1.028E-04	4.649E-05	3.719E-05			
			0.0	4.129E-03	3.026E-03	1.299E-03	3.526E-02	2.417E-02	2.451E-02	1.891E-02	1.891E-02	0.7463		
40.0	35.0	5	7.0	258.45	410.26	459.24	459.24	459.24	459.24	459.24	459.24	459.24	459.24	0.5997
			0.0	1.967E-02	6.825E-03	2.690E-03	3.092E-04	1.696E-04	1.413E-04	6.877E-05	3.317E-05			
			0.0	4.401E-03	3.471E-03	2.052E-03	3.145E-02	2.156E-02	3.368E-02	2.798E-02	1.687E-02	0.8673		
40.0	35.0	6	1.0	634.99	634.99	634.99	634.99	634.99	634.99	634.99	634.99	634.99	634.99	0.5997
			0.0	4.444E-01	1.434E-01	4.583E-03	8.966E-04	3.247E-04	1.127E-04	9.016E-05	7.514E-05	1.972E-05	1.578E-05	
			0.0	5.085E-03	7.294E-03	1.026E-03	4.560E-02	2.477E-02	1.146E-02	1.146E-02	1.791E-02	8.024E-03	1.8024E-03	1.1324
40.0	35.0	6	2.0	503.99	503.99	503.99	503.99	503.99	503.99	503.99	503.99	503.99	503.99	0.5997
			0.0	2.488E-01	1.109E-01	1.483E-02	8.956E-04	3.600E-04	1.466E-04	1.173E-04	4.525E-05	3.394E-05	2.715E-05	
			0.0	2.847E-03	5.639E-03	3.318E-03	4.554E-02	2.746E-02	1.491E-02	1.491E-02	1.079E-02	1.381E-02	1.381E-02	1.0198
40.0	35.0	6	3.0	440.28	440.28	440.28	440.28	440.28	440.28	440.28	440.28	440.28	440.28	0.5997
			0.0	1.185E-01	2.559E-02	1.022E-03	4.420E-04	1.999E-04	1.599E-04	7.237E-05	2.512E-05	2.010E-05		
			0.0	6.028E-03	5.725E-03	5.195E-02	3.372E-02	2.033E-02	2.033E-02	1.725E-02	1.022E-02	1.022E-02	1.0335	
40.0	31.0	1	1.0	1852.40	2940.49	5416.43	8598.09	11266.67	13848.61	15837.81	17197.03	17197.03	17197.03	0.2976
			0.0	0.0	0.0	0.0	0.0	1.194E-03	6.500E-04	3.615E-04	4.227E-04	2.916E-04	1.620E-04	
			0.0	0.0	0.0	0.0	0.0	9.108E-02	6.611E-02	4.977E-02	1.008E-03	1.186E-03	8.240E-02	0.3926
40.0	31.0	1	2.0	926.20	1470.25	2708.22	4299.04	5633.34	6824.31	7918.91	8598.52	8598.52	8598.52	0.2976
			0.0	0.0	0.0	0.0	0.0	1.180E-03	6.438E-04	3.882E-04	4.195E-04	2.894E-04	1.608E-04	
			0.0	0.0	0.0	0.0	0.0	9.004E-02	6.548E-02	4.936E-02	9.999E-02	1.177E-03	8.176E-02	0.3892
40.0	31.0	1	3.0	617.47	980.16	1805.48	2866.03	3755.56	4549.54	5279.27	5732.34	5732.34	5732.34	0.2976
			0.0	0.0	0.0	0.0	0.0	1.167E-03	6.378E-04	3.851E-04	4.163E-04	2.872E-04	1.925E-04	
			0.0	0.0	0.0	0.0	0.0	8.902E-02	6.487E-02	4.895E-02	9.924E-02	1.168E-03	5.789E-02	0.3988
40.0	31.0	2	4.0	459.62	729.61	1343.95	2133.39	2795.53	3386.55	3929.74	4241.38	4241.38	4241.38	0.2976
			0.0	0.0	0.0	0.0	0.0	1.162E-03	6.364E-04	3.847E-04	4.186E-04	2.887E-04	1.604E-04	
			0.0	0.0	0.0	0.0	0.0	8.867E-02	6.473E-02	4.891E-02	9.979E-02	1.175E-03	8.157E-02	0.3867
40.0	31.0	2	6.0	306.42	486.41	895.97	1422.26	1863.69	2257.70	2619.83	2827.58	2827.58	2827.58	0.2976
			0.0	0.0	0.0	0.0	0.0	1.289E-03	6.247E-04	3.785E-04	4.123E-04	3.361E-04	1.906E-04	
			0.0	0.0	0.0	0.0	0.0	9.831E-02	6.354E-02	4.813E-02	9.829E-02	1.367E-03	9.694E-02	0.4181
40.0	31.0	2	7.0	262.64	416.92	767.97	1219.08	1597.45	1935.17	2245.56	2423.64	2423.64	2423.64	0.2976
			0.0	0.0	0.0	0.0	0.0	1.275E-03	7.055E-04	4.305E-04	4.093E-04	3.335E-04	1.892E-04	
			0.0	0.0	0.0	0.0	0.0	9.724E-02	7.166E-02	5.474E-02	9.756E-02	1.357E-03	9.620E-02	0.4268
40.0	31.0	3	8.0	229.28	363.96	670.42	1064.22	1394.53	1689.35	1960.32	2111.86	2111.86	2111.86	0.2976
			0.0	0.0	0.0	0.0	0.0	1.264E-03	7.007E-04	4.281E-04	4.078E-04	3.324E-04	1.885E-04	
			0.0	0.0	0.0	0.0	0.0	9.641E-02	7.126E-02	5.442E-02	9.722E-02	1.352E-03	9.586E-02	0.4247
40.0	31.0	3	10.0	183.42	291.17	536.34	851.38	1115.62	1351.48	1568.25	1689.49	1689.49	1689.49	0.2976
			0.0	0.0	0.0	0.0	0.0	1.237E-03	6.882E-04	4.214E-04	2.859E-04	3.275E-04	1.857E-04	
			0.0	0.0	0.0	0.0	0.0	9.438E-02	7					

SAMPLE PLUME RISE AND DRIFT

DEPOSITION DISTANCES, MILES				0.10	0.20	0.50	1.00	1.50	2.00	2.50	3.00	4.00	5.00	REL HUM
DRY BULB	WET BULB	STAR. CLASS	WIND. KNOTS	PLUME RISE - METERS										REL HUM
				DRIFT - GM/HR SQ M										
				DRIFT - GM/HR										FRAC SOL
40.0	31.0	5	7.0	0.0	0.0	2.481E-03	2.327E-03	2.437E-03	1.504E-03	1.143E-03	1.009E-03	3.506E-02	2.404E-02	0.8867
				257.69	409.06	457.91	457.91	457.91	457.91	457.91	457.91	457.91	457.91	0.2976
				0.0	0.0	1.123E-02	4.873E-03	3.346E-03	1.695E-03	1.055E-03	6.684E-04	7.687E-05	4.216E-05	
				0.0	0.0	2.512E-03	2.478E-03	2.552E-03	1.724E-03	1.341E-03	1.593E-03	3.127E-02	2.144E-02	0.9821
40.0	31.0	6	1.0	633.01	633.01	633.01	633.01	633.01	633.01	633.01	633.01	633.01	633.01	0.2976
				2.670E-01	1.103E-01	2.169E-02	1.140E-03	4.933E-04	2.231E-04	9.693E-05	8.078E-05	2.804E-05	2.243E-05	
				3.055E-03	5.608E-03	4.853E-03	5.797E-02	3.763E-02	2.269E-02	1.232E-02	1.926E-02	1.141E-02	1.141E-02	1.1761
40.0	31.0	6	2.0	502.42	502.42	502.42	502.42	502.42	502.42	502.42	502.42	502.42	502.42	0.2976
				0.0	6.151E-02	2.783E-02	3.687E-03	4.576E-04	2.228E-04	1.782E-04	8.954E-05	3.648E-05	2.918E-05	
				0.0	3.128E-03	6.227E-03	1.875E-03	3.491E-02	2.266E-02	2.266E-02	2.134E-02	1.484E-02	1.484E-02	0.9678
40.0	31.0	6	3.0	438.90	438.90	438.90	438.90	438.90	438.90	438.90	438.90	438.90	438.90	0.2976
				0.0	0.0	1.630E-02	6.357E-03	1.819E-03	2.540E-04	2.032E-04	1.099E-04	4.971E-05	3.977E-05	
				0.0	0.0	3.647E-03	3.233E-03	1.388E-03	2.584E-02	2.584E-02	2.620E-02	2.022E-02	2.022E-02	0.7292
60.0	59.0	1	1.0	1764.57	2801.08	5159.63	8190.38	10732.43	13001.41	15086.81	15757.22	15757.22	15757.22	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	1	2.0	882.29	1400.54	2579.81	4095.20	5366.22	6500.71	7543.41	7878.61	7878.61	7878.61	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	1	3.0	588.19	933.69	1719.88	2730.13	3577.48	4333.80	5028.93	5252.41	5252.41	5252.41	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	2	4.0	437.36	694.26	1278.83	2030.02	2660.08	3222.45	3739.33	3878.65	3878.65	3878.65	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	2	6.0	291.57	462.84	852.56	1353.35	1773.38	2148.30	2492.88	2585.76	2585.76	2585.76	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	2	7.0	249.92	396.72	730.76	1160.01	1520.04	1841.40	2136.76	2216.37	2216.37	2216.37	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	3	8.0	218.10	346.21	637.72	1012.31	1326.51	1606.95	1864.70	1930.06	1930.06	1930.06	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	3	10.0	174.48	276.97	510.17	809.85	1061.20	1285.56	1491.76	1544.05	1544.05	1544.05	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	3	12.0	145.40	230.80	425.15	674.88	884.34	1071.30	1243.13	1286.71	1286.71	1286.71	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	4	8.0	217.12	344.65	634.85	1007.77	1320.55	1599.74	1856.33	1914.50	1914.50	1914.50	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	4	12.0	144.74	229.77	423.24	671.85	880.37	1066.49	1237.55	1276.33	1276.33	1276.33	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	4	16.0	108.56	172.33	317.43	503.89	660.28	799.87	928.17	957.25	957.25	957.25	0.9436
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.0	59.0	5	4.0	427.88	530.45	530.45	530.45	530.45	530.45	530.45	530.45	530.45	530.45	0.9436
				0.0	0.0	0.0	0.0	3.475E-03	1.466E-03	1.439E-03	8.325E-04	3.512E-04	1.373E-04	
				0.0	0.0	0.0	0.0	2.651E-03	1.491E-03	1.829E-03	1.984E-03	1.429E-03	6.980E-02	0.7779
60.0	59.0	5	6.0	285.25	452.81	463.39	463.39	463.39	463.39	463.39	463.39	463.39	463.39	0.9436
				0.0	0.0	0.0	0.0	1.954E-03	1.978E-03	1.013E-03	1.064E-03	4.739E-04	2.426E-04	
				0.0	0.0	0.0	0.0	1.490E-03	2.012E-03	1.288E-03	2.535E-03	1.928E-03	1.234E-03	0.8091
60.0	59.0	5	7.0	244.50	388.12	440.19	440.19	440.19	440.19	440.19	440.19	440.19	440.19	0.9436
				0.0	0.0	0.0	0.0	9.243E-04	1.136E-03	6.573E-04	5.315E-04	4.721E-04	2.721E-04	
				0.0	0.0	0.0	0.0	9.401E-02	1.444E-03	1.567E-03	3.162E-03	1.384E-03	0.5785	
60.0	59.0	6	1.0	606.53	606.53	606.53	606.53	606.53	606.53	606.53	606.53	606.53	606.53	0.9436
				0.0	0.0	2.613E-02	6.260E-03	1.447E-03	2.677E-04	1.532E-04	9.713E-05	4.731E-05	2.708E-05	
				0.0	0.0	5.846E-03	3.183E-03	1.104E-03	2.722E-02	1.948E-02	2.315E-02	1.925E-02	1.377E-02	0.8613
60.0	59.0	6	2.0	481.40	481.40	481.40	481.40	481.40	481.40	481.40	481.40	481.40	481.40	0.9436
				0.0	0.0	1.811E-02	5.433E-03	3.085E-03	1.302E-03	5.204E-04	1.253E-04	6.102E-05	3.493E-05	
				0.0	0.0	4.052E-03	2.763E-03	2.353E-03	1.324E-03	6.616E-02	2.986E-02	2.483E-02	1.776E-02	0.9165
60.0	59.0	6	3.0	420.54	420.54	420.54	420.54	420.54	420.54	420.54	420.54	420.54	420.54	0.9436
				0.0	0.0	0.0	0.0	7.347E-03	3.951E-03	1.760E-03	9.012E-04	3.981E-04	7.096E-05	4.062E-05
				0.0	0.0	3.736E-03	3.014E-03	1.790E-03	1.146E-03	9.490E-02	2.887E-02	2.066E-02	0.8588	
60.0	53.0	1	1.0	1753.82	2784.02	5128.23	8140.54	10667.12	12922.30	14995.01	15585.06	15585.06	15585.06	0.6273
				0.0	7.084E-02	2.144E-02	4.924E-03	2.107E-03	1.083E-03	1.111E-03	7.592E-04	3.516E-04	2.139E-04	
				0.0	3.594E-03	4.798E-03	2.504E-03	1.607E-03	1.102E-03	1.412E-03	1.810E-03	1.430E-03	1.088E-03	1.4927
60.0	53.0	1	2.0	876.91	1392.01	2564.12	4070.27	5333.56	6461.15	7497.51	7792.54	7792.54	7792.54	0.6273
				0.0	6.775E-02	2.092E-02	4.847E-03	2.082E-03	1.072E-03	1.101E-03	7.527E-04	3.486E-04	2.121E-04	
				0.0	3.446E-03	4.682E-03	2.465E-03	1.588E-03	1.091E-03	1.400E-03	1.794E-03	1.418E-03	1.079E-03	1.4631
60.0	53.0	1	3.0	584.61	928.01	1709.41	2713.51	3555.71	4307.43	4998.34	5195.02	5195.02	5195.02	0.6273
				0.0	7.383E-02	1.605E-02	4.772E-03	2.057E-03	1.062E-03	1.092E-03	7.464E-04	4.441E-04	2.103E-04	
				0.0	3.755E-03	3.592E-03	2.427E-03	1.569E-03	1.080E-03	1.388E-03	1.779E-03	1.807E-03	1.069E-03	1.4248
60.0	53.0	2	4.0	434.61	689.90	1270.81	2017.29	2643.39	3202.24	3715.87	3834.96	3834.96	3834.96	0.6273
				0.0	7.157E-02	1.581E-02	4.738E-03	2.049E-03	1.060E-03	1.091E-03	7.516E-04	3.480E-04	2.117E-04	
				0.0	3.640E-03	3.538E-03	2.409E-03	1.563E-03	1.078E-03	1.388E-03	1.792E-03	1.416E-03	1.077E-03	1.3812
60.0	53.0	2	6.0	289.74	459.94	847.21	1344.86	1762.26	2134.83	2477.25	2556.64	2556.64	2556.64	0.6273
				0.0	1.512E-02	4.597E-03	2.001E-03	1.039E-03	3.701E-04	7.390E-04	4.397E-04	2.082E-04		
				0.0	3.382E-03	2.338E-03	1.527E-03	1.057E-03	4.705E-02	1.762E-02	1.789E-03	1.059E-03	1.0327	
60.0	53.0	2	7.0	248.35	394.23	726.18	1152.74	1510.51	1829.85	2123.36	2191.40	2191.40	2191.40	0.6273
				0.0	1.053E-02	5.355E-03	1.978E-03	1.029E-03	3.685E-04	8.604E-04	4.361E-04	2.064E-04		
				0.0	2.357E-03	2.723E								

SAMPLE PLUME RISE AND DRIFT

DEPOSITION	DISTANCES, MILES	0.10	0.20	0.50	1.00	1.50	2.00	2.50	3.00	4.00	5.00	REL HUM
DRY BULB	WET BULB	STAB. CLASS	WIND, KNOTS	PLUME RISE - METERS DRIFT - GM/HR SQ M DRIFT - GM/HR								FRAC SOL
0.0	0.0	0.0	0.0	1.037E-02	5.313E-03	1.969E-03	1.026E-03	3.695E-04	8.639E-04	4.378E-04	2.072E-04	0.9979
0.0	0.0	0.0	0.0	2.321E 03	2.702E 03	1.502E 03	1.044E 03	4.698E 02	2.059E 03	1.781E 03	1.054E 03	0.6273
0.0	0.0	0.0	0.0	420.52	667.53	874.71	1059.63	1229.59	1261.59	1261.59	1261.59	0.6273
0.0	0.0	0.0	0.0	1.099E-02	5.022E-03	2.248E-03	1.193E-03	6.918E-04	8.363E-04	4.237E-04	2.637E-04	1.0709
0.0	0.0	0.0	0.0	2.459E 03	2.554E 03	1.715E 03	1.213E 03	8.795E 02	1.993E 03	1.724E 03	1.341E 03	0.6273
0.0	0.0	0.0	0.0	315.39	500.64	656.03	794.72	922.19	946.19	946.19	946.19	0.6273
0.0	0.0	0.0	0.0	1.166E-02	5.585E-03	2.154E-03	1.150E-03	6.699E-04	8.103E-04	4.105E-04	2.554E-04	1.0813
0.0	0.0	0.0	0.0	2.609E 03	2.840E 03	1.643E 03	1.170E 03	8.517E 02	1.932E 03	1.670E 03	1.299E 03	0.6273
0.0	0.0	0.0	0.0	526.86	526.86	526.86	526.86	526.86	526.86	526.86	526.86	0.6273
0.0	0.0	0.0	0.0	6.902E-02	2.706E-02	3.580E-03	6.480E-04	2.162E-04	1.729E-04	8.689E-05	3.540E-05	2.832E-05
0.0	0.0	0.0	0.0	3.510E 03	6.054E 03	1.820E 03	4.943E 02	2.199E 02	2.071E 02	1.440E 02	1.440E 02	0.9887
0.0	0.0	0.0	0.0	460.26	460.26	460.26	460.26	460.26	460.26	460.26	460.26	0.6273
0.0	0.0	0.0	0.0	1.918E-02	6.183E-03	1.769E-03	3.602E-04	1.975E-04	1.068E-04	4.829E-05	3.863E-05	0.7756
0.0	0.0	0.0	0.0	4.293E 03	3.144E 03	1.349E 03	3.663E 02	2.511E 02	2.546E 02	1.965E 02	1.965E 02	0.6273
0.0	0.0	0.0	0.0	437.21	437.21	437.21	437.21	437.21	437.21	437.21	437.21	0.6273
0.0	0.0	0.0	0.0	2.044E-02	7.090E-03	1.577E-03	3.211E-04	1.761E-04	9.522E-04	5.147E-04	2.832E-04	0.8199
0.0	0.0	0.0	0.0	4.575E 03	3.605E 03	1.203E 03	3.266E 02	2.239E 02	2.270E 02	2.905E 02	1.752E 02	0.6273
0.0	0.0	0.0	0.0	602.08	602.08	602.08	602.08	602.08	602.08	602.08	602.08	0.6273
0.0	0.0	0.0	0.0	4.645E-01	1.498E-01	4.787E-03	9.366E-04	3.391E-04	1.177E-04	9.418E-05	2.747E-05	1.648E-05
0.0	0.0	0.0	0.0	5.315E 03	1.071E 03	4.763E 02	2.587E 02	1.197E 02	1.197E 02	6.548E 01	8.381E 01	1.1739
0.0	0.0	0.0	0.0	477.87	477.87	477.87	477.87	477.87	477.87	477.87	477.87	0.6273
0.0	0.0	0.0	0.0	2.598E-01	1.716E-01	1.546E-01	7.535E-04	1.223E-04	4.717E-04	2.747E-04	1.648E-04	9.707E-04
0.0	0.0	0.0	0.0	2.973E 03	8.728E 03	3.460E 03	4.748E 02	2.863E 02	1.555E 02	1.124E 02	1.439E 02	5.037E 01
0.0	0.0	0.0	0.0	417.46	417.46	417.46	417.46	417.46	417.46	417.46	417.46	0.6273
0.0	0.0	0.0	0.0	1.235E-01	2.025E-02	1.064E-03	4.602E-04	2.081E-04	9.042E-05	7.535E-05	2.615E-05	2.092E-05
0.0	0.0	0.0	0.0	6.283E 03	5.432E 03	3.510E 02	2.116E 02	1.150E 02	1.796E 02	1.064E 02	1.965E 02	0.9588
0.0	0.0	0.0	0.0	1743.62	2767.82	5098.37	8093.14	10605.02	12847.05	14907.71	15422.14	15422.14
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.813E-03	1.112E-03	6.021E-04	5.845E-04	5.996E-04	5.742E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.431E 03	8.485E 02	6.124E 02	7.431E 02	1.429E 03	1.108E 03
0.0	0.0	0.0	0.0	0.0	0.0	0.0	5302.51	6423.53	7453.86	7711.07	7711.07	0.5470
0.0	0.0	0.0	0.0	871.81	1383.91	2549.19	2.769E-03	1.252E-03	5.960E-04	1.722E-04	5.945E-04	2.699E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.408E 03	9.553E 02	5.062E 02	2.189E 02	1.417E 03	1.098E 03
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.697E 02	3.535E 01	4.282E 01	4.969E 01	5.140E 01	5.140E 01
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.727E-03	1.237E-03	6.900E-04	1.716E-04	5.894E-04	3.162E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.387E 03	9.439E 02	6.001E 02	2.181E 02	1.405E 03	1.089E 03
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.627E 02	3.183E 01	3.693E 01	3.793E 01	3.793E 01	0.5050
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.233E-03	6.756E-04	4.085E-04	5.937E-04	2.695E-04	1.787E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.408E 02	6.871E 02	5.194E 02	1.415E 02	1.097E 03	9.087E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.751E 01	2.122E 01	2.462E 01	2.529E 01	2.529E 01	0.3453
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.205E-03	6.245E-04	4.016E-04	5.838E-04	3.162E-04	1.775E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.189E 02	6.737E 02	5.105E 02	1.392E 03	1.287E 03	8.933E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1501.44	1818.87	2110.61	2167.79	2167.79	0.3453
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.191E-03	6.560E-04	3.982E-04	5.789E-04	3.136E-04	1.742E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.084E 02	6.672E 02	5.062E 02	1.380E 03	1.276E 03	8.858E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1310.12	1587.10	1841.67	1887.37	1887.37	0.3453
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.180E-03	6.514E-04	3.959E-04	5.769E-04	3.125E-04	1.755E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.004E 02	6.625E 02	5.033E 02	1.375E 03	1.271E 03	8.825E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1048.10	1269.68	1473.34	1509.89	1509.89	0.4317
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.309E-03	6.391E-04	3.893E-04	4.459E-04	3.073E-04	1.707E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.983E 02	6.501E 02	4.950E 02	1.063E 03	1.250E 03	8.680E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	873.42	1058.07	1227.78	1258.25	1258.25	0.3453
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.280E-03	6.245E-04	3.830E-04	4.388E-04	3.024E-04	1.679E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.767E 02	6.381E 02	4.869E 02	1.046E 03	1.230E 03	8.540E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1303.98	1579.66	1833.03	1871.47	1871.47	0.4037
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.185E-03	6.542E-04	3.976E-04	5.814E-04	3.149E-04	1.749E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.042E 02	6.605E 02	5.055E 02	1.386E 03	1.281E 03	8.895E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	869.32	1053.11	1222.02	1247.65	1247.65	0.3453
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.286E-03	6.300E-04	3.846E-04	4.421E-04	3.047E-04	1.692E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.807E 02	6.407E 02	4.890E 02	1.054E 03	1.240E 03	8.605E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	651.99	789.83	916.52	935.74	935.74	0.4062
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.232E-03	6.927E-04	4.272E-04	4.284E-04	2.951E-04	1.639E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.398E 02	7.045E 02	5.432E 02	1.021E 03	1.201E 03	8.333E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	523.45	523.45	523.45	523.45	523.45	0.4045
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.129E-02	6.737E-03	2.771E-03	1.939E-04	1.616E-04	5.391E-05
0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.764E 03	3.426E 03	2.114E 03	9.076E 02	2.465E 02	3.852E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	457.27	457.27	457.27	457.27	457.27	0.9477
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.014E-02	4.768E-03	3.328E-03	1.540E-03	9.369E-04	4.408E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.268E 03	2.424E 03	2.539E 03	1.566E 03	1.191E 03	1.051E 03
0.0	0.0	0.0	0.0	0.0	0.0	0.0	434.37	434.37	434.37	434.37	434.37	0.8993
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.170E-02	5.076E-03	2.967E-03	1.765E-03	8.352E-04	3.930E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.619E 03	2.581E 03	2.263E 03	1.795E 03	1.062E 03	9.368E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	597.84	597.84	597.84	597.84	597.84	0.9110
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.800E-01	1.156E-01	2.273E-02	1.195E-03	3.111E-04	2.337E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.204E 03	5.878E 03	5.085E 03	6.075E 02	2.377E 02	2.377E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	474.51	474.51	474.51	474.51	474.51	0.12207
0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.437E-02	2.911E-02	3.855E-03	4.785E-04	2.329E-04	1.124E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.274E 03	6.513E 03	1.961E 03	3.650E 02	2.369E 02	1.428E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	414.52	414.52	414.52	414.52	414.52	0.3453
0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.076E-02	1.702E-02	5.048E-03	5.160E-04	2.653E-04	1.377E-04
0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.598E 03	3.809E 03	2.567E 03	3.936E 02	2.698E 02	1.751E 02
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1666.59	2645.55	4873.14	7735.63	10136.53	12279.53
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	833.29	13				

SAMPLE PLUME RISE AND DRIFT

DEPOSITION DISTANCES, MILES		0.10	0.20	0.50	1.00	1.50	2.00	2.50	3.00	4.00	5.00	REL HUM	
DRY BULB	WET BULB	STAB. CLASS	WIND, KNOTS	PLUME RISE - METERS DRIFT - GM/HR SQ M DRIFT - GM/HR									FRAC SOL
80.0	79.0	2	7.0	235.68	374.12	689.14	1093.94	1433.46	1736.52	1994.33	1994.33	1994.33	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	3	8.0	205.58	326.33	601.11	954.20	1250.35	1514.69	1735.22	1735.22	1735.22	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	3	10.0	164.46	261.07	480.89	763.36	1000.28	1211.75	1388.17	1388.17	1388.17	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	3	12.0	137.05	217.55	400.74	636.13	833.57	1009.79	1156.81	1156.81	1156.81	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	4	8.0	204.49	324.60	597.92	949.13	1243.72	1506.65	1718.68	1718.68	1718.68	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	4	12.0	136.32	216.40	398.61	632.76	829.14	1004.44	1145.78	1145.78	1145.78	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	4	16.0	102.24	162.30	298.96	474.57	621.86	753.33	859.34	859.34	859.34	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	5	4.0	401.86	504.52	504.52	504.52	504.52	504.52	504.52	504.52	504.52	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	5	6.0	267.91	425.28	440.73	440.73	440.73	440.73	440.73	440.73	440.73	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	5	7.0	229.64	364.53	418.66	418.66	418.66	418.66	418.66	418.66	418.66	0.9568
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
80.0	79.0	6	1.0	574.16	574.16	574.16	574.16	574.16	574.16	574.16	574.16	574.16	0.9568
				0.0	0.0	2.499E-02	5.987E-03	5.373E-04	2.618E-04	1.498E-04	9.499E-05	4.627E-05	2.649E-05
				0.0	0.0	5.592E-03	3.045E-03	4.099E-02	2.662E-02	1.905E-02	2.264E-02	1.883E-02	1.347E-02
80.0	79.0	6	2.0	455.71	455.71	455.71	455.71	455.71	455.71	455.71	455.71	455.71	0.9568
				0.0	0.0	1.736E-02	9.450E-03	2.957E-03	9.522E-04	1.935E-04	1.226E-04	5.974E-05	3.420E-05
				0.0	0.0	3.884E-03	4.806E-03	2.256E-03	9.685E-02	2.460E-02	2.923E-02	2.431E-02	1.739E-02
80.0	79.0	6	3.0	398.10	398.10	398.10	398.10	398.10	398.10	398.10	398.10	398.10	0.9568
				0.0	0.0	7.051E-03	4.004E-03	1.689E-03	8.650E-04	3.821E-04	6.952E-05	3.980E-05	
				0.0	0.0	3.586E-03	3.055E-03	1.718E-03	1.100E-03	9.108E-02	2.828E-02	2.024E-02	0.8375
80.0	71.0	1	1.0	1645.87	2612.66	4812.55	7639.48	10010.55	12126.91	13900.95	13900.95	13900.95	0.6430
				0.0	6.589E-02	1.947E-02	4.392E-03	1.859E-03	1.714E-03	6.458E-04	8.503E-04	3.938E-04	2.396E-04
				0.0	3.351E-03	4.357E-03	2.234E-03	1.418E-03	1.743E-03	8.211E-02	2.027E-03	1.602E-03	1.218E-03
80.0	71.0	1	2.0	822.94	1306.33	2406.28	3819.75	5005.28	6063.46	6950.48	6950.48	6950.48	1.4484
				0.0	7.184E-02	2.223E-02	4.318E-03	1.835E-03	1.695E-03	6.425E-04	8.422E-04	3.900E-04	2.373E-04
				0.0	3.653E-03	4.974E-03	2.196E-03	1.400E-03	1.724E-03	8.169E-02	2.008E-03	1.587E-03	1.207E-03
80.0	71.0	1	3.0	548.62	870.89	1604.18	2546.50	3336.85	4042.31	4633.65	4633.65	4633.65	0.6430
				0.0	6.883E-02	2.167E-02	5.070E-03	1.812E-03	5.072E-04	1.175E-03	8.343E-04	3.863E-04	2.350E-04
				0.0	3.500E-03	4.849E-03	2.578E-03	1.382E-03	5.159E-02	1.494E-03	1.989E-03	1.572E-03	1.195E-03
80.0	71.0	2	4.0	407.13	646.29	1190.47	1889.75	2476.27	2999.79	3409.65	3409.65	3409.65	1.4718
				0.0	7.568E-02	2.135E-02	5.037E-03	1.807E-03	5.101E-04	1.186E-03	8.418E-04	3.897E-04	2.371E-04
				0.0	3.849E-03	4.777E-03	2.562E-03	1.378E-03	5.188E-02	1.508E-03	2.007E-03	1.586E-03	1.206E-03
80.0	71.0	2	6.0	271.42	430.86	793.65	1259.84	1650.85	1999.86	2273.10	2273.10	2273.10	0.6430
				0.0	1.600E-02	4.878E-03	2.127E-03	1.105E-03	1.164E-03	8.261E-04	3.824E-04	2.327E-04	
				0.0	3.580E-03	2.481E-03	1.622E-03	1.124E-03	1.480E-03	1.969E-03	1.556E-03	1.183E-03	1.1570
80.0	71.0	2	7.0	232.65	369.31	680.27	1079.86	1415.01	1714.17	1948.37	1948.37	1948.37	0.6430
				0.0	1.564E-02	4.803E-03	2.101E-03	1.094E-03	1.153E-03	8.185E-04	3.789E-04	2.305E-04	
				0.0	3.499E-03	2.442E-03	1.602E-03	1.112E-03	1.466E-03	1.951E-03	1.541E-03	1.172E-03	1.1409
80.0	71.0	3	8.0	202.90	322.08	593.29	941.78	1234.08	1494.98	1694.79	1694.79	1694.79	0.6430
				0.0	1.533E-02	4.743E-03	2.081E-03	1.086E-03	1.149E-03	8.154E-04	3.774E-04	2.296E-04	
				0.0	3.430E-03	2.412E-03	1.588E-03	1.104E-03	1.461E-03	1.944E-03	1.536E-03	1.168E-03	1.1297
80.0	71.0	3	10.0	162.32	257.67	474.63	753.43	987.27	1195.99	1355.83	1355.83	1355.83	0.6430
				0.0	1.046E-02	5.443E-03	2.032E-03	1.064E-03	1.128E-03	8.007E-04	3.706E-04	2.254E-04	
				0.0	2.340E-03	2.768E-03	1.550E-03	1.082E-03	1.434E-03	1.909E-03	1.508E-03	1.146E-03	1.0599
80.0	71.0	3	12.0	135.27	214.72	395.52	627.85	822.72	996.66	1129.86	1129.86	1129.86	0.6430
				0.0	1.003E-02	5.286E-03	1.985E-03	1.043E-03	1.108E-03	7.865E-04	3.640E-04	2.214E-04	
				0.0	2.245E-03	2.688E-03	1.514E-03	1.061E-03	1.409E-03	1.875E-03	1.481E-03	1.126E-03	1.0338
80.0	71.0	4	8.0	201.78	320.30	590.00	936.56	1227.24	1486.70	1677.91	1677.91	1677.91	0.6430
				0.0	1.540E-02	4.766E-03	2.092E-03	1.091E-03	1.160E-03	8.230E-04	3.810E-04	2.318E-04	
				0.0	3.446E-03	2.424E-03	1.596E-03	1.110E-03	1.474E-03	1.962E-03	1.550E-03	1.179E-03	1.1373
80.0	71.0	4	12.0	134.52	213.53	393.33	624.37	818.16	991.13	1118.61	1118.61	1118.61	0.6430
				0.0	1.007E-02	5.310E-03	1.995E-03	1.048E-03	1.118E-03	7.935E-04	3.672E-04	2.234E-04	
				0.0	2.254E-03	2.701E-03	1.521E-03	1.066E-03	1.422E-03	1.892E-03	1.494E-03	1.136E-03	1.0406
80.0	71.0	4	16.0	100.89	160.15	295.00	468.28	613.62	743.35	838.95	838.95	838.95	0.6430
				0.0	1.071E-02	5.020E-03	2.277E-03	1.218E-03	7.274E-04	7.661E-04	3.545E-04	2.156E-04	
				0.0	2.396E-03	2.553E-03	1.737E-03	1.239E-03	9.248E-02	1.826E-03	1.442E-03	1.096E-03	1.0196
80.0	71.0	5	4.0	396.21	497.42	497.42	497.42	497.42	497.42	497.42	497.42	497.42	0.6430
				0.0	6.297E-02	2.832E-02	3.746E-03	4.648E-04	2.262E-04	1.810E-04	9.093E-05	3.704E-05	2.963E-05
				0.0	3.202E-03	6.337E-03	1.905E-03	3.546E-02	2.301E-02	2.301E-02	2.168E-02	1.507E-02	1.507E-02
80.0	71.0	5	6.0	264.14	419.30	434.54	434.54	434.54	434.54	434.54	434.54	434.54	0.9859
				0.0	1.660E-02	6.463E-03	1.848E-03	2.580E-04	2.064E-04	1.116E-04	5.047E-05	2.193E-05	
				0.0	3.716E-03	3.287E-03	1.410E-03	2.624E-02	2.624E-02	2.624E-02	2.053E-02	1.115E-02	0.7346
80.0	71.0	5	7.0	226.41	359.40	412.77	412.77	412.77	412.77	412.77	412.77	412.77	0.6430
				0.0	1.788E-02	5.760E-03	1.647E-03	3.354E-04	1.839E-04	9.946E-05	4.497E-05	3.598E-05	
				0.0	4.001E-03	2.929E-03	1.257E-03	3.411E-02	2.338E-02	2.371E-02	1.830E-02	1.830E-02	0.7226
80.0	71.0	6	1.0	565.28	565.28	565.28	565.28	565.28	565.28	565.28	565.28	565.28	0.6430
				4.891E-01	1.577E-01	5.039E-03	9.857E-04	3.569E-04	1.239E-04	9.912E-05	2.891E-05	2.168E-05	1.734E-05
				5.596E-03									

SAMPLE PLUME RISE AND DRIFT													
DEPOSITION DISTANCES, MILES				0.10	0.20	0.50	1.00	1.50	2.00	2.50	3.00	4.00	5.00
DRY	WET	STAB.	WIND.	PLUME RISE - METERS									
BULB	BULB	CLASS	KNOTS	DRIFT - GM/HR SQ M									
80.0	63.0	1	1.0	DRIFT - GM/HR									
80.0	63.0	1	1.0	1626.52	2581.93	4755.95	7549.60	9892.77	11984.22	13608.05	13608.05	13608.05	13608.05
80.0	63.0	1	2.0	813.26	1290.97	2377.98	3774.80	4946.39	5992.11	6804.03	6804.03	6804.03	6804.03
80.0	63.0	1	3.0	542.17	860.64	1585.32	2516.53	3297.59	3994.74	4536.02	4536.02	4536.02	4536.02
80.0	63.0	2	4.0	402.17	638.40	1175.95	1866.71	2446.08	2963.22	3335.16	3335.16	3335.16	3335.16
80.0	63.0	2	6.0	268.11	425.60	783.97	1244.47	1630.72	1975.48	2223.44	2223.44	2223.44	2223.44
80.0	63.0	2	7.0	229.81	364.80	671.97	1066.69	1397.76	1693.27	1905.81	1905.81	1905.81	1905.81
80.0	63.0	3	8.0	200.40	318.11	585.97	930.17	1218.87	1476.55	1657.36	1657.36	1657.36	1657.36
80.0	63.0	3	10.0	160.32	254.49	468.77	744.14	975.09	1181.24	1325.89	1325.89	1325.89	1325.89
80.0	63.0	3	12.0	133.60	212.08	390.65	620.11	812.58	984.37	1104.90	1104.90	1104.90	1104.90
80.0	63.0	4	8.0	199.24	316.27	582.58	924.79	1211.82	1468.02	1640.14	1640.14	1640.14	1640.14
80.0	63.0	4	12.0	132.83	210.85	388.39	616.53	807.88	978.68	1093.43	1093.43	1093.43	1093.43
80.0	63.0	4	16.0	99.62	158.14	291.29	462.40	605.91	734.01	820.07	820.07	820.07	820.07
80.0	63.0	5	4.0	390.91	490.77	490.77	490.77	490.77	490.77	490.77	490.77	490.77	490.77
80.0	63.0	5	6.0	260.61	413.69	501.58	501.58	501.58	501.58	501.58	501.58	501.58	501.58
80.0	63.0	5	7.0	223.38	354.59	407.25	407.25	407.25	407.25	407.25	407.25	407.25	407.25
80.0	63.0	6	1.0	556.93	556.93	556.93	556.93	556.93	556.93	556.93	556.93	556.93	556.93
80.0	63.0	6	2.0	442.04	442.04	442.04	442.04	442.04	442.04	442.04	442.04	442.04	442.04
80.0	63.0	6	3.0	386.16	386.16	386.16	386.16	386.16	386.16	386.16	386.16	386.16	386.16

PROGRAM ORFAD

EXAMPLE COOLING TOWER CALCULATION - NATURAL DRAFT - CASE 1

852 HOURS OF FOG REPORTED
 0 HOURS OF ICE FOG REPORTED
 283 HOURS OF GROUND FOG REPORTED
 404 HOURS WHEN DRY BULB=WET BULB
 14 HOURS INCOMPLETE DATA

10 YEAR AVERAGE

HOURS OF ADDITIONAL FOG PER YEAR

MILES	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
N	5.055E 00	4.960E 00	4.871E 00	4.784E 00	4.702E 00	4.628E 00	4.553E 00	4.482E 00	4.421E 00	4.356E 00
NNE	5.543E 00	5.436E 00	5.339E 00	5.242E 00	5.154E 00	5.070E 00	4.991E 00	4.913E 00	4.843E 00	4.774E 00
NE	4.881E 00	4.788E 00	4.703E 00	4.618E 00	4.539E 00	4.467E 00	4.397E 00	4.328E 00	4.268E 00	4.207E 00
ENE	3.723E 00	3.650E 00	3.587E 00	3.519E 00	3.461E 00	3.408E 00	3.351E 00	3.297E 00	3.254E 00	3.209E 00
E	3.996E 00	3.920E 00	3.851E 00	3.779E 00	3.715E 00	3.658E 00	3.598E 00	3.541E 00	3.494E 00	3.443E 00
ESE	2.529E 00	2.480E 00	2.436E 00	2.391E 00	2.350E 00	2.314E 00	2.276E 00	2.240E 00	2.210E 00	2.178E 00
SE	1.723E 00	1.688E 00	1.659E 00	1.628E 00	1.601E 00	1.577E 00	1.550E 00	1.525E 00	1.506E 00	1.485E 00

SSE 1.631E 00 1.598E 00 1.571E 00 1.539E 00 1.514E 00 1.492E 00 1.467E 00 1.442E 00 1.425E 00 1.405E 00
 S 2.000E 00 1.961E 00 1.929E 00 1.890E 00 1.859E 00 1.832E 00 1.799E 00 1.771E 00 1.750E 00 1.725E 00
 SSW 2.245E 00 2.200E 00 2.162E 00 2.120E 00 2.085E 00 2.052E 00 2.019E 00 1.987E 00 1.961E 00 1.933E 00
 SW 3.678E 00 3.606E 00 3.541E 00 3.477E 00 3.415E 00 3.362E 00 3.311E 00 3.255E 00 3.216E 00 3.170E 00
 WSW 5.441E 00 5.337E 00 5.244E 00 5.143E 00 5.054E 00 4.981E 00 4.898E 00 4.815E 00 4.758E 00 4.692E 00
 W 9.263E 00 9.083E 00 8.925E 00 8.754E 00 8.605E 00 8.480E 00 8.340E 00 8.197E 00 8.100E 00 7.984E 00
 WNW 5.057E 00 4.959E 00 4.872E 00 4.778E 00 4.696E 00 4.629E 00 4.552E 00 4.473E 00 4.421E 00 4.360E 00
 NW 4.464E 00 4.378E 00 4.304E 00 4.221E 00 4.151E 00 4.091E 00 4.019E 00 3.954E 00 3.906E 00 3.850E 00
 NNW 3.018E 00 2.960E 00 2.909E 00 2.854E 00 2.807E 00 2.767E 00 2.716E 00 2.673E 00 2.640E 00 2.602E 00

PROGRAM ORFAD

MILES WIND FROM	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	5.00
N	4.292E 00	4.224E 00	4.171E 00	4.118E 00	4.069E 00	4.014E 00	3.971E 00	3.925E 00	3.838E 00
NNE	4.704E 00	4.631E 00	4.573E 00	4.516E 00	4.460E 00	4.399E 00	4.351E 00	4.303E 00	4.206E 00
NE	4.142E 00	4.076E 00	4.025E 00	3.976E 00	3.927E 00	3.873E 00	3.832E 00	3.789E 00	3.705E 00
ENE	3.157E 00	3.104E 00	3.066E 00	3.032E 00	2.996E 00	2.950E 00	2.920E 00	2.889E 00	2.825E 00
E	3.391E 00	3.334E 00	3.292E 00	3.254E 00	3.215E 00	3.168E 00	3.136E 00	3.101E 00	3.033E 00
ESE	2.146E 00	2.110E 00	2.083E 00	2.059E 00	2.034E 00	2.005E 00	1.984E 00	1.963E 00	1.919E 00
SE	1.461E 00	1.433E 00	1.417E 00	1.401E 00	1.385E 00	1.363E 00	1.351E 00	1.337E 00	1.306E 00
SSE	1.382E 00	1.355E 00	1.339E 00	1.325E 00	1.310E 00	1.288E 00	1.277E 00	1.264E 00	1.236E 00
S	1.696E 00	1.663E 00	1.643E 00	1.626E 00	1.608E 00	1.581E 00	1.568E 00	1.551E 00	1.518E 00
SSW	1.903E 00	1.869E 00	1.847E 00	1.826E 00	1.804E 00	1.776E 00	1.759E 00	1.741E 00	1.703E 00
SW	3.119E 00	3.058E 00	3.026E 00	2.988E 00	2.954E 00	2.907E 00	2.883E 00	2.852E 00	2.789E 00
WSW	4.613E 00	4.529E 00	4.478E 00	4.425E 00	4.376E 00	4.303E 00	4.266E 00	4.219E 00	4.130E 00
W	7.854E 00	7.713E 00	7.622E 00	7.532E 00	7.449E 00	7.328E 00	7.266E 00	7.181E 00	7.028E 00
WNW	4.287E 00	4.206E 00	4.159E 00	4.111E 00	4.066E 00	3.997E 00	3.964E 00	3.920E 00	3.837E 00
NW	3.786E 00	3.719E 00	3.674E 00	3.632E 00	3.592E 00	3.535E 00	3.504E 00	3.463E 00	3.388E 00
NNW	2.562E 00	2.518E 00	2.485E 00	2.457E 00	2.429E 00	2.394E 00	2.371E 00	2.342E 00	2.289E 00

HOURS ANALYZED = 7618

10 YEAR AVERAGE
DRIFT, CM/YR PER SQ METER

MILES WIND FROM	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
N	0.0	3.923E 00	2.626E 00	1.487E 00	9.096E-01	6.375E-01	4.137E-01	3.027E-01	2.450E-01	1.907E-01
NNE	0.0	3.092E 00	1.868E 00	9.342E-01	4.755E-01	3.254E-01	1.738E-01	1.370E-01	1.193E-01	9.296E-02
NE	0.0	3.697E 00	2.229E 00	1.140E 00	6.695E-01	4.611E-01	2.844E-01	2.230E-01	1.930E-01	1.579E-01
ENE	0.0	3.499E 00	2.131E 00	1.041E 00	5.511E-01	3.866E-01	2.139E-01	1.683E-01	1.466E-01	1.183E-01
E	0.0	3.904E 00	2.395E 00	1.211E 00	6.582E-01	4.505E-01	2.620E-01	1.956E-01	1.654E-01	1.335E-01
ESE	0.0	2.356E 00	1.455E 00	7.586E-01	4.049E-01	2.777E-01	1.625E-01	1.242E-01	1.031E-01	8.058E-02
SE	0.0	2.783E 00	1.787E 00	1.004E 00	5.603E-01	4.125E-01	2.548E-01	1.906E-01	1.664E-01	1.305E-01
SSE	0.0	3.005E 00	1.881E 00	1.038E 00	5.544E-01	4.106E-01	2.391E-01	1.819E-01	1.633E-01	1.269E-01

S	0.0	3.732E	00	2.255E	00	1.272E	00	7.284E-01	5.318E-01	3.241E-01	2.569E-01	2.301E-01	1.798E-01
SSW	0.0	3.274E	00	1.990E	00	1.136E	00	6.679E-01	5.021E-01	3.088E-01	2.611E-01	2.257E-01	1.761E-01
SW	0.0	6.777E	00	4.231E	00	2.369E	00	1.372E	00	1.000E	00	6.494E-01	4.977E-01
WSW	0.0	8.876E	00	5.623E	00	3.271E	00	2.065E	00	1.596E	00	1.101E	00
W	0.0	1.594E	01	1.034E	01	6.012E	00	3.803E	00	2.764E	00	1.845E	00
WNW	0.0	9.637E	00	6.176E	00	3.277E	00	1.980E	00	1.362E	00	8.446E-01	6.423E-01
NW	0.0	7.496E	00	4.851E	00	2.609E	00	1.545E	00	1.045E	00	6.446E-01	4.746E-01
NNW	0.0	4.231E	00	2.897E	00	1.720E	00	1.128E	00	7.829E-01	5.127E-01	3.727E-01	2.930E-01

PROGRAM ORFAD

MILES WIND FROM	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	5.00
N	1.376E-01	1.102E-01	9.446E-02	7.795E-02	6.908E-02	6.301E-02	5.545E-02	4.647E-02	3.709E-02
NNE	7.100E-02	6.192E-02	5.289E-02	4.544E-02	4.158E-02	3.840E-02	3.556E-02	3.149E-02	2.580E-02
NE	1.208E-01	9.789E-02	8.355E-02	7.036E-02	6.483E-02	5.879E-02	5.189E-02	4.625E-02	3.716E-02
ENE	9.147E-02	7.511E-02	6.661E-02	5.769E-02	5.287E-02	4.911E-02	4.423E-02	3.955E-02	3.426E-02
E	9.868E-02	8.044E-02	6.802E-02	5.808E-02	5.161E-02	4.710E-02	4.225E-02	3.646E-02	2.910E-02
ESE	6.091E-02	5.057E-02	4.245E-02	3.582E-02	3.172E-02	2.878E-02	2.519E-02	2.219E-02	1.720E-02
SE	9.754E-02	8.415E-02	7.120E-02	5.855E-02	5.237E-02	4.707E-02	4.189E-02	3.767E-02	3.108E-02
SSE	9.824E-02	8.139E-02	7.273E-02	6.242E-02	5.760E-02	5.310E-02	4.817E-02	4.544E-02	3.744E-02
S	1.397E-01	1.173E-01	9.991E-02	8.462E-02	7.612E-02	6.867E-02	6.075E-02	5.488E-02	4.633E-02
SSW	1.380E-01	1.138E-01	9.786E-02	8.255E-02	7.305E-02	6.394E-02	5.541E-02	5.111E-02	3.911E-02
SW	2.630E-01	2.161E-01	1.863E-01	1.564E-01	1.404E-01	1.265E-01	1.097E-01	9.808E-02	7.841E-02
WSW	4.751E-01	3.862E-01	3.268E-01	2.685E-01	2.398E-01	2.125E-01	1.841E-01	1.624E-01	1.230E-01
W	6.952E-01	5.647E-01	4.770E-01	3.922E-01	3.441E-01	3.069E-01	2.647E-01	2.323E-01	1.807E-01
WNW	2.950E-01	2.406E-01	2.022E-01	1.688E-01	1.491E-01	1.357E-01	1.209E-01	1.055E-01	8.381E-02
NW	2.076E-01	1.673E-01	1.431E-01	1.174E-01	1.044E-01	9.625E-02	8.460E-02	7.417E-02	5.831E-02
NNW	1.574E-01	1.257E-01	1.064E-01	8.835E-02	7.705E-02	6.889E-02	6.006E-02	5.043E-02	4.032E-02
TOTAL DRIFT =	6.864E	07							
TOTAL SALTS OUT =	4.085E	08							

10 YEAR AVERAGE

HOURS OF ADDITIONAL ICE PER YEAR

MILES WIND FROM	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
N	3.785E	00	3.722E	00	3.649E	00	3.586E	00	3.525E	00
NNE	4.480E	00	4.400E	00	4.319E	00	4.243E	00	4.172E	00
NE	4.266E	00	4.192E	00	4.112E	00	4.040E	00	3.973E	00
ENE	2.549E	00	2.506E	00	2.459E	00	2.416E	00	2.374E	00
E	3.169E	00	3.115E	00	3.056E	00	3.002E	00	2.951E	00
ESE	1.646E	00	1.619E	00	1.588E	00	1.560E	00	1.533E	00
SE	7.920E-01	7.822E-01	7.656E-01	7.530E-01	7.389E-01	7.290E-01	7.163E-01	7.042E-01	6.952E-01	6.863E-01
SSE	8.405E-01	8.284E-01	8.122E-01	7.977E-01	7.834E-01	7.729E-01	7.592E-01	7.463E-01	7.370E-01	7.270E-01

S 9.292E-01 9.179F-01 8.980E-01 8.813E-01 8.664E-01 8.567E-01 8.408E-01 8.262E-01 8.154E-01 8.046E-01
SSW 1.555E 00 1.533E 00 1.501F 00 1.475E 00 1.452F 00 1.429E 00 1.405E 00 1.381E 00 1.364E 00 1.344E 00
SW 2.589E 00 2.554E 00 2.499E 00 2.457E 00 2.415E 00 2.384E 00 2.341E 00 2.301E 00 2.270F 00 2.239E 00
WSW 3.229E 00 3.184E 00 3.115E 00 3.063E 00 3.011E 00 2.969E 00 2.918E 00 2.866E 00 2.828E 00 2.791E 00
W 6.062F 00 5.972E 00 5.851F 00 5.749E 00 5.650E 00 5.569E 00 5.475E 00 5.383E 00 5.305E 00 5.237E 00
WNW 3.583E 00 3.530E 00 3.456E 00 3.398E 00 3.339E 00 3.292E 00 3.237E 00 3.179E 00 3.137E 00 3.096E 00
NW 3.011E 00 2.965E 00 2.906E 00 2.855E 00 2.805E 00 2.766E 00 2.719E 00 2.675E 00 2.636E 00 2.602E 00
NNW 1.929E 00 1.898E 00 1.862E 00 1.829E 00 1.794E 00 1.770E 00 1.741E 00 1.713E 00 1.688E 00 1.666E 00

PROGRAM ORFAD

MILES WIND FROM	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	5.00
N	3.216E 00	3.172F 00	3.130F 00	3.088E 00	3.045E 00	3.012E 00	2.965E 00	2.938E 00	2.870E 00
NNE	3.806E 00	3.754E 00	3.704E 00	3.655E 00	3.605E 00	3.564E 00	3.511E 00	3.477E 00	3.399E 00
NE	3.625E 00	3.576E 00	3.528E 00	3.481E 00	3.431E 00	3.393E 00	3.341E 00	3.310E 00	3.235E 00
ENE	2.165E 00	2.135E 00	2.108E 00	2.081E 00	2.049E 00	2.026E 00	1.991E 00	1.975E 00	1.934E 00
E	2.692E 00	2.655E 00	2.621E 00	2.587E 00	2.548E 00	2.519E 00	2.478E 00	2.457E 00	2.404E 00
ESE	1.399E 00	1.379E 00	1.361E 00	1.343E 00	1.323E 00	1.309E 00	1.287E 00	1.276E 00	1.248E 00
SE	6.728F-01	6.642E-01	6.558F-01	6.467E-01	6.349E-01	6.299E-01	6.149E-01	6.130E-01	5.996E-01
SSE	7.139F-01	7.043E-01	6.949E-01	6.866E-01	6.730E-01	6.670E-01	6.511E-01	6.492E-01	6.367E-01
S	7.892E-01	7.787E-01	7.689E-01	7.591E-01	7.439E-01	7.383E-01	7.179E-01	7.172E-01	7.030E-01
SSW	1.323E 00	1.305F 00	1.288E 00	1.269E 00	1.249E 00	1.238E 00	1.213E 00	1.205E 00	1.178E 00
SW	2.202F 00	2.174F 00	2.143E 00	2.112E 00	2.079E 00	2.062F 00	2.016E 00	2.006E 00	1.958E 00
WSW	2.743E 00	2.706E 00	2.670E 00	2.634E 00	2.591E 00	2.567E 00	2.510E 00	2.499E 00	2.443E 00
W	5.149E 00	5.082E 00	5.014F 00	4.949E 00	4.863E 00	4.816E 00	4.722E 00	4.694E 00	4.590E 00
WNW	3.044E 00	3.002E 00	2.962E 00	2.923E 00	2.875E 00	2.847E 00	2.789E 00	2.774E 00	2.712E 00
NW	2.556F 00	2.523E 00	2.491E 00	2.460E 00	2.417E 00	2.392E 00	2.347E 00	2.332E 00	2.282E 00
NNW	1.636E 00	1.614E 00	1.593E 00	1.574E 00	1.549E 00	1.533E 00	1.507E 00	1.496E 00	1.464E 00

10 YEAR AVERAGE
SALT AVERAGE/CUMETER AT HEIGHT 8.0 M

MILES WIND FROM	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
N	0.0	2.424F-01	2.260F-01	1.491E-01	1.003F-01	8.037E-02	5.229E-02	4.581F-02	4.364F-02	3.791E-02
NNE	0.0	2.001F-01	1.759F-01	1.080E-01	6.327F-02	4.867E-02	2.644E-02	2.497F-02	2.521E-02	2.207E-02
NE	0.0	2.393F-01	2.102F-01	1.283E-01	8.105F-02	6.350E-02	3.741E-02	3.500E-02	3.543E-02	3.184E-02
ENE	0.0	2.291F-01	2.011F-01	1.209F-01	7.205F-02	5.676E-02	3.088E-02	2.909E-02	2.950F-02	2.664E-02
E	0.0	2.506F-01	2.221F-01	1.358E-01	8.345F-02	6.491E-02	3.712E-02	3.390E-02	3.330F-02	2.980E-02
ESE	0.0	1.512F-01	1.345F-01	8.485E-02	5.116F-02	3.974F-02	2.299E-02	2.090F-02	2.056F-02	1.791E-02
SE	0.0	1.767F-01	1.605F-01	1.055E-01	6.531F-02	5.291F-02	3.223E-02	2.853F-02	2.847F-02	2.481E-02
SSE	0.0	1.919F-01	1.720F-01	1.113F-01	6.706F-02	5.409E-02	3.140E-02	2.837F-02	2.931E-02	2.524E-02
S	0.0	2.416F-01	2.125F-01	1.368F-01	8.491E-02	6.782E-02	4.047E-02	3.780F-02	3.910F-02	3.438E-02
SSW	0.0	2.089F-01	1.846F-01	1.199F-01	7.570F-02	6.156F-02	3.688F-02	3.588F-02	3.552F-02	3.074E-02

➤

▼

1

IHC002I STDP 69

M
E
L
F

PLOT 19
01.48.14
04-03-76
P-660

EXAMPLE COOLING TOWER CALCULATION - NATURAL DRAFT - CASE 1

1 AMOUNT OF DRIFT

04-03-76

EXAMPLE COOLING TOWER CALCULATION - NATURAL DRAFT - CASE 1

2 HOURS OF FOG

04-03-76

EXAMPLE COOLING TOWER CALCULATION - NATURAL DRAFT - CASE 1

3 HOURS OF ICE

04-03-76

EXAMPLE COOLING TOWER CALCULATION - NATURAL DRAFT - CASE 1

4 SALT IN AIR

04-03-76

Appendix G

TRANSLATION OF CODED WIND DIRECTIONS TO DIRECTION INDEXES

A somewhat cryptical FORTRAN formula,

$$IWD = IWD - 9*(IWD/10) - 1 , \quad (G-1)$$

appears in the ORFAD main program in the section devoted to weather data processing. Since the question "What does it do?" has arisen several times, the following is offered in explanation.

Wind directions on an 8-point compass are coded by NOAA, as shown on the left-hand side of Table G-1. Wind directions on the 16-point compass are then coded by combining appropriate terms from two of the 8-point directions; for example, east-northeast (ENE) is coded as 32, since E is 3 and NE is 2. This process yields the coded directions on the right-hand side of the table.

Let us now apply Eq. (G-1) piecemeal to the ENE coded direction, that is, take IWD as 32 initially. First, we get

$$IWD/10 = 3 , \quad (G-2)$$

because we are using integer arithmetic. As a result, we have

$$9*(IWD/10) = 27 , \quad (G-3)$$

and, finally,

$$IWD = 32 - 27 - 1 = 4 , \quad (G-4)$$

that is, the direction index for ENE is 4. Similarly, for south-southwest (SSW), we get

$$IWD = 56 - 45 - 1 = 10 \quad (G-5)$$

as the direction index for SSW.

For the compass directions N through NW, Eq. (G-1) thus yields the numbers 1 through 15 as the corresponding direction indices. The equation fails, however, for NNW and CALM. These latter two are treated as special cases and assigned indices 16 and 17, respectively.

Table G-1. Relation of compass directions, coded directions, and direction indices for the 8- and 16-point compasses

For 8-point compass		For 16-point compass		Direction index
Compass direction	Coded direction	Compass direction	Coded direction	
N	1	N	11	1
NE	2	NNE	12	2
E	3	NE	22	3
SE	4	ENE	32	4
S	5	E	33	5
SW	6	ESE	34	6
W	7	SE	44	7
NW	8	SSE	54	8
		S	55	9
		SSW	56	10
		SW	66	11
		WSW	76	12
		W	77	13
		WNW	78	14
		NW	88	15
		NNW	18	16
		"Calm"	00	17

Although assigned a direction index, a calm condition is not actually treated as a wind in a specific direction. Rather, the index merely provides a convenient identifier for accumulating the occurrences of calm conditions.

Internal Distribution

1. H. G. Arnold	35. E. C. Long
2. S. I. Auerbach	36-65. H. A. McLain
3. H. F. Bauman	66. M. E. Mitchell
4. S. E. Beall	67. B. D. Murphy
5. M. Bender	68. A. A. N. Patrinos
6. C. R. Boston	69. R. C. Robertson
7. J. W. Boyle	70. M. W. Rosenthal
8. R. W. Brocksen	71-100. T. H. Row
9. J. B. Cannon	101. R. M. Rush
10. N. C. J. Chen	102. M. R. Sheldon
11. W. B. Cottrell	103. M. Siman-Tov
12. C. C. Coutant	104. M. J. Skinner
13. R. B. Craig	105. I. Spiewak
14. F. L. Culler	106. R. L. Spore
15. D. M. Eissenberg	107. R. E. Thoma
16. A. Eraslan	108. D. B. Trauger
17. G. G. Fee	109. W. J. Wilcox
18. W. Fulkerson	110. A. J. Witten
19. T. P. Hamrick	111. H. E. Zittel
20. H. W. Hoffman	112-113. Central Research Library
21. L. Jung	114. Document Reference Section
22. G. W. Keilholtz	115-117. Laboratory Records Department
23. R. L. Kroodsma	118. Laboratory Records (RC)
24-33. M. E. LaVerne	119. EISO Library (Building 2028)
34. J. M. Loar	

External Distribution

120. H. R. Denton, U.S. NRC, Washington, D.C. 20545
121. D. R. Muller, U.S. NRC, Washington, D.C. 20545
122. V. A. Moore, U.S. NRC, Washington, D.C. 20545
123. G. W. Knighton, U.S. NRC, Washington, D.C. 20545
124. B. J. Youngblood, U.S. NRC, Washington, D.C. 20545
125. W. H. Regan, U.S. NRC, Washington, D.C. 20545
126. M. L. Ernst, U.S. NRC, Washington, D.C. 20545
127. W. R. Ott, U.S. NRC, Washington, D.C. 20545
128. J. E. Fairbent, U.S. NRC, Washington, D.C. 20545
129. R. A. Kornasiewicz, U.S. NRC, Washington, D.C. 20545
130. J. E. Carson, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Ill. 60439
131. A. J. Policastro, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Ill. 60439
132. W. F. Sandusky, Battelle Pacific Northwest Laboratories, Richland, Wash. 99352
133. Director, Research and Technical Support Division, ERDA-ORO
- 134-160. Technical Information Center, ERDA, Oak Ridge, TN 37830