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THE SRL METEOROLOGICAL PROGRAM AND OFF-SITE DOSE CALCULATIONS

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THE SRL METEOROLOGICAL PROGRAM AND OFF-SITE DOSE CALCULATIONS

by

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ABSTRACT

Micrometeorological data from instruments mounted on a 1200-foot TV tower were recorded once each three minutes for a period of two years. The data were converted to ordinary dispersion parameters using correlation equations developed by Brookhaven National Laboratory. The derived dispersion parameters and relevant micrometeorological data were used to derive dose-frequency distribution for an assumed accidental release of radionuclides from a reactor operating at 1000 MW. The dose-frequency distributions are presented for assumed release heights of 230 and 850 feet (70 and 260 meters).

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INTRODUCTION

A meteorological program was initiated at the Savannah River Laboratory (SRL) in October 1965 to obtain data for reactor safety studies. The objective of the program was to evaluate the probabilities of various consequences if airborne radioactivity were released in a very unlikely reactor accident. To obtain the data, meteorological instruments were installed on two towers which are ~15 miles apart. The Cassel fire tower on the Savannah River Plant (SRP) site was instrumented at three elevations up to 110 ft. The commercial television transmitting tower of WJBF-TV was instrumented at eleven elevations up to 1200 ft. The television tower is near Beech Island, S. C., and is approximately seven miles from the nearest plant boundary. The television tower was the primary facility because the instrumented elevations encompass the range of release heights under study. All analyses presented in this report were derived from data taken at the television tower.

The data acquisition program has provided two years of meteorological data. A continuing data analysis program was initiated early in the project to determine as a function of elevation:

1) Frequency distribution of estimated whole body gamma and thyroid inhalation doses resulting from a postulated activity release; the release is assumed to occur for each meteorological data sample.

2) Wind speed frequency distributions

   a) Stable conditions
   b) Unstable conditions.

3) Wind direction distribution.

4) Distribution of derived diffusion coefficients.

5) Temperature inversion frequency.

Item 1 above is the primary result obtained from the program. This result forms the basis for evaluating the potential off-site hazards with existing equipment and facilities and also provides a basis for recommending measures to reduce off-site consequences, if necessary.

This report contains a description of the meteorological system, methods employed for analyses, and results of the analyses.

SUMMARY

Detailed micrometeorological data, collected at elevations up to 1200 ft and representative of the SRP contiguous area, provided the basis for the evaluation of potential off-site whole body gamma and thyroid inhalation doses for an assumed reactor Design Basis Accident. The meteorology data, collected at 3-min intervals for over two years, were converted to ordinary Gaussian dispersion parameters. The Gaussian dispersion coefficients were used to estimate the whole body and thyroid doses for a ground level receptor on the plume axis assuming instantaneous release of 100% of the equilibrium inventory of noble gases and 0.05% of the iodine inventory from a reactor operating at 1000 MW.

Dose estimates were made for each set of meteorology data (about 260,000 sets for the two-year period), and the estimates were collected as a dose-frequency tabulation. For the existing 70-meter (230 feet) release height, the calculated whole body dose at 8 km was less than the 10 CFR 100 guideline of 25 R for 69% of the observed meteorology conditions. The calculated thyroid dose at 8 km was less than the 10 CFR 100 guideline of 300 rem for 100% of the observed meteorology conditions with a maximum of 108 rem.

A major aim of the program was to determine the potential reduction in off-site dose that could be obtained by increasing the release height. The observed data show that the whole body dose for a release height of 260 meters (850 feet) would be less than the 25 R guideline dose for 99.9% of the observed meteorological conditions. The calculated thyroid dose for 260-meter release height was always less than the 300 rem guideline dose with a maximum of less than 5 rem.

Another major benefit derived from increasing the release height is the reduction of the maximum potential dose. For the 2-year period, the calculated maximum whole body dose for the 70-meter release height was 192 R; while for the 260-meter release height, the calculated maximum value was 25.8 R.

Supplementary studies showed also that increasing the release height from 70 to 260 meters reduced the calculated whole body man-rem product about a factor of 3, for the conditions that produce the highest doses.

The major results of the program are the improved estimates of the potential off-site dose for the existing SRP reactor confinement system and the Design Basis Accident (DBA), and the demonstration of the effectiveness of increasing the release height in reducing the potential off-site doses. If potential off-site doses are to be reduced beyond existing conditions a taller stack, for example, a 260-meter (850-foot) stack comparable to those presently being used by the utility industry, would be preferred because:

(1) Effectiveness - A reduction by a factor of 8 in the whole body dose is expected.

(2) Reliability - The system is always on line, and the normal and accident functions are identical.

The meteorology program also provided considerable detailed data on wind speed, wind direction, wind variability, thermal stability, and the standard deviations of the wind directional components. The collection of data is stored on magnetic tape and can be obtained upon request to the Savannah River Operations Office (SROO) of the United States Atomic Energy Commission (USAEC).

DISCUSSION

GENERAL CONSIDERATIONS

The meteorology program was initiated as part of a continuing effort in reactor safety studies to evaluate potential off-site doses that could arise from reactor operations at SRP and to compare with the criteria of the Atomic Energy Commission in 10 CFR 100.[1] Earlier analyses of potential consequences following a very unlikely release of radioactive material in a reactor accident were deficient for two significant reasons, i.e., the data used in the analyses were from geographic locations other than SRP, and the data were insufficient in quantity and quality to establish frequency of occurrence of atmospheric conditions at elevations of interest. The earlier analyses were based on parametric surveys of possible combinations of atmospheric conditions, and final results were based on the worst case for each downwind distance and release height. Considerable uncertainty and enforced conservatism were inherent in this method because the combination of conditions that produce the worst case may not be a meteorological reality; or the frequency of occurrence may be so low as to be insignificant. The improved analyses presented in this present report are derived from simultaneously measured complete sets of meteorology data, from calculated dispersion properties at elevations of interest, and from calculated consequences assuming an activity release and indefinite persistence of the observed atmospheric conditions. This process is repeated for each data sample taken at ~3-min intervals to provide a dose-frequency relationship. Two years of data have been processed in this manner.

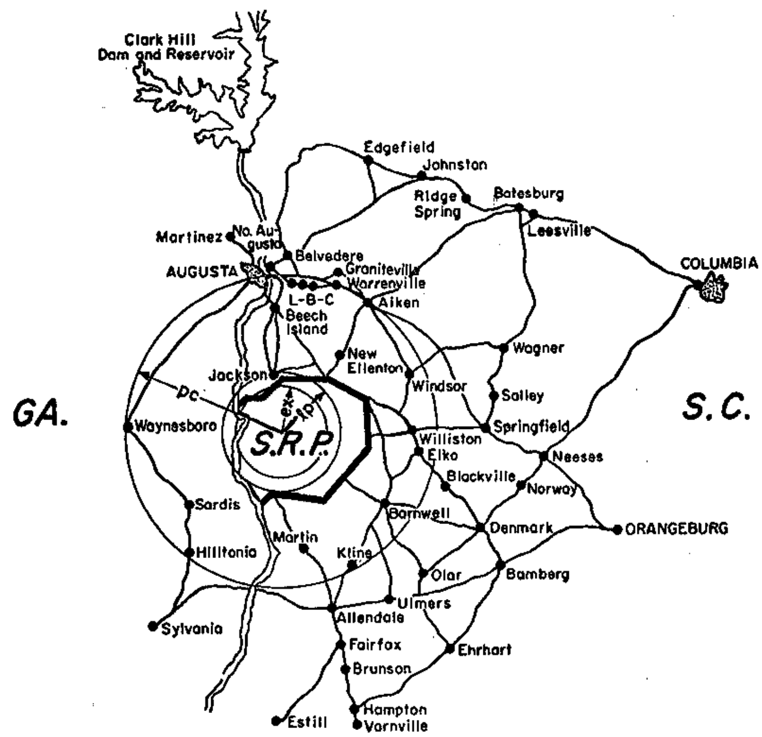
These analyses assume a hypothetical activity release to the atmosphere of 100% of the equilibrium inventory of noble gases and 0.05% of the iodines following an assumed full-core meltdown of a Savannah River reactor operating at 1000 MW.

SITE DESCRIPTION

The Savannah River Plant borders the Savannah River in southwestern South Carolina. The geographical location is shown in Figure 1. The terrain of the plant site is typical of the general area - gently rolling hills predominantly covered with pine trees.

The production reactors at SRP are located near the center of the plant, separated by at least two miles. The nearest plant boundary is five miles (8 km) from any reactor. Pertinent distances for siting considerations are given below.

	Plant Boundary	Town	City
Distance, km	8	13.5	40
Population	0	2000	120,000



Exclusion Radius, R_{ex} = 8 km
Low Population Radius, $R_{\ell p}$ = 13.5 km
Population Center Radius, P_{pc} = 40 km

FIG. 1 LOCATION OF SAVANNAH RIVER PLANT

INSTRUMENTATION

Tower Mounted Instruments - The SRL meteorological data were obtained from three basic types of sensing instruments. Wind speed, wind direction, and temperature are measured up to 1200 ft. Figure 2 shows the overall tower configuration at both locations. There are 28 data points on the tall tower and 13 on the short tower. Figure 3 is a view of the 1200-ft WJBF-TV tower showing the upper 8 of 10 instrumented booms. The booms extend 10 ft outward to minimize the eddy effects of the tower structure. Figure 4 is a more detailed view of a lower level. The expected accuracy of wind speed measurement from this mounting procedure and tower orientation is shown in Figure 5.[2] Wind speeds are accurate to within ±10% for a 310° sector of arc. Wind direction is accurate to within ±5% over the same arc. The 110-ft Cassel's fire tower is shown in Figure 6. All tower sensors were supplied by Climet Instruments, Inc., of Sunnyvale, California.

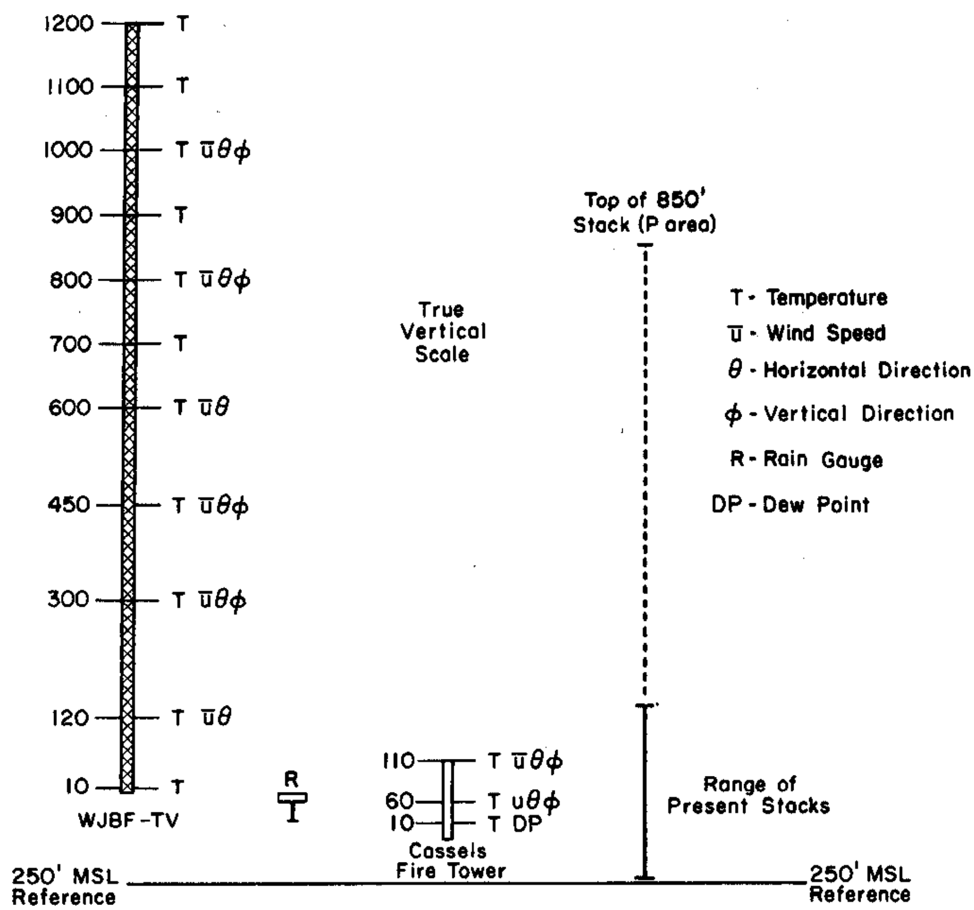


FIG. 2 TOWER INSTRUMENT CONFIGURATIONS

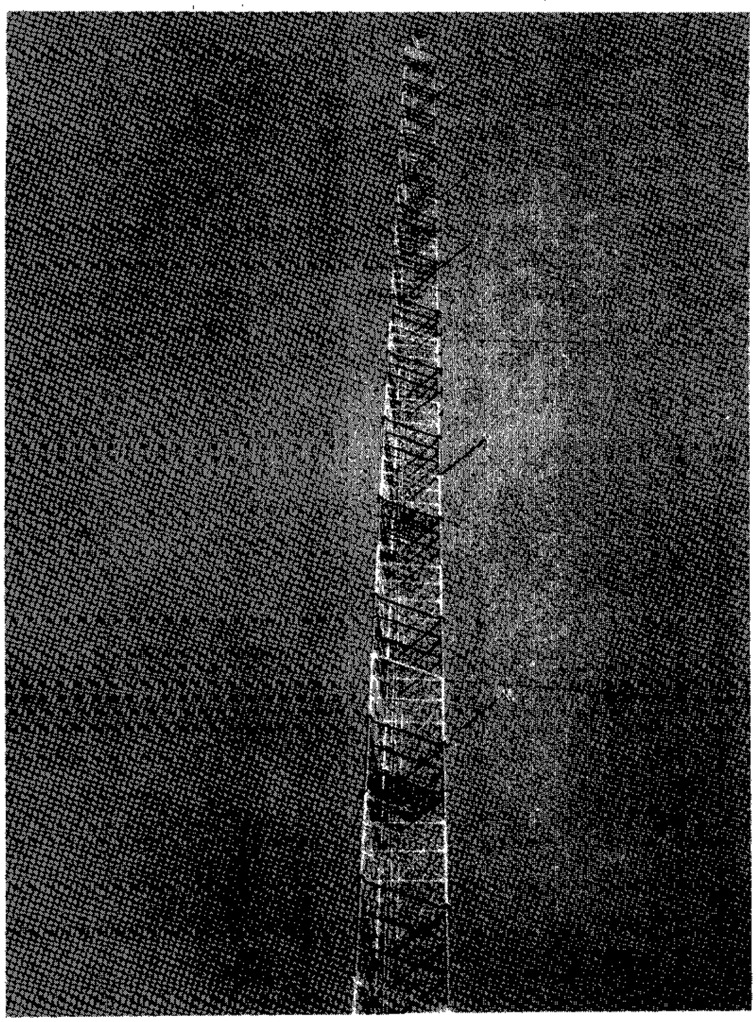


FIG. 3 UPPER 8 INSTRUMENTED BOOMS ON 1200-FT WJBF-TV TOWER

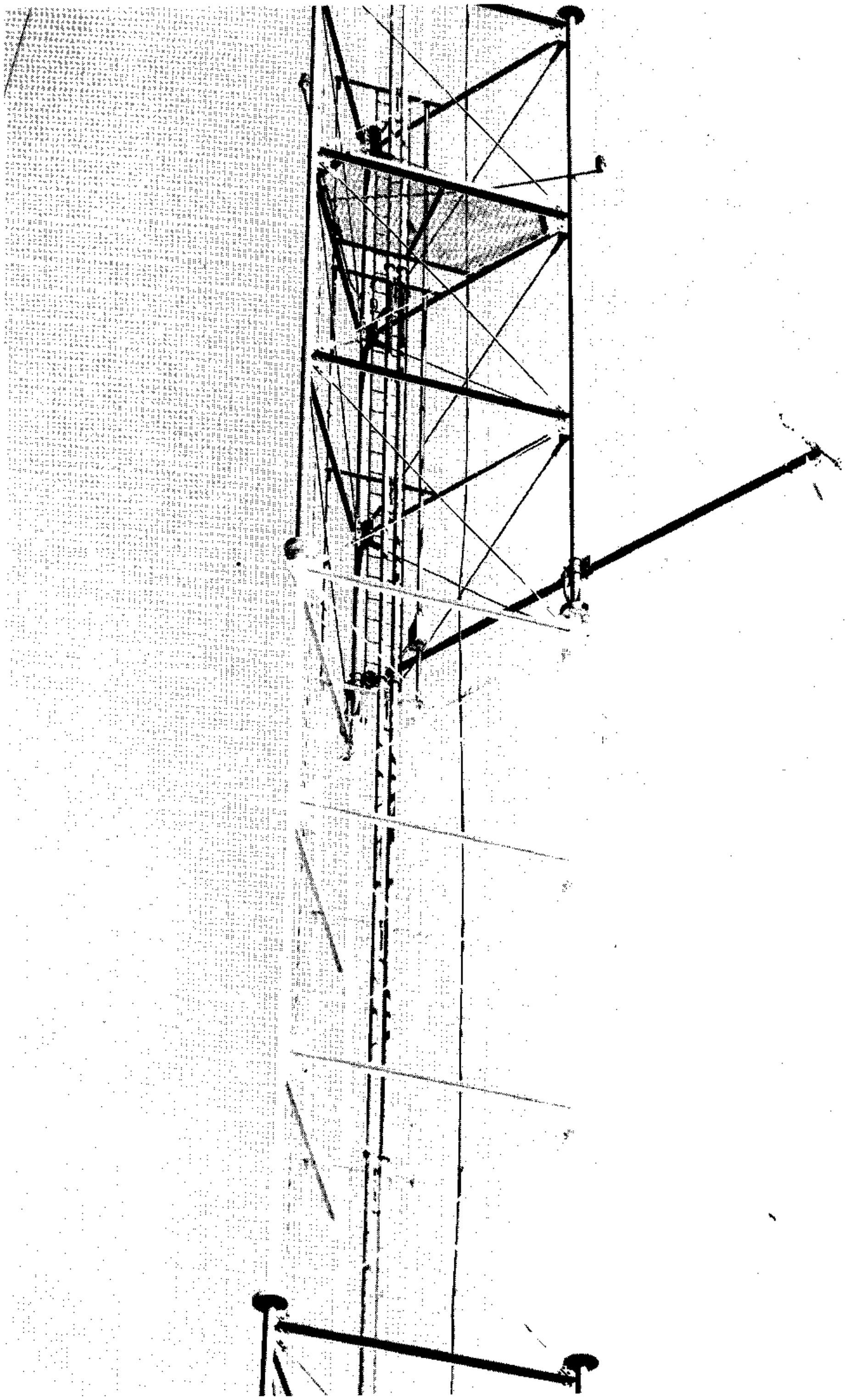


FIG. 4 LOWER LEVEL OF 1200-FT WJBF-TV TOWER

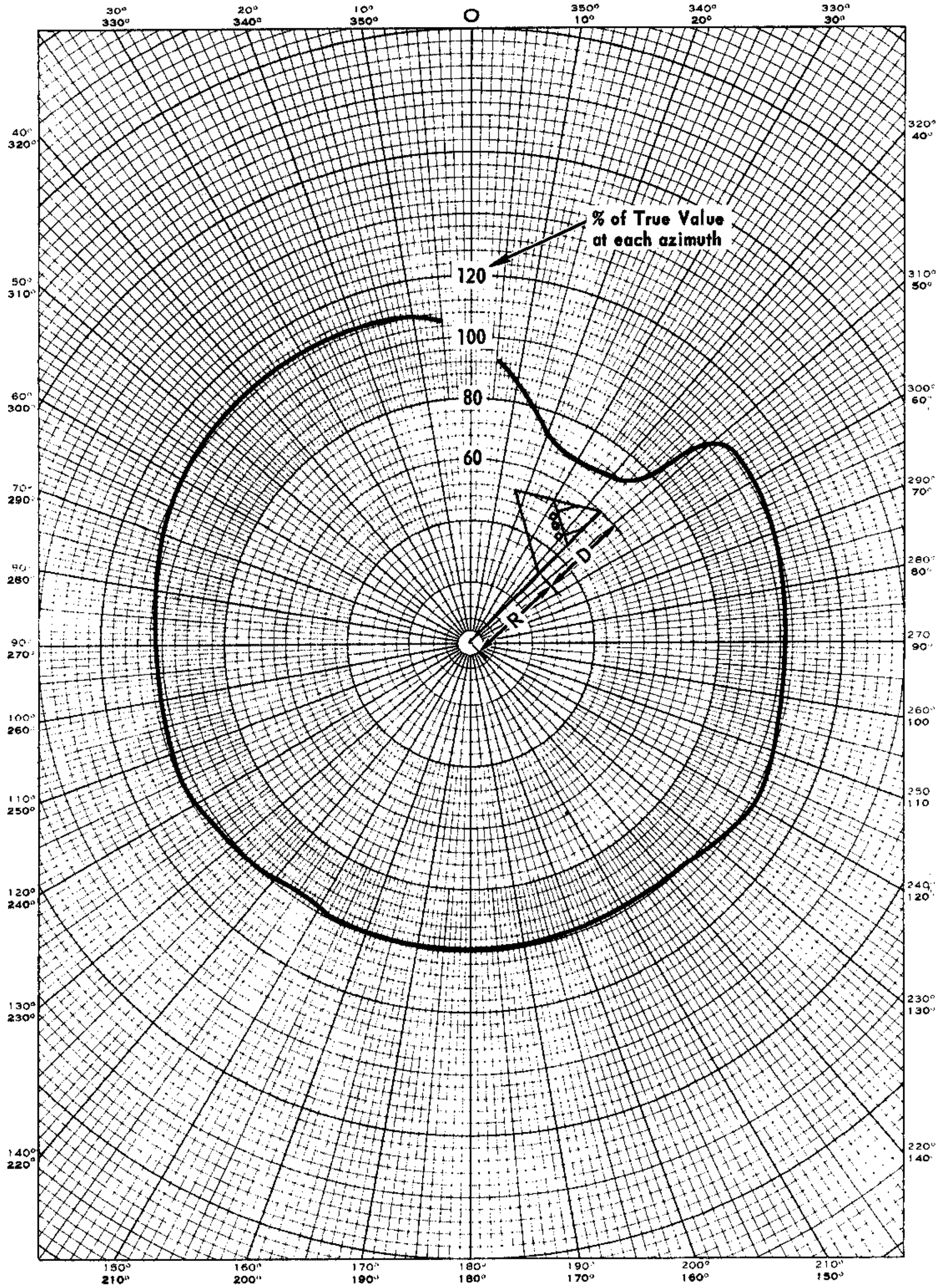


FIG. 5 WIND SPEED ACCURACY VS. AZIMUTH (WJBF-TV, R = D)

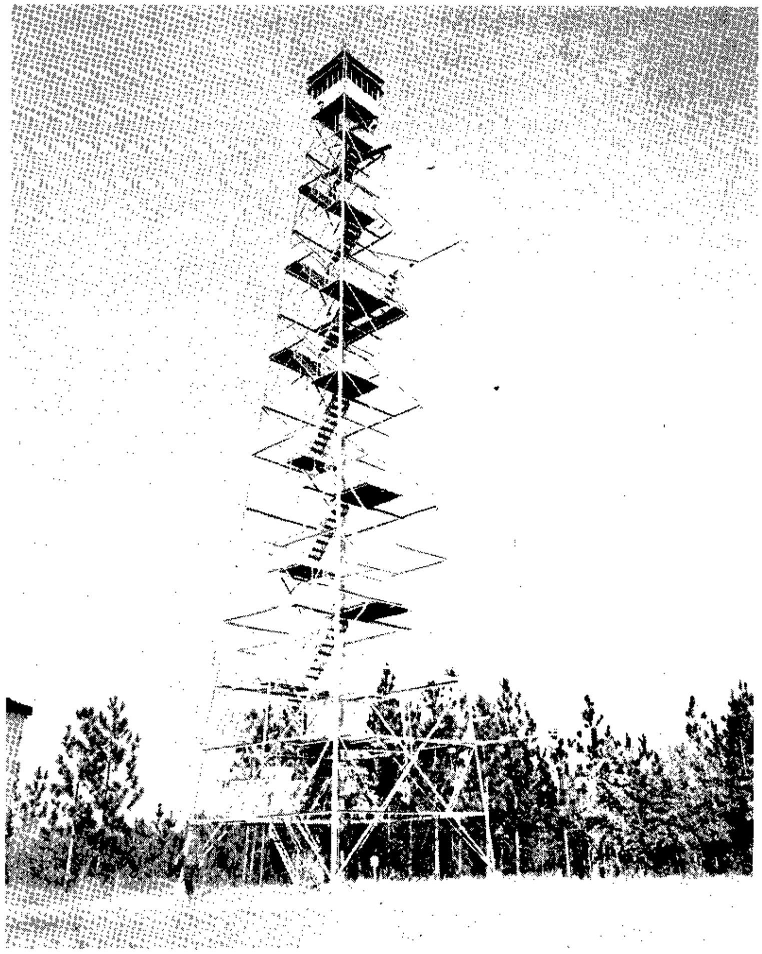


FIG. 6 110-FT CASSEL'S FIRE TOWER

Wind speed (Model 011-1, Figure 7) is sensed by integrating electrical pulses produced by a rotating slotted disc (attached to a 3-cup anemometer shaft) that interrupts a light beam to a photodiode. Nominal threshold velocity for this instrument is 0.75 to 1.0 mph.

Two types of direction instruments are used. A bivane transmitter (Model 012-9, Figure 8) measures the azimuthal and vertical components of wind direction, and a horizontal transmitter (Model 012-7) measures only the azimuthal direction. These are vane-driven potentiometers that provide an output voltage proportional to direction. The wind vanes are made of expanded styrofoam to provide low inertia properties.

Temperature is sensed by platinum resistance thermometers that are housed in aspirated temperature shields. Figure 9 shows a wind aspirated temperature shield designed to minimize solar effects by its concentric tubular construction, and a vane that keeps the mouth of the shield directed into the wind. Both towers have motor aspirated temperature shields at the lowest elevation to provide proper sampling under very low wind conditions that occur more frequently near the ground.

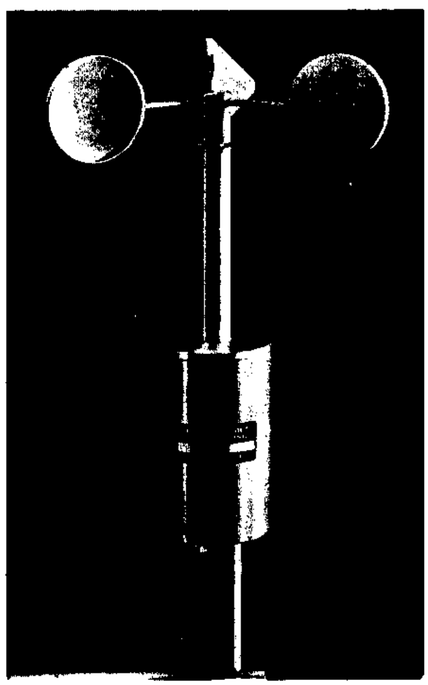


FIG. 7 WIND SPEED TRANSMITTER

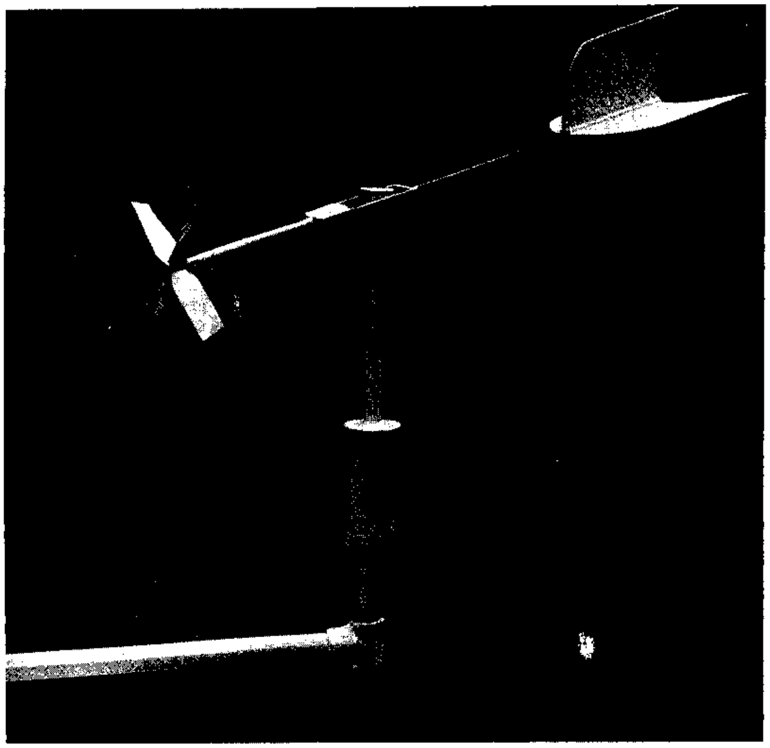


FIG. 8 BIVANE WIND DIRECTION TRANSMITTER

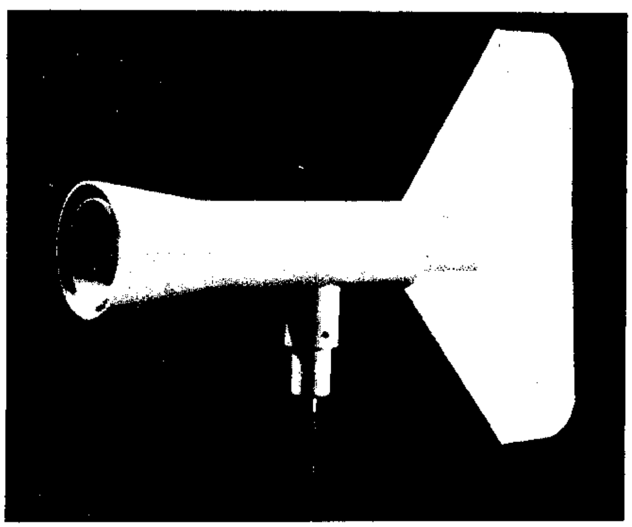


FIG. 9 WIND ASPIRATED TEMPERATURE SHIELD

Ground-Based Equipment - The ground-based equipment configuration is essentially the same at both towers, the only difference is the number of data points that are monitored. Figure 10 shows the receiving and conversion equipment for the tall tower installation. This equipment translates all analog signals from the sensing instruments to a 0 to 1 v level, performs an analog-to-digital conversion, and provides the output on punched paper tape. In addition, there are four channels of sigma computation that compute the standard deviations of wind direction for selected data points.

There are six channels of wind data translation at the tall tower, and three channels at the short tower. Each channel is capable of handling three separate input signals, i.e., wind speed, azimuthal direction, and vertical direction. Each channel provides three output signals for each input signal. A 3-sec averaged signal (0 to 1 v) is provided for analog-to-digital conversion; nonaveraged signals are provided as input to the sigma computers (0 to 5.4 v output) and the auxiliary analog recording system (0-50 mv).

At each location there are four channels of sigma (standard deviations of wind directions) computation. A signal for each channel is selected from any of the 6 direction signals available

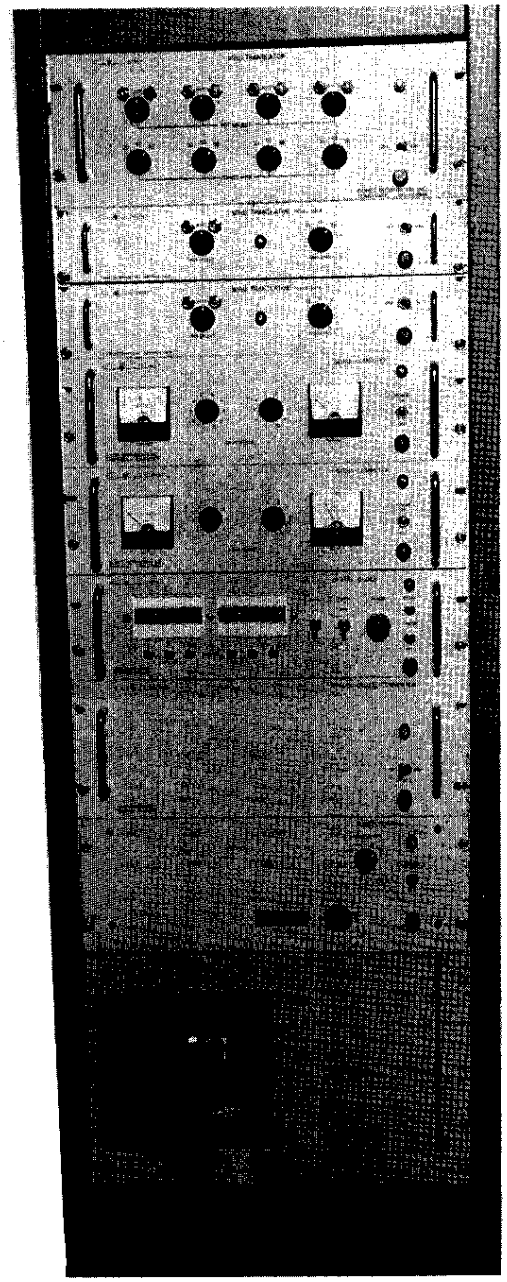


FIG. 10 GROUND-BASED RECEIVING AND CONVERSION EQUIPMENT

from the wind translators. Sigmas at the tall tower are continuously computed from past history over an adjustable time interval of 10 to 30 min. The sigmas at the short tower are based on a time interval of 10 sec. Figure 11 shows the schematic of the sigma computers. The design bases for the computers are discussed fully in Reference 3.

Temperatures are determined by measuring the resistance of the resistance thermometers with individual Wheatstone bridge circuits located in the analog-to-digital conversion chassis. The output from each bridge is limited to 0 to 10 mv to minimize electrical heating of the thermometers. A chopper stabilized operational amplifier raises the 0 to 10 mv signal to 0 to 1 v for analog-to-digital compatibility with all other signals.

Analog-to-digital conversion is accomplished by a servomechanical system. Each signal is sequentially measured in a null balance potentiometer circuit coupled to a drive motor and disc-encoder.

The punch control chassis performs the sequencing operations and contains all the solid state micrologic components necessary for the logical information flow to the paper tape punch. In addition to the signals previously mentioned, clock data, supplied directly from the clock chassis, cause the time and date to be

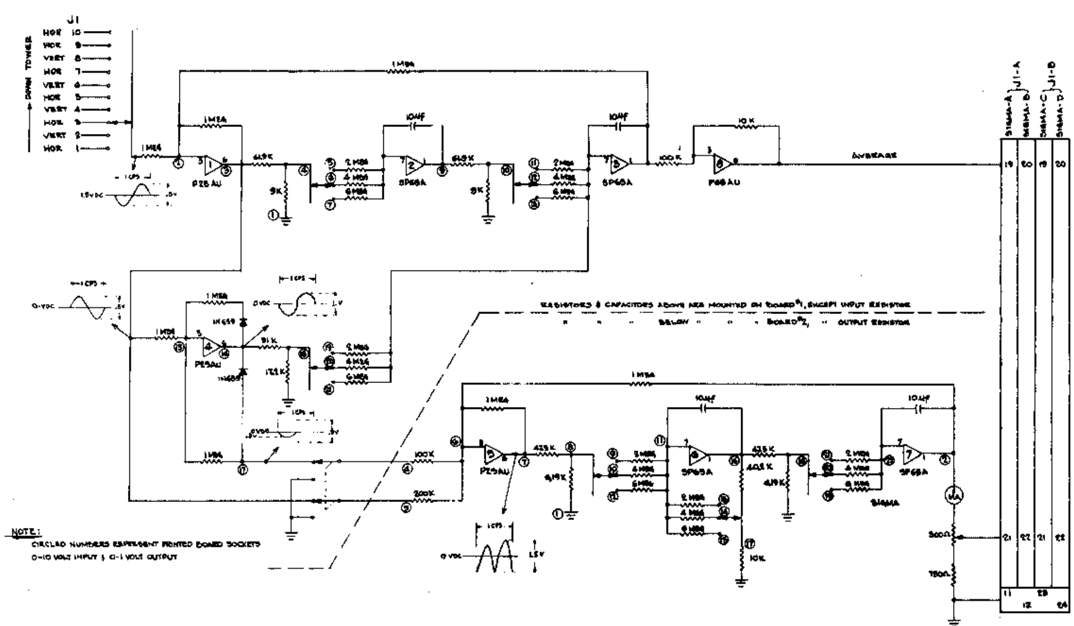


FIG. 11 SIGMA COMPUTER SCHEMATIC

punched at the beginning of each readout cycle. The readout cycle is adjustable from 3 to 10 min. About 1.5 min are required to scan the 36 data points at the tall tower. Table I shows the entire data output as a function of elevation for each tower.

TABLE I

Data Output (Both Towers)

TV Tower, ft	Data	Fire Tower, ft	Data
10	T, R	15	T, $\overline{u}$, θ, ϕ, DP
120	T, $\overline{u}$, θ	75	T, $\overline{u}$, θ, ϕ
300	T, $\overline{u}$, θ, ϕ, σ_θ, σ_ϕ	110	T, $\overline{u}$, θ, ϕ
450	T, $\overline{u}$, θ, ϕ		
600	T, $\overline{u}$, θ		
700	T		
800	T, $\overline{u}$, θ, ϕ, σ_θ, σ_ϕ		
900	T		
1000	T, $\overline{u}$, θ, ϕ		
1100	T		
1200	T		

R - Rain gauge
T - Temperature
$\overline{u}$ - Wind speed
θ - Horizontal direction
ϕ - Vertical direction
σ_θ - Standard deviation, horizontal
σ_ϕ - Standard deviation, vertical
DP - Dew point cell

The detailed data processing procedure is presented in Appendix A. A more detailed description of the steps taken in starting the program and of the performance of the system are given in Appendix C.

CONSIDERATIONS FOR DOSE CALCULATIONS

The dose calculations presented in this report are based on equilibrium inventory for the nuclides of interest and the release mechanisms and systems specific to the SRP reactors.[4] Two types of doses are considered - whole body dose and thyroid inhalation doses. The source is based on the following assumptions:

1. Full-core meltdown; the Design Basis Accident (DBA). The assumed release inside the reactor building is 100% of the equilibrium inventory of noble gases and 50% of the iodine inventory following operation at 1000 MW.

2. An iodine collection efficiency of 99.9%. This efficiency is based on actual measurements of on-line collection units and on numerous experimental tests.

3. A particulate solids collection efficiency of 99%. It is assumed that of the 1% of the total solids released from the fuel, 50% is deposited inside the building and 50% reaches the filters.

4. All activity releases are assumed to be instantaneous. Normal ventilation flow will displace a volume of air equal to the building volume in approximately 10 min. If the release occurs for a 10 to 30-min interval, radioactive decay during release is insignificant, and the release may be assumed to be instantaneous.

The assumed release for the DBA is therefore 100% of the noble gases, 0.05% of the iodines, and 0.005% of the particulate solids. In comparison with other doses, the released solids are considered insignificant and will not be discussed further.

To calculate either the whole body gamma or the iodine inhalation doses, the spatial distribution of the released material must be derived from dispersion coefficients. The calculation techniques are presented in detail under <u>Dose Calculations</u>.

DOSE CALCULATIONS

Estimates of downwind concentrations are based on procedures developed by Brookhaven National Laboratory (BNL)[5] using atmospheric dispersion properties derived from measured meteorological data. The BNL procedures are based on numerous field experiments and verified by comparing calculated and measured results from BNL and other sites. Comparisons are primarily based on release tests made from 400 ft and below. Calculated and measured concentrations agree within a factor of 2 over this height range and generally within 25%. The procedures are presumed valid for release heights up to 850 ft although available data indicate ground level concentrations in this height range are generally overestimated which would make the analyses presented in this report conservative. A basic consideration in applying the BNL procedures to SRL data is the topographical similarity of both meteorological sites. Preliminary analyses of the SRL 300-ft data support the assumption of similarity for dispersion considerations.

Estimates of downwind concentrations are made by the Gaussian plume model

$$\chi = \frac{S}{\pi \bar{u} \sigma_y \sigma_z} \exp\left(\frac{-\lambda x}{\bar{u}}\right) \exp - \left[\frac{1}{2}\left\{\frac{(z-h)^2}{{\sigma_z}^2} + \frac{y^2}{{\sigma_y}^2}\right\}\right] \quad (1)$$

where χ = downwind concentration, Mev/m^3

S = source term, Mev/sec

λ = decay constant, sec^{-1}

$\bar{u}$ = average wind speed, m/sec

x = downwind distance, m

h = release height, m

y = distance from plume centerline, m

z = height above ground level, m

σ_y = horizontal Gaussian dispersion coefficients, m

σ_z = vertical Gaussian dispersion coefficients, m

A summary of the BNL procedure for estimating the parameters $\bar{u}$, σ_y, and σ_z follows.

a) Determine the stability classification for the height of interest. Positive dt/dz is classed as stable, and zero or negative dt/dz is classed as unstable, where t is the temperature.

For stable atmospheric conditions: $(dt/dz > 0)$

b1) Determine $\overline{u}$ for the height of interest.

$$\overline{u} = u_H(z/Z_H)^{0.5} \qquad (2)$$

where $\overline{u}$ = wind speed at height z, m/sec

u_H = measured wind speed at Z_H, m/sec

z = elevation at which wind speed is being determined, m

Z_H = elevation at which wind speed is measured, m. Z_H should be as near z as is practical.

c1) Determine horizontal and vertical Gaussian dispersion coefficients.

$$\sigma_y = 0.15\ \sigma_a x^{0.71} \qquad (3)$$

$$\sigma_z = 0.15\ \sigma_e x^{0.71} \qquad (4)$$

where σ_a = standard deviation of the horizontal wind direction, degrees

σ_e = standard deviation of the vertical wind direction, degrees

Two options are available for determining σ_a and σ_e. Actual measurements from the sigma computers may be used, or the BNL limiting values may be assumed. If BNL values are assumed, σ_a is set to 2^o, and σ_e is set to 0.4^o. These values are considered by BNL to be limiting minimum values and will make the dose estimates conservative. If measured σ_a's and σ_e's are used, the BNL values are used as minimum limits.

For unstable atmospheric conditions: $(dt/dz \leqslant 0)$

b2) Determine $\overline{u}_{100}$ for a height of 100 meters.

$$\overline{u}_{100} = u_H(100/Z_H)^{0.25} \qquad (5)$$

where $\overline{u}_{100}$ = wind velocity at 100 meters

c2) Determine $\sigma_{a_{100}}$ for a height of 100 meters.

$$\sigma_{a_{100}} = \frac{23}{\overline{u}_{100}} + 4.75 \qquad (6)$$

where $\sigma_{a_{100}}$ = estimated standard deviation of horizontal wind direction, degrees

d2) Determine $\overline{u}$ for the height of interest.

$$\overline{u} = u_H(z/Z_H)^{0.25} \quad (7)$$

e2) Determine standard deviations of horizontal and vertical wind direction, σ_a and σ_e, respectively, at the height of interest.

$$\left.\begin{aligned} \sigma_a &= (\sigma_{a_{100}} u_{100})/\overline{u} \quad (8a) \\ \sigma_e &= 0.7\ \sigma_a \quad (9a) \end{aligned}\right\} \text{estimated}$$

or, if measured σ's are used

$$\left.\begin{aligned} \sigma_a &= (\sigma_{a,H} u_H)/\overline{u} \quad (8b) \\ \sigma_e &= (\sigma_{e,H} u_H)/\overline{u} \quad (9b) \end{aligned}\right\} \text{measured}$$

where $\sigma_{a,H}$ = measured standard deviation of horizontal wind direction at height H, degrees

$\sigma_{e,H}$ = measured standard deviation of vertical wind direction at height H, degrees

f2) Determine Gaussian dispersion coefficients σ_y and σ_z

$$\sigma_y = 0.045\ \sigma_a x^{0.86} \quad (10)$$

$$\sigma_z = 0.045\ \sigma_e x^{0.86} \quad (11)$$

Thyroid Inhalation Dose Estimates - Thyroid doses are derived from the estimated downwind concentrations of iodine isotopes from Equation 1 and procedures outlined in TID-14844.[6] All calculations are made for ground level concentrations on the plume axis. An instantaneous release mode is assumed; therefore, the calculated dose implies exposure to the entire release inventory. Thyroid doses, D, are estimated as follows.

$$D = \frac{2.309 \times 10^{-8} R}{m \pi \overline{u} \sigma_y \sigma_z} \exp\left(\frac{-h^2}{2\sigma_z^2}\right) \sum_{i=1}^{n} S_i F_i T_{e,i} \exp\left(\frac{-\lambda_i x}{\overline{u}}\right) \quad (12)$$

where R = breathing rate of active man, m^3/sec

m = mass of adult thyroid, g

n = number of isotopes

S = source for isotope i, total effective Mev/sec

F = fraction of inhaled iodine that is absorbed

T_e = effective half-life of isotope in the body, sec

Values of the parameters used in these analyses are given in Table II.

TABLE II

Parameters for Thyroid Dose Calculations

1000 MW

Isotope	λ	Source Mev/sec-MW	Fraction Released	Computed Source Mev/sec	Biological Elimination Rate, sec^{-1}	Fraction Deposited in Thyroid	Effective Energy, Mev
^{131}I	$.996 \times 10^{-6}$	$.363 \times 10^{15}$	5.0×10^{-4}	1.82×10^{14}	$.657 \times 10^{6}$	.23	0.23
^{132}I	$.802 \times 10^{-4}$	$.282 \times 10^{16}$	5.0×10^{-4}	1.41×10^{15}	$.839 \times 10^{4}$	.23	0.65
^{133}I	$.925 \times 10^{-5}$	$.115 \times 10^{16}$	5.0×10^{-4}	5.75×10^{14}	$.752 \times 10^{5}$	.23	0.54
^{134}I	$.220 \times 10^{-3}$	$.310 \times 10^{16}$	5.0×10^{-4}	1.55×10^{15}	$.311 \times 10^{4}$	.23	0.82
^{135}I	$.288 \times 10^{-4}$	$.290 \times 10^{16}$	5.0×10^{-4}	1.45×10^{15}	$.242 \times 10^{5}$	.23	0.52

Breathing Rate, R, for active man = 3.47×10^{-4} m^3/sec

Adult Thyroid Mass, m = 20 grams

Whole Body Gamma Dose Estimates - The whole body gamma dose is considerably more complicated to calculate than is the thyroid dose because of the long mean free path of the gamma rays. The procedures used in these analyses are based on a computational technique developed by L. M. Arnett and reported in Reference 7. This method represents the finite spatial distribution of airborne source material as an infinite number of line sources. An instantaneous release is assumed, and, since the calculated material concentration at a downwind point is assumed to extend to infinity in both upwind and downwind directions, the entire dose is considered to be accumulated in unit time. Therefore, the spatial integration giving D_γ is also a time integration and is expressed as follows.

$$D_\gamma = \sum_{i=1}^{n} \frac{S_i \nu}{4\bar{u}h} \exp \frac{-\lambda_i x}{\bar{u}} \int_0^\infty F(\gamma) G(\mu h \gamma) d\gamma \qquad (13)$$

where S = source for isotope i, Mev/sec

ν = dose conversion factor, $\frac{R}{s} \Big/ \frac{Mev}{(m^2)(sec)}$

n = number of isotopes

μ = linear attenuation coefficient of air for gamma radiation, m^{-1}

$\gamma = a/h$

a = distance from gamma source to receptor, m

and

$$F(\gamma) = \frac{\alpha^2\beta}{\pi}\int_0^{\pi} \exp\left[-\frac{\alpha^2}{2}\left\{\beta^2\gamma^2\sin^2\theta + (\gamma\cos\theta-1)^2\right\}\right] d\theta \qquad (14)$$

$$G(\mu h\gamma) = \frac{2}{\pi}\left[K_{i1}(\mu a) + \mu a K_o(\mu a) + \frac{(\mu a)^2}{7E^{2.4}} K_1(\mu a)\right] \qquad (15)$$

where $\alpha = h/\sigma_z$

$\beta = \sigma_z/\sigma_y$

E = gamma energy, Mev

K = Bessel functions

A FORTRAN IV code, RADOS,[8] was written to perform these dose calculations. However, due to the large number of data samples being processed, a method was developed to minimize computer time. Noting that the space distribution function, $F(\gamma)$, and the distance attenuation function, $G(\mu h\gamma)$, are both independent of the release inventory, the integrals of Equation 13 were computed and tabulated as a function of σ_y and the ratio, σ_z/σ_y. This two-dimensional array was computed for two release heights of interest (70 and 260 m) in increments of 50 meters for σ_y. A third degree double interpolation technique is used to evaluate the integral of Equation 13 for specific values of the dispersion coefficients, σ_y and σ_z. The two-dimensional array was computed only for the 1 Mev gamma energy since it was found that for the particular release inventory under consideration all gamma rays could be expressed in terms of equivalent 1 Mev gamma rays with insignificant error in the computed result.

To further simplify the calculations for a standardized set of conditions, a release inventory for 1000 MW reactor power was assumed in the data analysis program, WRED, described in Appendix E. With this code the total release in Mev/sec was computed and tabulated as a function of wind speed for the downwind distances of interest. The inventory values were tabulated in increments of 0.1 m/sec wind speed from 0.5 to 2.5 m/sec and in increments of 1.0 m/sec wind speed from 2.5 to 35 m/sec to ensure adequate precision in interpolation. Again, third degree interpolation is used to compute the total source for particular wind speeds.

To estimate the gamma dose, it is now only necessary to obtain the product of the space distribution-attenuation integral and the total source in Mev/sec at the distance of interest, and multiply by the term ($\nu/4\pi h$). Table III gives the standard source conditions that have been included as an integral part of the data reduction program. This option (the standard conditions) permits a complete statistical analysis of 40,000 sets of data (near the maximum obtainable during 3-months acquisition) in less than 20 min on the IBM System 360/65.

TABLE III

Standard Source Conditions

Reactor Power	1000 MW
Halogen Release Fraction	5.0×10^{-4}
Noble Gas Release Fraction*	1.0
Release Heights	70 and 260 meters
Downwind Distances	2, 8, 13.5, and 40 km

* The noble gas source in Mev/MW was taken from TID-14844.

As each data sample is processed, the estimated doses are classified according to dose magnitude at each distance, release height, and wind direction sector with summaries included for eight 45°-wind sectors. The number of data samples that yield an estimated dose within each dose increment in each category is updated for each sample. The result of this process is a statistical tabulation of dose vs. frequency of occurrence as a function of distance and release height (assuming a hypothetical release for each data set). Therefore, for a given dose magnitude and assumed release of radioactive material, the probability of a downwind receptor receiving a dose of this magnitude may be estimated from the dose vs. frequency of occurrence relationship. The data should not be extrapolated beyond the range shown in the figures and tables.

From these analyses and the assumed DBA (full-core meltdown at 1000 MW) and observed meteorological data covering 2 years, the following conclusions are drawn:

(1) The calculated whole body dose at the plant boundary would be less than the 10 CFR 100 guideline of 25 R for about 69% of the observed meteorological conditions for the present 70-meter (230 ft) release height.

(2) The maximum calculated whole body dose at the plant boundary was 192 R for the observed meteorological conditions with the present 70-meter release height.

(3) The calculated thyroid dose at/or beyond the plant boundary was less than the 10 CFR 100 guideline of 300 rem for 100% of the observed meteorological conditions for the present 70-meter release height. The maximum calculated value was 116 rem.

(4) The analyses based on the observed meteorological conditions show that increasing the release height from 70 to 260 meters would reduce the calculated whole body dose at the plant boundary a factor of about 8 at the same frequency of occurrence. The calculated whole body dose at the plant boundary for the 260-meter release height was less than 25 R for 99.9% of the observed meteorological conditions.

(5) The maximum calculated whole body dose at/or beyond the plant boundary was 25.8 R for the 260-meter release height. This value is below the range of major biological concern and can be compared with a maximum value of 192 R for the present 70-meter release height.

(6) None of the calculated thyroid doses exceeded 2.5 rem for a 260-meter release height, a factor of 50 below the 10 CFR 100 guideline of 300 rem and a reduction by a factor of about 100 as compared to the 70-meter release case.

(7) If the actual distances to a plant boundary are used for the whole body dose estimate rather than the 8 km nearest distance for one reactor, the dose would be less than about 10 R for 70% of the observed meteorological conditions for the 70-meter release height and 99.3% of the observed conditions for the 260-meter release height. The comparable values for the 8 km distance are 70% and 98.2%, respectively.

RESULTS OF DOSE ANALYSES

Results of dose analyses performed according to methods outlined in the previous section are shown in Figures 12-16. The results are given for two release heights, 70 meters (230 ft) and 260 meters (850 ft), corresponding to the present SRP reactor ventilation release heights and a typical height to improve dispersion comparable to tall stacks now being placed in service in the utility industry.

All results shown are for an assumed release to the atmosphere of 100% of the noble gases and 0.05% of the iodine inventory from a reactor operating at 1000 MW.

The calculated whole body dose for the present 70-meter release height is shown in Figure 12 as a function of distance for four levels of cumulative frequency of occurrence. At the nearest plant boundary (8 km) the calculated dose at a cumulative probability of 90% is 51.2 R. The maximum calculated dose at 8 km is 192 R for the observed meteorological conditions.

The calculated thyroid dose for the present 70-meter release height is shown in Figure 13 as a function of distance. The analyses show that the thyroid dose reaches a maximum at about 13.5 km for each frequency level. Based on the observed data none of the thyroid doses would exceed the 10 CFR 100 guideline of 300 rem at the plant boundary. The highest calculated dose estimate is 129.2 rem.

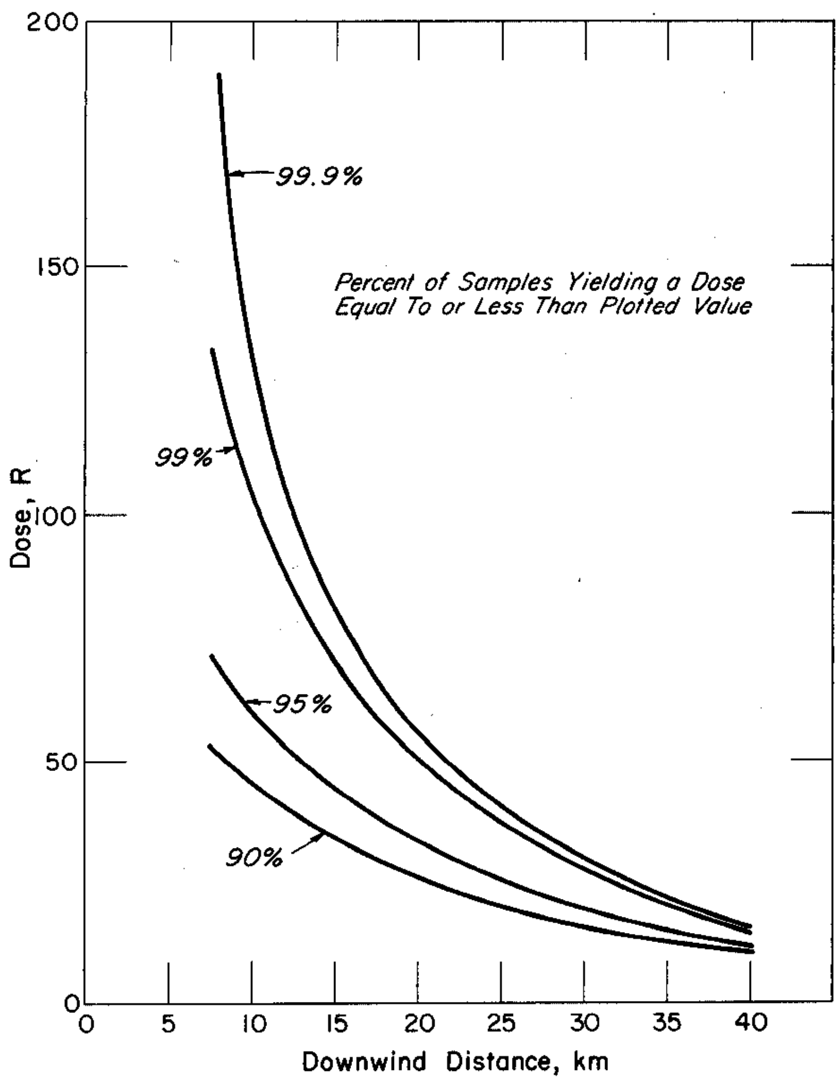


FIG. 12 WHOLE BODY DOSE VS. DISTANCE FOR 70-METER RELEASE HEIGHT

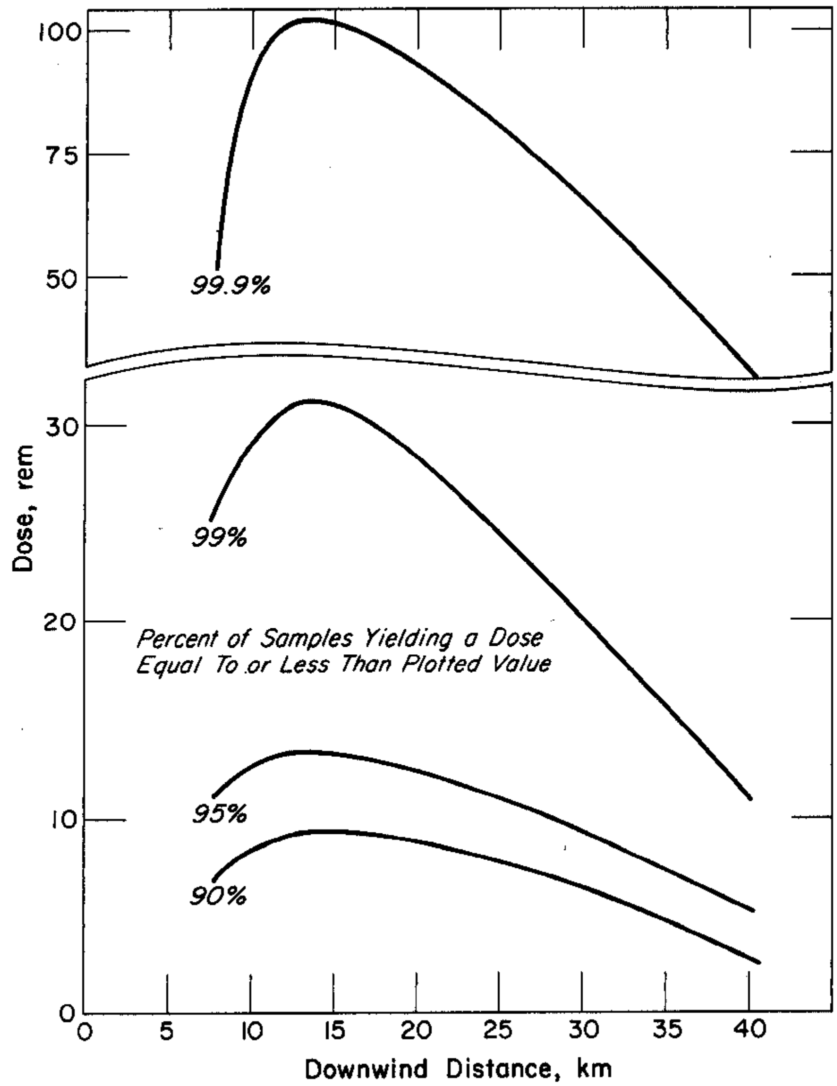


FIG. 13 THYROID DOSE VS DISTANCE FOR 70-METER RELEASE HEIGHT

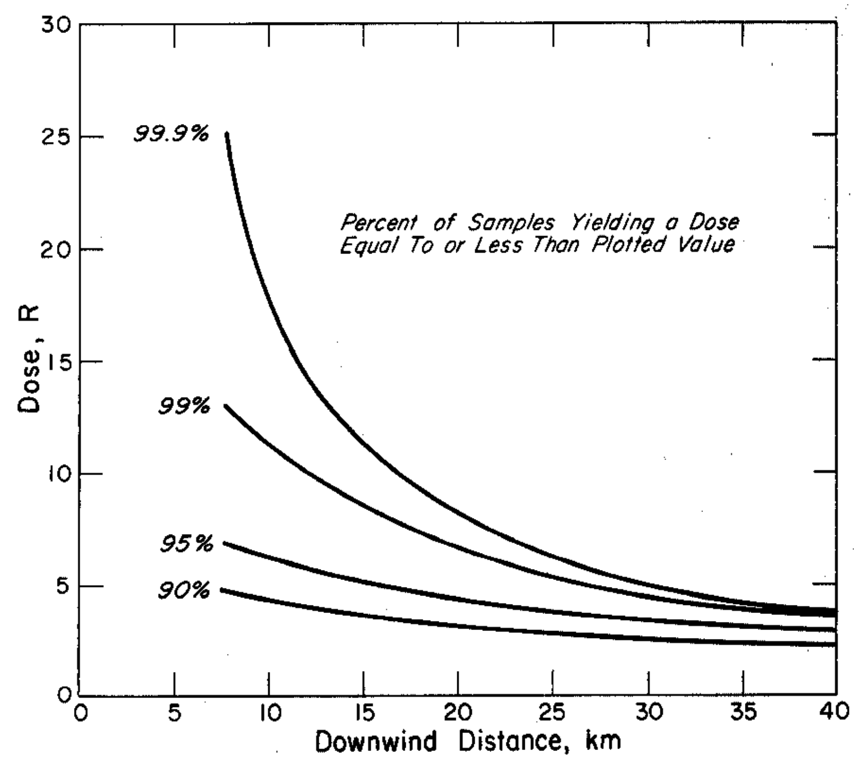


FIG. 14 WHOLE BODY DOSE VS. DISTANCE FOR 260-METER RELEASE HEIGHT

The calculated whole body dose for a 260-meter (850 ft) release height is shown in Figure 14 as a function of distance. The whole body dose at 8 km was less than 25 R for 99.9% of the observed meteorological conditions. The maximum calculated dose at 8 km was 25.8 R. At 40 km (the distance to Augusta, Ga.) the calculated doses were all less than 4.2 R.

The calculated thyroid doses for a 260-meter release height were all less than 2.5 rem at distances of 8 km and beyond. The values of the calculated dose are so small as to be of little biological concern.

The calculated whole body and thyroid doses are shown as a function of release height in Figures 15 and 16. The results are shown for four levels of cumulative frequency of occurrence at 8 km (the nearest plant boundary) and 40 km (the distance to Augusta, Ga.).

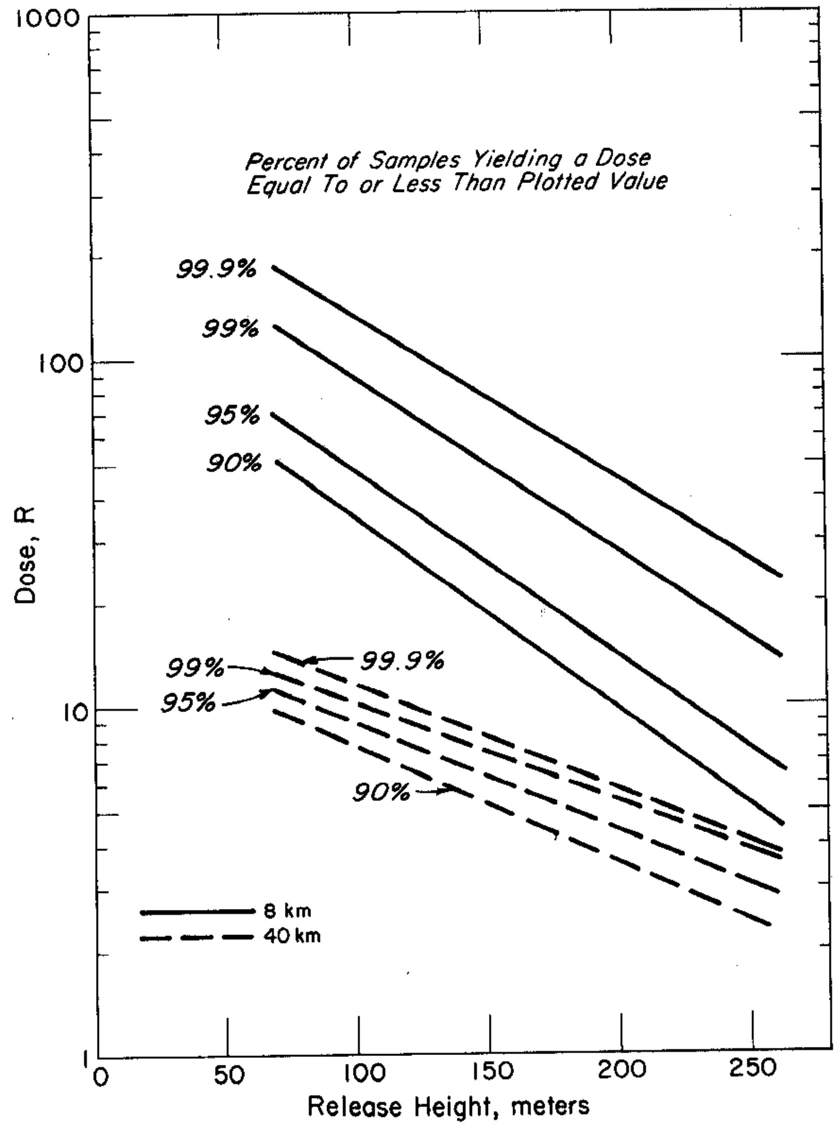


FIG. 15 WHOLE BODY DOSE VS RELEASE HEIGHT AT 8 AND 40 KM

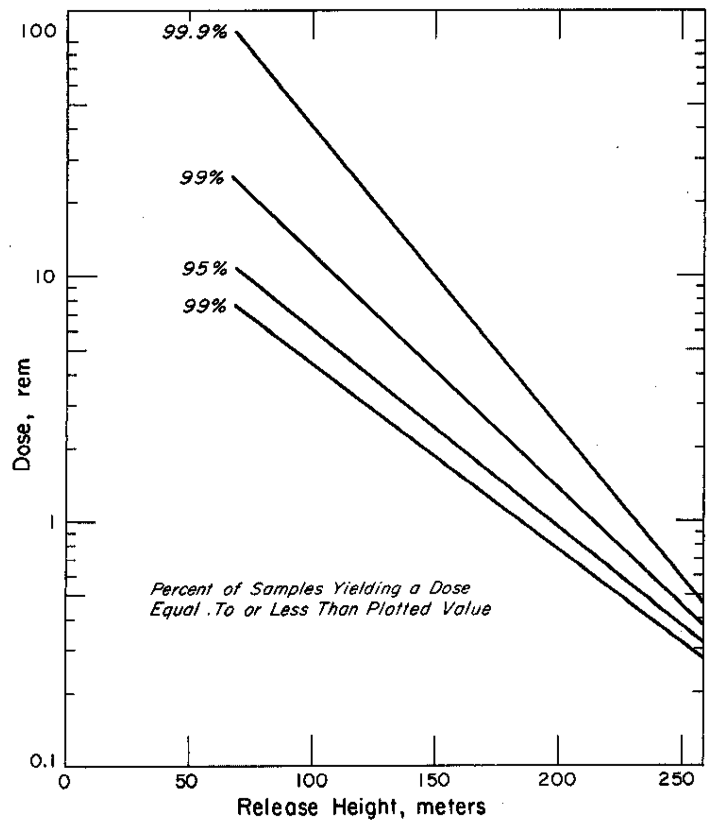


FIG. 16 THYROID DOSE VS. RELEASE HEIGHT AT 8 KM

Effect of Finite Release Time - All analyses considered so far are based on an assumed instantaneous release of radioactive material. A more realistic assumption is that the release might occur over a time interval of 10 to 30 min. This implies that it would be appropriate to average the estimated doses from each data sample over a comparable time interval for a more realistic dose estimate. A sample set of 3-months data was averaged in this manner to determine if the dose estimates would be significantly altered. The sample set of data had a frequency distribution reasonably similar to the total data now available.

The averaging process is performed by averaging the first set of N estimated doses, classifying this average as previously stated, then dropping the contribution to this average by the first of the N dose estimates. One new dose estimate is made and a new average for N dose estimates is computed and classified. This process is continued for each data sample and results in a frequency distribution based on a continuous average of N dose estimates. N is an input parameter which specifies the number of dose estimates over which the averages are computed.

The frequency distribution of whole body gamma dose at 8 km as determined by this averaging process is shown in Figures 17 and 18 compared to the frequency distribution as determined from individual samples. These data indicate no significant change in the frequency distribution below the 99th percentile for averaging periods up to 30 min for a 70-meter release height as shown in Figure 17. The maximum estimated dose is decreased to 97% of the individual value which indicates the persistence of some conditions that yield high dose estimates for 30 min or more. The 3-hour averages for the 70-meter release height show a more significant reduction in dose vs. frequency of occurrence. The 3-hour averages for the 99th percentile are reduced to 75% of the individual value, and the maximum dose estimate is 66% of the individual maximum. Similar results are shown in Figure 18 for the 260-meter release height. The 30-min averages are reduced to 83% of the individual value at the 99th percentile and 80% for maximum dose. The 3-hour averages are 74% at the 99th percentile and 51% for maximum dose. These reduction factors are slight underestimates because radioactive decay over the averaging periods was not considered. The variability of wind direction over these averaging periods is also neglected.

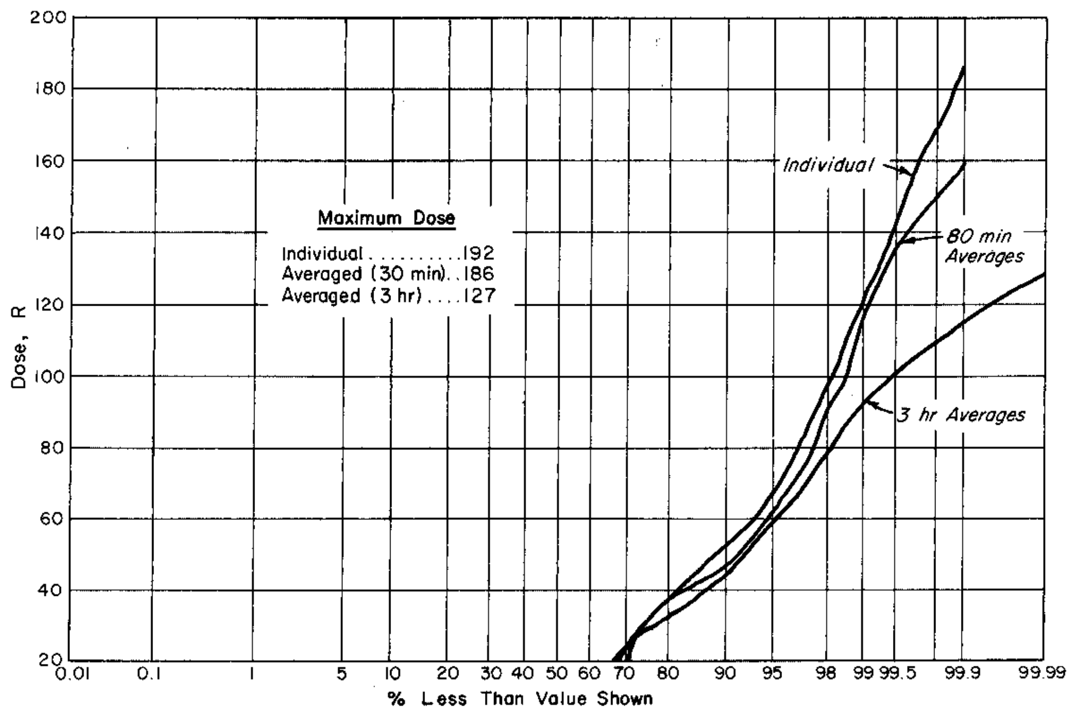


FIG. 17 FREQUENCY DISTRIBUTIONS OF WHOLE BODY DOSE AT 8 KM FOR 70-METER RELEASE HEIGHT

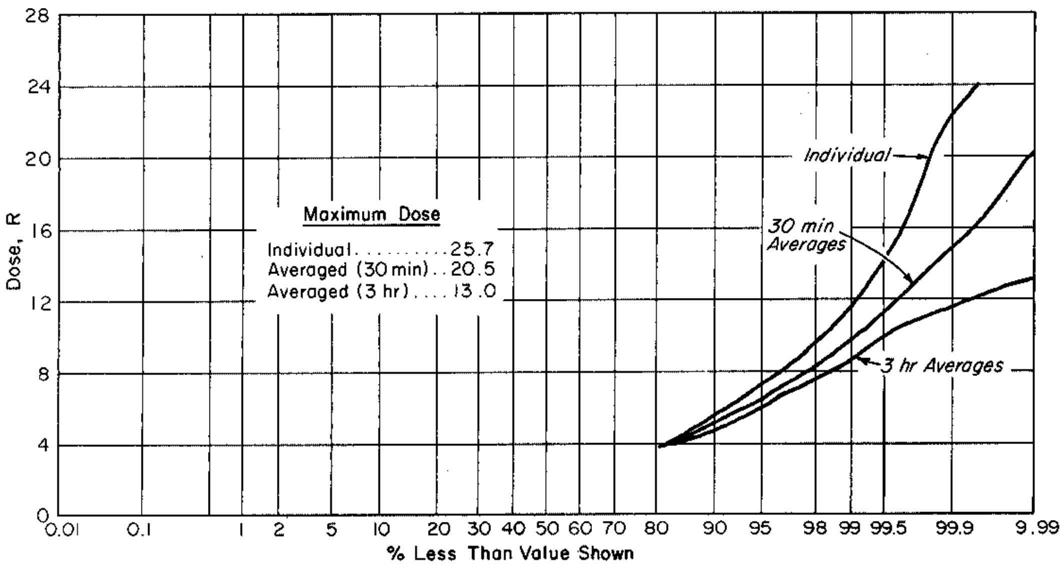


FIG. 18 FREQUENCY DISTRIBUTION OF WHOLE BODY DOSE AT 8 KM FOR 260-METER RELEASE HEIGHT

Wind Persistence - The duration of the wind blowing from one direction within a given azimuthal angle (hereafter called wind persistence) was studied. Figures 19 and 20 show the probability of wind persistence for two elevations and several angular widths. These calculations were made by first computing an average direction based on one hour's data and then processing additional data to update the hourly average for each data sample. This process is continued until the updated average deviates more than $\theta/2$ degrees from the initial one-hour averaged direction where θ is the angular width in degrees. The elapsed time for wind persistence is then computed, and the wind persistence is classified according to duration in hours. The current hourly average is then used as a base and the process continues as previously outlined. Figure 19 shows the probability for a given wind persistence for sector widths of 45, 30, and 22.5° at 300 ft. Figure 20 is a similar plot at 800 ft. These studies show the probability of the wind persistence at 300 ft for a 10-hour period is 0.033, 0.057, and 0.125 for a 22.5, 30, and 45° sector width, respectively. Results were very similar at 800 ft.

The wind persistence studies imply that a controlled release over a period of hours would significantly reduce the dose at a given cumulative probability for an off-site receptor. This reduction would be enhanced further by the fact that the low wind speeds, which produce the highest dose estimates, are generally accompanied by high directional variability.

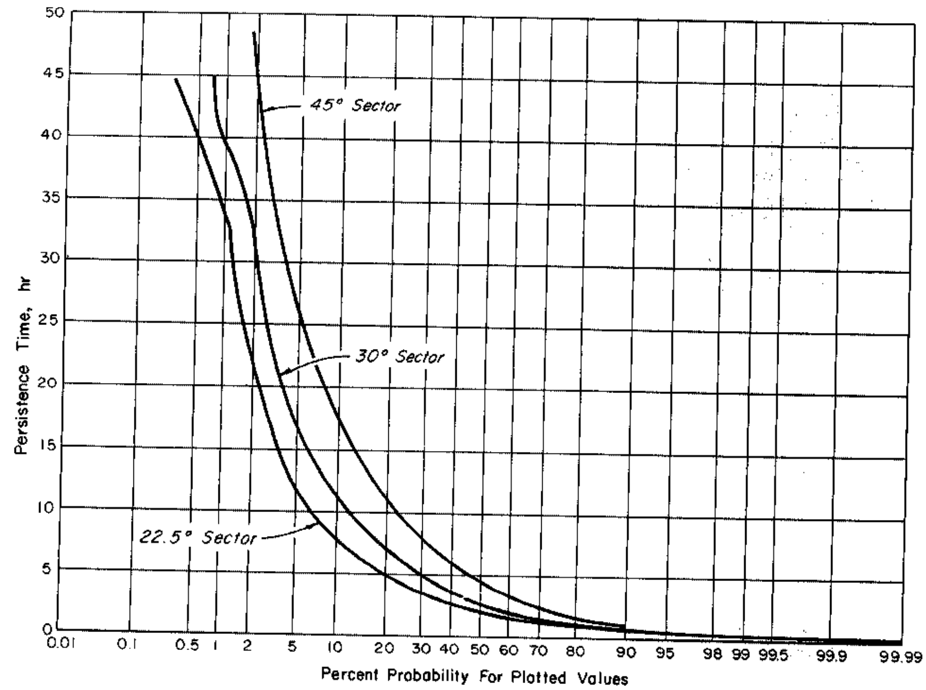


FIG. 19 PROBABILITY OF WIND PERSISTENCE AT 300 FEET

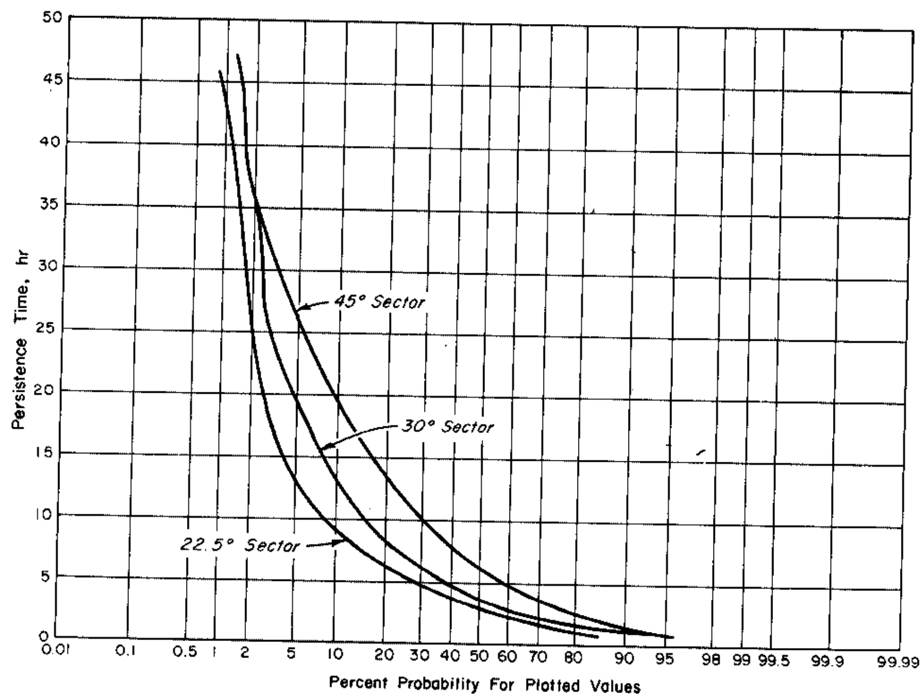


FIG. 20 PROBABILITY OF WIND PERSISTENCE AT 800 FEET

Estimates of the Integrated Whole Body Dose (Man-Rem) - The man-rem product of population exposure resulting from an unlikely release of radioactive material was also estimated. These estimates are based on ground level whole body gamma doses for a uniform horizontal distribution and a Gaussian vertical distribution of material that is confined within a sector. Constant σ_z's of 84 and 252 meters were used for 70- and 260-meter release heights because they yielded slightly higher doses. The man-rem product is relatively insensitive to this parameter. Results are shown in Figures 21 and 22 as the cumulative man-rem product of dose times number of people out to the distance indicated for a sector width of 22.5°. The most populated sector (Sector 14) includes Jackson, S. C., Beech Island, S. C., North Augusta, S. C., Augusta, Ga., and Fort Gordon, Ga. Sector 13 is typical of the remaining sectors; therefore results are shown for these two sectors only. Figure 23 shows the population distribution for each of the 16 sectors.

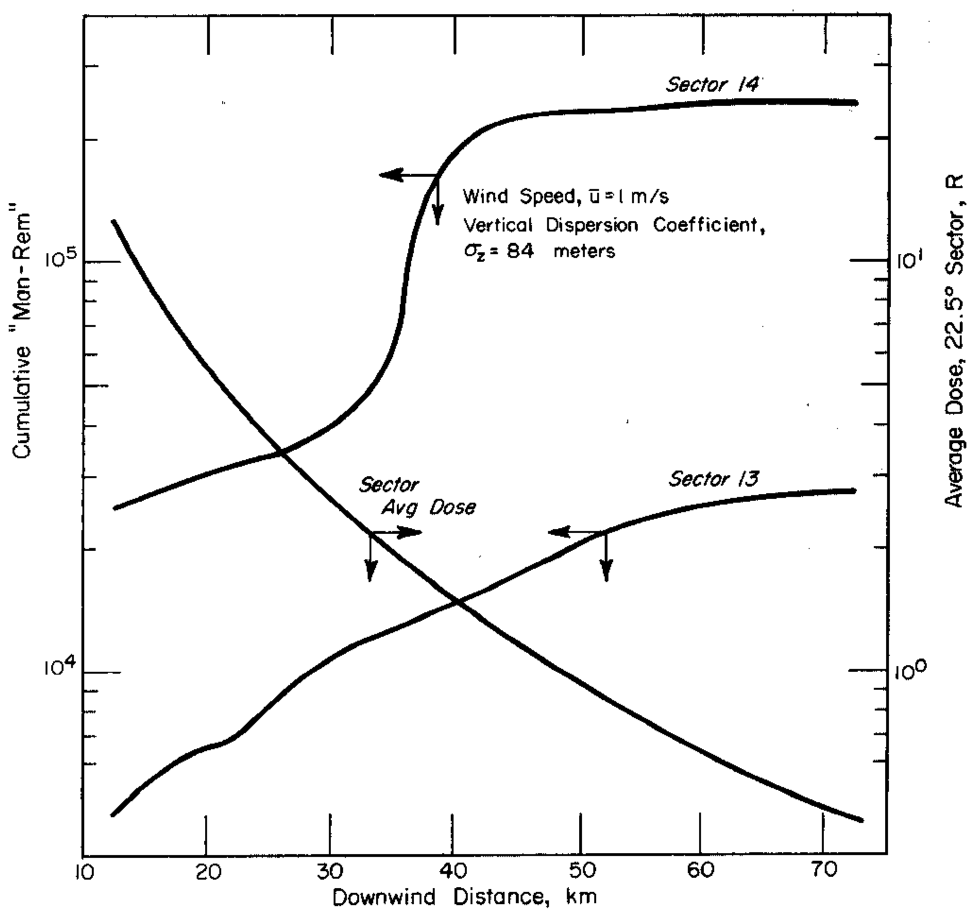


FIG. 21 CUMULATIVE WHOLE BODY MAN-REM DOSE FOR 70-METER RELEASE HEIGHT

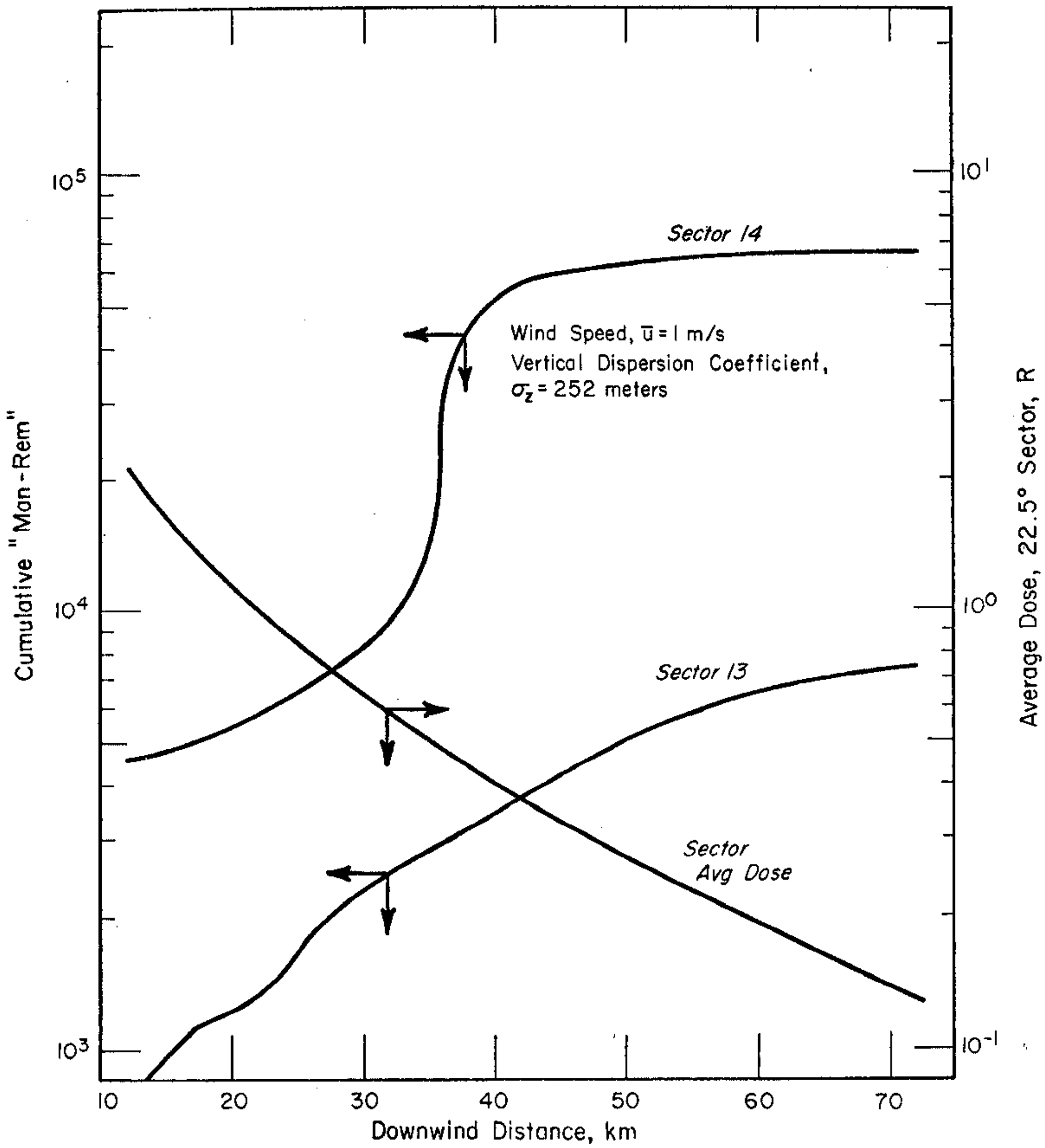


FIG. 22 CUMULATIVE WHOLE BODY MAN-REM DOSE FOR 260-METER RELEASE HEIGHT

Results for the present 70-meter release height are shown in Figure 21 for a wind speed of 1 m/sec and very stable conditions. The indicated frequency of occurrence is determined from the wind directional frequency and the wind speed data shown later in Tables VIII-XII. The cumulative man-rem product out to a distance of 75 km is less than 240,000 man-rem in any 22.5° sector for 99.97% of the observed meteorological conditions.

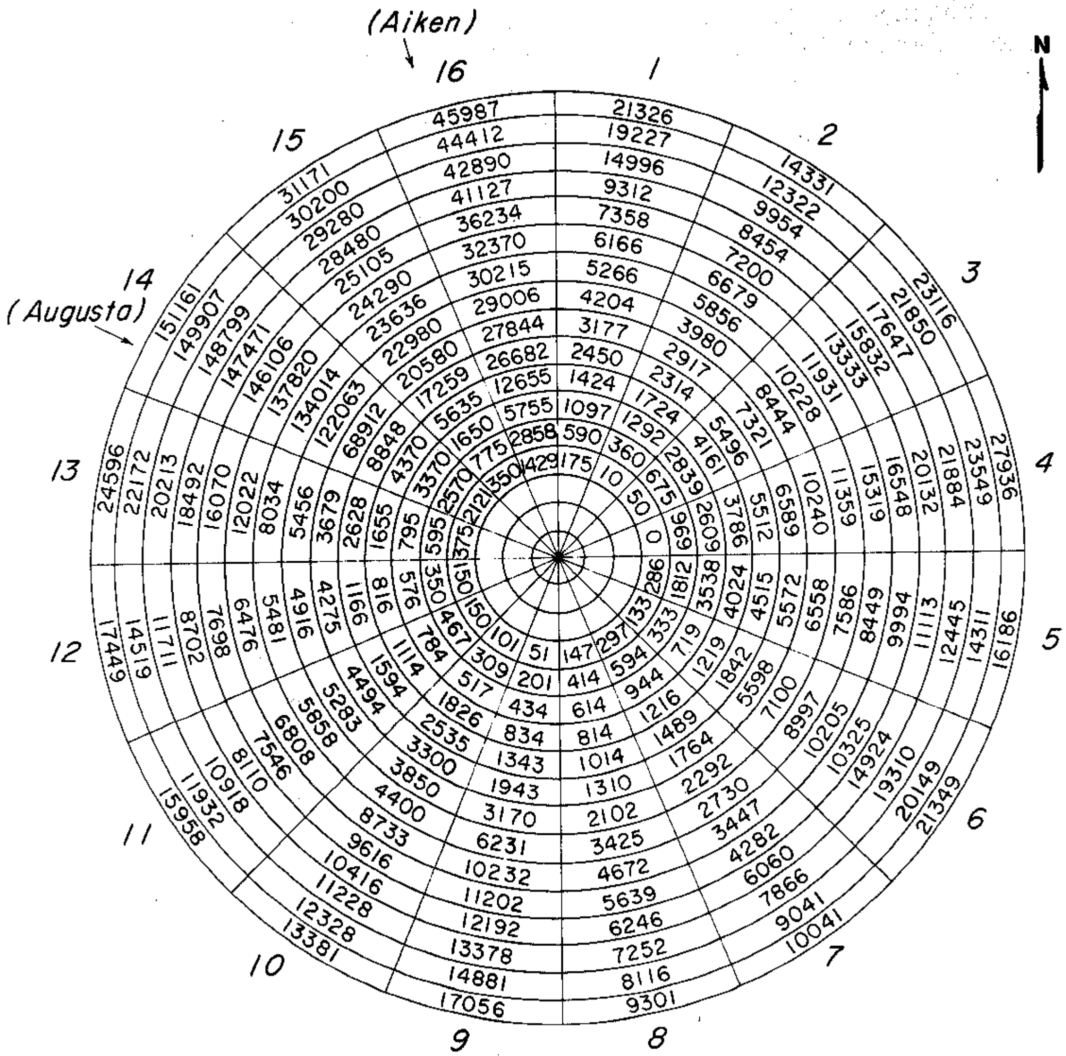


FIG. 23 CUMULATIVE POPULATION DISTRIBUTION FOR THE CONTIGUOUS SRP AREA - 1960 CENSUS (RADIAL INCREMENTS = 5 KM, 22.5° SECTOR)

Results for a 260-meter release height are shown in Figure 22 for a wind speed of 1 m/sec and conditions which yield the maximum man-rem dose estimate. The cumulative man-rem product out to 75 km is less than 67,000 man-rem in any 22.5° sector for 99.97% of the observed meteorological conditions. Under conditions which tend to yield the highest dose estimates, the man-rem product out to 75 km is a factor of 3 lower for release at 260 meters than for release at 70 meters. For many other conditions, an elevated release height does not appreciably alter the man-rem product.

The wind persistence was computed for the most populated sector (Sector 14) and is shown in Figure 24 as a function of wind persistence in hours vs. probability of occurrence at 300 and 800 ft. These data indicate that a further reduction in estimated cumulative man-rem product for the most populated sector should be made because the worst meteorological conditions are low wind speeds which would require long wind persistence to remain within the sector. Low wind speeds are generally accompanied by high directional variability.

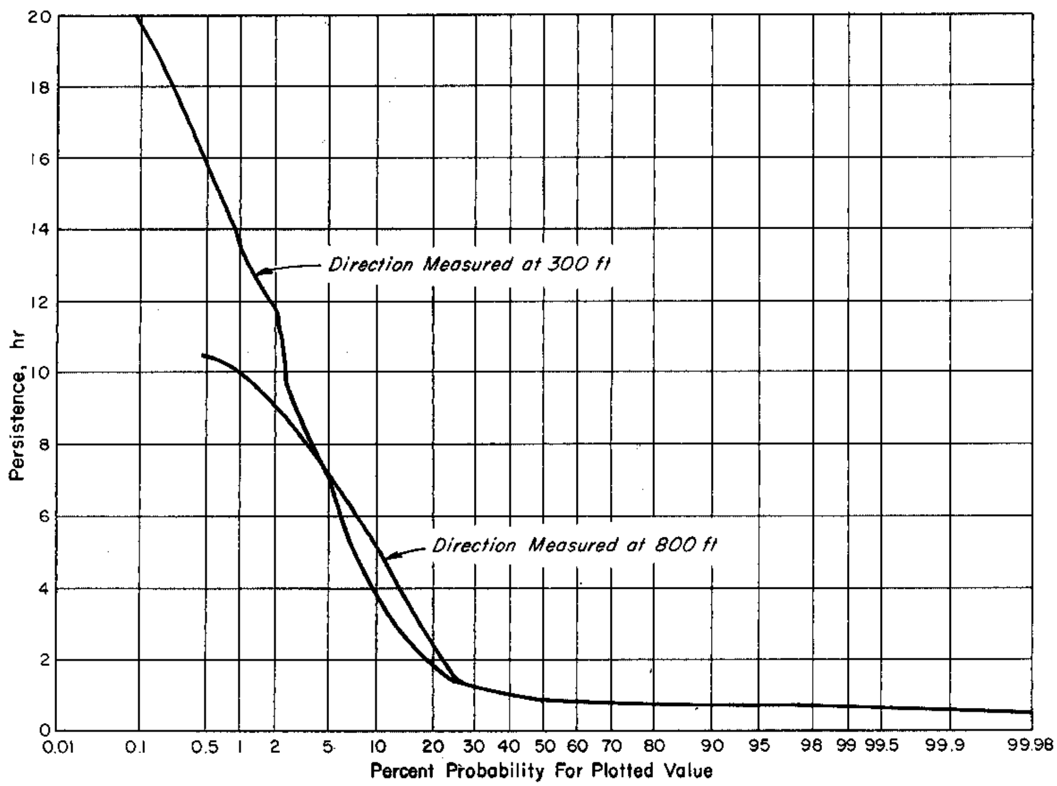


FIG. 24 PERCENT PROBABILITY VS. WIND PERSISTENCE FROM SRP TO AUGUSTA, GEORGIA (22.5° SECTOR)

The man-rem product for thyroid inhalation dose was not estimated because these dose magnitudes were much further below the levels of biological concern than the whole body gamma doses.

A description of the FORTRAN IV program that was written specifically to perform these man-rem calculations is in Appendix F.

Doses as a Function of Average Distance Within a Sector - In the preceding calculations, the distance to the plant boundary was always taken to be 8 km, which is the minimum distance from the K Area reactor to the nearest plant boundary. Since this minimum distance applies to only one particular direction, it is considered more appropriate to compute dose estimates based on the average distance within a sector and the probability of the wind blowing toward the boundary within this sector. This method allows the utilization of measured directional probabilities in determining dose estimates at the plant boundary for each of the 45° sectors and accounts for the fact that the distance from each reactor area to the plant boundary varies with azimuth. The following calculations apply specifically to K Area, but similar results are obtained for each of the reactor areas.

Table IV contains data pertinent for each sector, and Table V gives the results of the analysis with actual distances. The whole body and thyroid dose estimates are equal to or less than about 10 R for 70% of the observed meteorological conditions for a 70-meter release height. For a 260-meter release height, the comparable value is 99.93%. The thyroid dose is less than 300 rem for all cases.

TABLE IV

Wind Sector Parameters

Wind from Sector	Blowing into Sector	Distance to Plant Boundary	Wind Direction Fraction 70 Meters	260 Meters
1	5	10.4 km	.1043	.0873
2	6	10.0	.1397	.1318
3	7	13.4	.1125	.1161
4	8	18.3	.1083	.0883
5	1	22.6	.1567	.1453
6	2	19.5	.1685	.1811
7	3	14.6	.1485	.1805
8	4	12.8	.0615	.0695

TABLE V

Estimated Doses

Plant Perimeter	70 Meters	260 Meters
Whole Body Dose ⩽10 R, %	70	99.3
Maximum Whole Body Dose, R	192	25.8
Thyroid Dose <300 rem, %	100	100
Maximum Thyroid Dose, rem	116	1.25
40 Kilometers		
Whole Body Dose ⩽10 R, %	89	100
Maximum Whole Body Dose, R	16.2	3.8
Thyroid Dose <300 rem, %	100	100
Maximum Thyroid Dose, rem	34	2.5

Progression of Frequency Distributions as Data Were Processed - Figure 25 shows the progression of the dose frequency distribution as data were accumulated and processed every 3 months. These data show that there was an upward trend in the dose at a particular cumulative frequency for the 70-meter release height, particularly for the 99th percentile where the statistics are low. The lower percentiles, that include more data, approach constant values as the number of samples increased. Percentiles for the 260-meter release height have remained relatively constant over the 2-year data acquisition period.

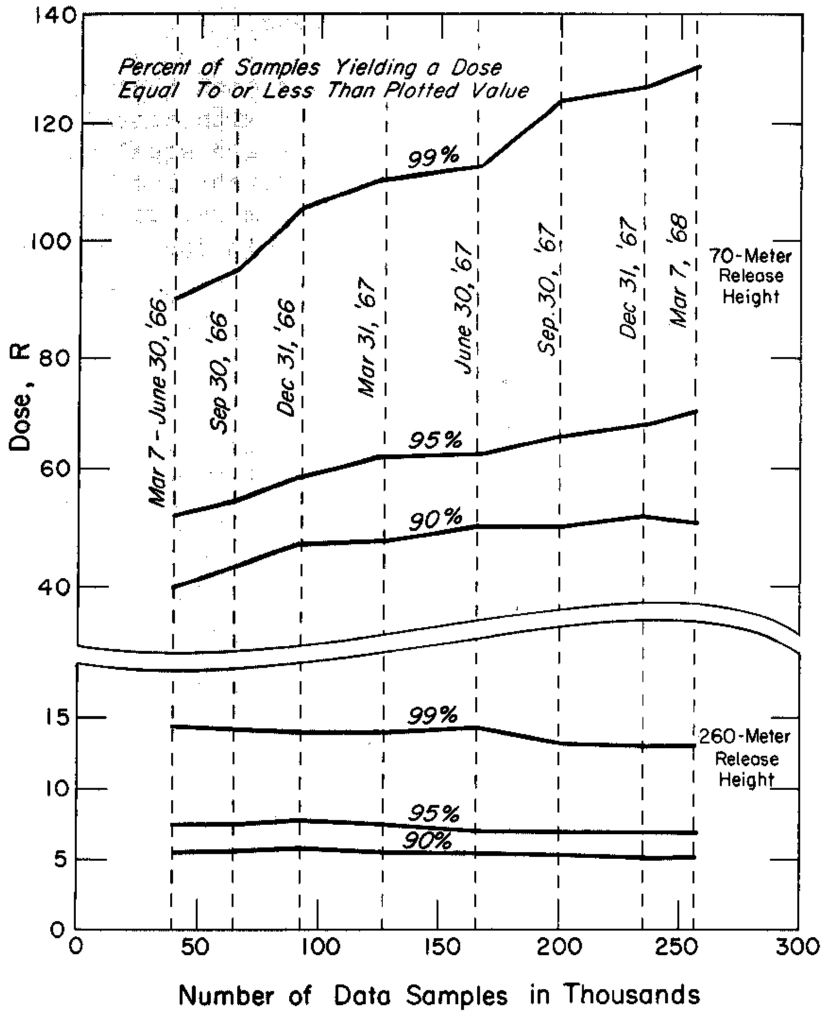


FIG. 25 WHOLE BODY DOSE VS. NUMBER OF DATA SAMPLES AT 8 KM

Table VI compares the dose estimates and percentiles related to guideline values for two years and earlier values from one year's data. The values have not changed significantly for either release height with an increase from one to two years' data. Thus the data acquisition was terminated at the end of the two years.

TABLE VI

Estimated Doses at Plant Boundary for One- and Two-Year Data

	Release Height, meters	1-Yr Data (107,000 sets)	2-Yr Data (260,000 sets)
Whole Body Dose ⩽10 R	70	70%	69%
Whole Body Dose ⩽52 R	70	90%	90%
Whole Body Dose ⩽190 R	70	99.9%	99.9%
Maximum Whole Body Dose	70	192 R	192 R
Maximum Thyroid Dose	70	100 rem	108 rem
Thyroid Dose <300 rem	70 - 260	100%	100%
Whole Body Dose ⩽10 R	260	98%	98.2%
Maximum Whole Body Dose	260	27 R[(a)]	26 R
Thyroid Dose <10 rem	260	100%	100%

(a) Error in previous computations

FACTORS INFLUENCING DOSE CALCULATIONS

The dose analyses were based on atmospheric dispersion parameters derived from BNL correlations as a function of wind speed and stability classification. Although this procedure is assumed valid, the sensitivity of the results to changes in the correlating equations and fitting parameters was studied. The relationship between the horizontal and vertical dispersion coefficients was held constant, within each stability classification, for each of the variational studies.

Analyses were performed on a sample set of 30,000 data samples under the following conditions:

(1) Equation 6 was modified to obtain smaller dispersion coefficients under unstable conditions. The correlating equation in this analysis was

$$\sigma_{100} = 12/\bar{u}_{100} + 4.75 \qquad (16)$$

which yields a horizontal dispersion angle of 16.75° for a wind speed of 1 m/sec instead of 27.75° for the BNL method. At a distance of 8 km, and beyond, from the release point no difference was noted in the frequency distributions above the 80th percentile for the 70-meter release height, nor above the 95th percentile for the 260-meter release height. The differences at all percentiles for the 260-meter release height are inconsequential due to the relatively low dose levels. These results are shown as Case I in Figures 26 and 27. The BNL correlation used for all studies in this report differed insignificantly from Case I in Figure 26, the 70-meter release. For the 260-meter release, introduction of the more restricted horizontal dispersion angle leads to an appreciably higher calculated dose as shown in Figure 27.

(2) A constant value for the horizontal dispersion angle was assigned for each release height to simulate Gifford Class D dispersion. Results were very similar to (1) above and are shown as Case II in Figures 26 and 27.

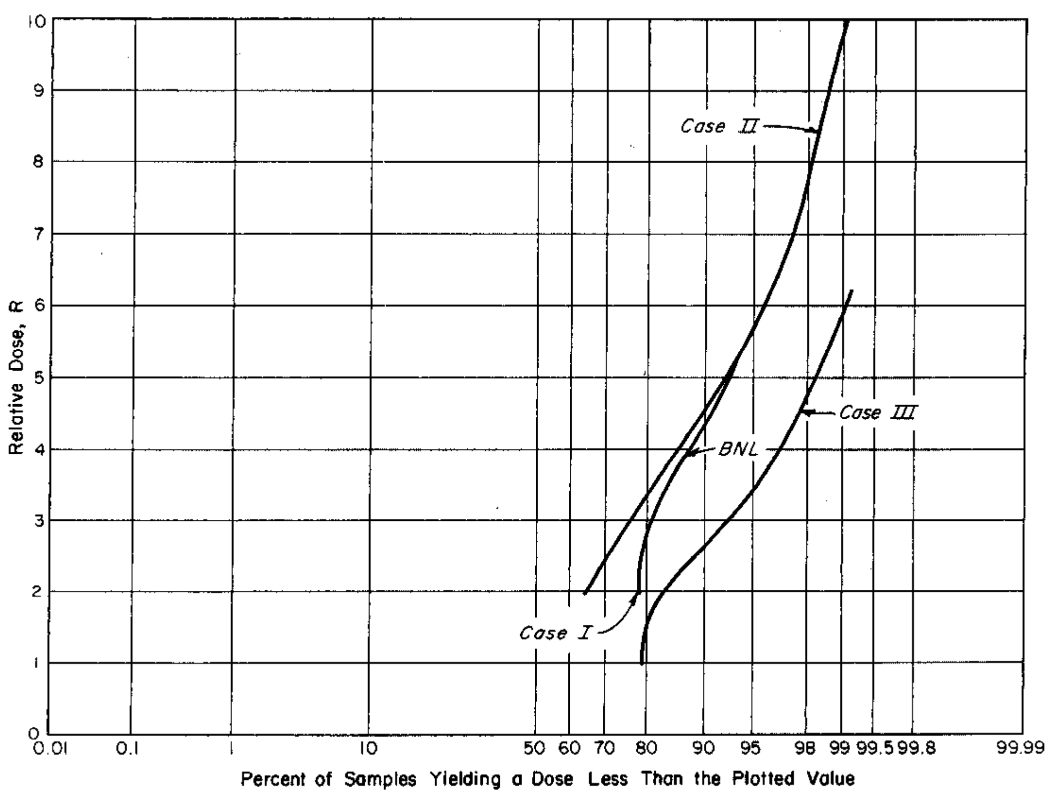


FIG. 26 EFFECTS OF VARIOUS CORRELATING TECHNIQUES ON DOSE ANALYSES FOR 70-METER RELEASE HEIGHT AT 8 KM

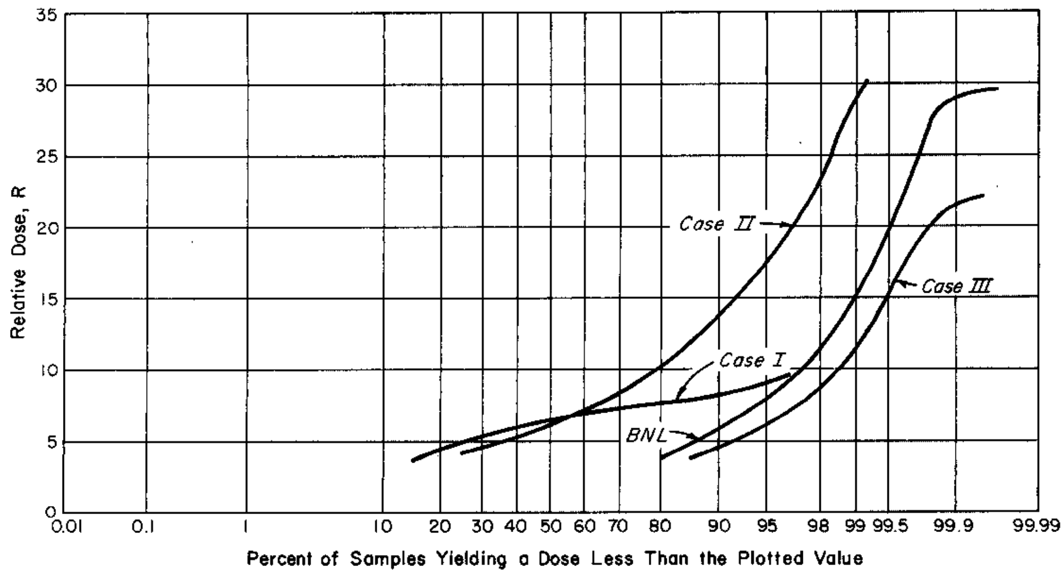


FIG. 27 EFFECTS OF VARIOUS CORRELATING TECHNIQUES ON DOSE ANALYSES FOR 260-METER RELEASE HEIGHT AT 8 KM

(3) The dispersion angle for stable conditions was assumed to be 4° instead of 2°. This resulted in smaller dose estimates for all percentiles for both release heights. This is shown as Case III in Figures 26 and 27.

In addition to the above analyses, a set of approximately 40,000 data samples was processed utilizing the SRL measured sigma (standard deviation of wind direction) data and the resulting dose estimates were compared to estimates obtained with the BNL approximated sigmas. It should be noted that there is no general agreement as to the direct applicability of the sigma data because little vertical sigma data had been obtained prior to the present measurements. The response of the sigma computer at very low frequencies is attenuated rapidly below 0.01 cps; therefore, the computed sigma will be underestimated when the average wind direction (averaged over a time interval that is short compared to the sigma averaging time) meanders at very low frequencies or continually drifts azimuthally.

A minimum horizontal dispersion angle of 2° was assumed from the BNL hypothesis that this should be the limiting angle.

This analysis using the SRL measured sigmas agreed well with the BNL analysis using approximated sigmas for the 70-meter release height. Using the measured sigmas, the estimated doses for the same frequency of occurrence were decreased a few percent. Dose estimates for the 260-meter release height increased about a factor of 2 for the same frequency of occurrence above the 80th percentile. The estimated maximum dose also increased by a factor of 2.

As a result of these analyses, the following conclusions are drawn:

(1) At distances of 8 km and beyond and using the BNL method, the unstable atmospheric conditions yield dose estimates that are small compared to estimates from stable conditions.

(2) When a minimum 2° horizontal dispersion angle is assumed, dose estimates are higher than estimates made for a larger minimum dispersion angle. This assumption makes the SRL dose estimates conservative because different degrees of stable conditions are not considered.

(3) The utilization of measured sigma data, although not yet established as practical, gives dose estimates that agree well with estimates using BNL approximated sigmas for the 70-meter release height, and agree within a factor of 2 for the 260-meter release height.

The dose estimates in this report are based on assumptions, some of which may tend to make the calculated doses conservative (higher), while others may make the calculated doses nonconservative (lower). Assumptions or factors that could make the dose estimates higher than would reasonably be expected are:

(1) A release inside the building of 100% of the equilibrium inventory of noble gases and 50% of the iodines. This is postulated as the worst possible case and would very probably be much less, particularly for the iodines.

(2) The assumption of an instantaneous release to the atmosphere. The actual release would more likely occur over a period of 30 minutes to hours thereby reducing off-site exposure significantly by radioactive decay.

(3) The persistence of wind speed and direction over the effective transport time. The relatively large distances involved in transporting airborne material to off-site locations enhance the probability of increased dispersion (and reduced dose estimates) from wind variability.

(4) A limiting dispersion angle of 2 degrees for all stable atmospheric conditions. The largest dose estimates at off-site locations were derived from these limiting conditions. If the

BNL correlations allowed for varying degrees of stable atmospheric conditions, the cumulative frequency of occurrence of the higher doses would be reduced.

Assumptions or factors that could make calculated doses lower than would be reasonably expected are:

(1) The applicability of the BNL computation methods and correlations to SRP. Comparison of the measured sigmas at SRL with the sigmas derived from the BNL correlation were in good agreement at ~300 feet. Comparison of measured and derived sigmas for 800 feet was not as good. If measured sigmas were used, the maximum calculated doses would be about a factor of two higher. The measured sigmas were not used for either elevation because applicability of the measurements has not been verified by diffusion tests.

(2) The data collection period was only two years long. Longer data samples could lead to higher doses, although the studies in this report show that the increase would be insignificant.

METEOROLOGICAL ANALYSES

Distribution analyses of meteorological parameters were continually updated as data became available. These analyses were:

a) Wind speed frequency distributions

b) Atmospheric stability

c) Wind speed frequency within stability classifications

Table VII shows wind speed frequency distributions for the 6 wind set elevations. Within each speed increment, as indicated, are the number of events, the ratio of this number of events to the total for each elevation, and the cumulative percent including the speed increment of concern. The last row of numbers gives the total number of events for each elevation. The difference between these totals and the total number of records processed represents the number of samples rejected from each elevation due to malfunctions or suspect data.

Wind speed distributions for 850 ft and 230 ft, the two elevations of interest, are shown in Table VIII for each of 8 wind sectors. The numbers immediately following the sector designations represent the percentages of the total samples for that sector. The percentages for each speed increment and sector represent the percent of events with respect to the total within the sector.

Tables IX through XII show the same kind of information as Table VIII, but for a finer speed mesh for the two stability classifications. Percentages shown are with respect to the total number of samples processed.

Table XIII is a stability analysis for the two elevations of interest which was performed according to the BNL classification procedure outlined under Dose Calculations. Classifications were made for stable conditions according to lapse rate and for unstable conditions according to lapse rate and the computed dispersion angle σ_a. Also, if conditions at either elevation were unstable according to the sample being processed, a search was made to determine if an inversion exists below. These events were counted and classified according to lapse magnitude as shown.

A possible fumigation event is considered to have occurred if the lapse rate at the elevation of interest changes from some positive value to a negative value of at least $1^{\circ}F/100$ ft. This condition occurs very infrequently for both release heights.

An interesting point indicated by these analyses is that greater than 90% of the data at both elevations fall within the $\pm 1^{\circ}F/100$ ft classification.

Tables XIV through XXVIII are the dose distribution analyses for the 70- and 260-meter release height and three downwind distances out to 40 km. These tables are obtained directly from the WRED code described in Appendix E and tabulated doses are for 1000 MW operation. Tables VII through XXVIII constitute a full output from the code for a consolidation of a new run and previous statistics. A similar output is also provided for the data constituting the new run only.

TABLE VII

2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

FREQUENCY OF WIND SPEED IN METERS PER SEC BY ELEVATION IN FEET

	ELEVATION						FRACTION AT EACH SPEED BY ELEVATION						ACCUM FRACTION BY SPEED BY ELEVATION					
SPEED	1000	800	600	450	300	120	1000	800	600	450	300	120	1000	800	600	450	300	120
0 TO 1	3054	4350	4530	7133	6655	11744	0.02	0.02	0.02	0.03	0.03	0.05	0.02	0.02	0.02	0.03	0.03	0.05
1 TO 2	6634	9543	10370	9998	15345	26109	0.04	0.04	0.04	0.05	0.06	0.11	0.06	0.06	0.06	0.08	0.09	0.15
2 TO 3	13042	18581	19837	18369	28575	47555	0.09	0.07	0.08	0.09	0.11	0.19	0.15	0.13	0.14	0.16	0.20	0.35
3 TO 4	15266	24017	24782	22720	34373	56300	0.10	0.10	0.10	0.11	0.13	0.23	0.25	0.23	0.24	0.27	0.33	0.58
4 TO 5	16158	25349	26490	23719	36510	46297	0.11	0.10	0.11	0.11	0.14	0.19	0.36	0.33	0.34	0.38	0.47	0.77
5 TO 6	16207	26908	27726	26357	38747	29049	0.11	0.11	0.11	0.12	0.15	0.12	0.46	0.43	0.45	0.50	0.62	0.89
6 TO 7	14218	23231	25474	24042	32190	12576	0.09	0.09	0.10	0.11	0.13	0.05	0.56	0.53	0.56	0.61	0.75	0.94
7 TO 8	11780	21237	23311	21944	26761	6569	0.08	0.08	0.09	0.10	0.10	0.03	0.63	0.61	0.65	0.72	0.85	0.97
8 TO 9	11222	20311	21970	20856	19411	3901	0.07	0.08	0.09	0.10	0.08	0.02	0.71	0.69	0.74	0.81	0.93	0.98
9 TO 10	9836	17342	18055	15841	9688	2012	0.06	0.07	0.07	0.07	0.04	0.01	0.77	0.76	0.81	0.89	0.97	0.99
10 TO 11	9738	16560	17454	12095	4526	1189	0.06	0.07	0.07	0.06	0.02	0.00	0.84	0.83	0.88	0.94	0.98	0.99
11 TO 12	7463	13545	12417	6457	1963	585	0.05	0.05	0.05	0.03	0.01	0.00	0.89	0.88	0.93	0.97	0.99	1.00
12 TO 13	5611	10098	8377	3321	992	318	0.04	0.04	0.03	0.02	0.00	0.00	0.92	0.92	0.96	0.99	1.00	1.00
13 TO 14	4508	8055	5350	1522	615	165	0.03	0.03	0.02	0.01	0.00	0.00	0.95	0.95	0.98	0.99	1.00	1.00
14 TO 15	3006	5093	2548	571	289	86	0.02	0.02	0.01	0.00	0.00	0.00	0.97	0.97	0.99	1.00	1.00	1.00
15 TO 16	1940	3240	1194	281	144	41	0.01	0.01	0.00	0.00	0.00	0.00	0.98	0.99	1.00	1.00	1.00	1.00
16 TO 17	1118	1826	539	150	82	13	0.01	0.01	0.00	0.00	0.00	0.00	0.99	0.99	1.00	1.00	1.00	1.00
17 TO 18	610	879	181	61	43	11	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
18 TO 19	316	338	76	32	18	5	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
19 TO 20	172	144	36	10	5	1	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
OVER 20	120	111	41	46	52	65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
TOTALS	152019	250758	250758	215525	256984	244591												

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE VIII

2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

WIND DIRECTION DATA AT 853. FEET

	SECTOR 1 8.73		SECTOR 2 13.18		SECTOR 3 11.61		SECTOR 4 8.83		SECTOR 5 14.53		SECTOR 6 18.11		SECTOR 7 18.05		SECTOR 8 6.95	
SPEED	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
1	1018	4.53	1347	3.97	995	3.33	977	4.30	1341	3.59	1294	2.78	1167	2.51	941	5.26
2	1107	4.93	1202	3.54	1247	4.17	1146	5.04	1405	3.76	1791	3.84	1406	3.03	1066	5.96
3	2073	9.23	2143	6.32	1977	6.62	1862	8.20	2486	6.65	3168	6.80	2606	5.61	1764	9.87
4	2862	12.74	3017	8.90	2829	9.47	2098	9.24	3049	8.15	3747	8.04	3215	6.92	1956	10.94
5	2666	11.87	3565	10.51	3551	11.89	2307	10.16	3200	8.56	4038	8.66	3357	7.23	1744	9.76
6	2510	11.17	4009	11.82	3750	12.55	2442	10.75	3527	9.43	4311	9.25	3500	7.53	1550	8.67
7	1925	8.57	3337	9.84	2668	8.93	2339	10.30	3167	8.47	4120	8.84	3389	7.30	1183	6.62
8	1829	8.14	2772	8.17	2372	7.94	1927	8.48	3075	8.22	3558	7.63	3265	7.03	1211	6.78
9	1586	7.06	2382	7.02	2183	7.31	1734	7.63	2829	7.57	3816	8.19	3435	7.39	1295	7.25
10	1281	5.70	2185	6.44	2215	7.41	1329	5.85	2317	6.20	3252	6.98	3056	6.58	1169	6.54
11	1210	5.39	2088	6.16	2044	6.84	1280	5.63	2237	5.98	2842	6.10	3434	7.39	1087	6.08
12	807	3.59	1761	5.19	1503	5.03	789	3.47	1592	4.26	2352	5.05	3219	6.93	872	4.88
13	532	2.37	1262	3.72	811	2.71	591	2.60	1193	3.19	1872	4.02	2503	5.39	693	3.88
14	456	2.03	922	2.72	568	1.90	465	2.05	1084	2.90	1496	3.21	1952	4.20	450	2.52
15	230	1.02	606	1.79	307	1.03	209	0.92	876	2.34	986	2.12	1272	2.74	277	1.55
16	136	0.61	457	1.35	141	0.47	134	0.59	706	1.89	710	1.52	888	1.91	140	0.78
17	56	0.25	307	0.91	96	0.32	171	0.75	519	1.39	504	1.08	567	1.22	67	0.37
18	39	0.17	173	0.51	81	0.27	192	0.85	321	0.86	290	0.62	434	0.93	48	0.27
19	26	0.12	92	0.27	94	0.31	186	0.82	197	0.53	169	0.36	304	0.65	42	0.23
20	15	0.07	61	0.18	49	0.16	115	0.51	146	0.39	140	0.30	295	0.64	45	0.25
21	98	0.44	229	0.68	391	1.31	423	1.86	2125	5.68	2151	4.62	3188	6.86	274	1.53

WIND DIRECTION DATA AT 230. FEET

	SECTOR 1 10.43		SECTOR 2 13.97		SECTOR 3 11.25		SECTOR 4 10.83		SECTOR 5 15.67		SECTOR 6 16.85		SECTOR 7 14.85		SECTOR 8 6.15	
SPEED	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
1	802	2.99	702	1.95	985	3.40	1302	4.67	1125	2.79	876	2.02	795	2.08	699	4.42
2	1995	7.44	1506	4.19	1748	6.04	1892	6.79	2761	6.85	2208	5.09	1811	4.74	1342	8.49
3	3626	13.52	3442	9.57	2963	10.23	3122	11.21	4448	11.03	3993	9.21	3627	9.50	2217	14.02
4	4366	16.28	4564	12.69	3528	12.18	3531	12.67	5208	12.92	4875	11.24	4398	11.51	2198	13.90
5	4082	15.22	5369	14.93	4201	14.51	3734	13.40	5333	13.23	5550	12.80	4223	11.06	2006	12.68
6	3785	14.11	5686	15.82	4275	14.76	3710	13.32	5873	14.56	6097	14.06	4641	12.15	1812	11.46
7	2738	10.21	4737	13.18	3776	13.04	3346	12.01	4633	11.49	5372	12.39	4319	11.31	1719	10.87
8	2100	7.83	4062	11.30	2968	10.25	2672	9.59	3645	9.04	4844	11.17	4048	10.60	1410	8.92
9	1526	5.69	2703	7.52	2318	8.01	1888	6.78	2967	7.36	3930	9.06	3542	9.27	994	6.28
10	744	2.77	1619	4.50	961	3.32	937	3.36	1482	3.68	2361	5.44	2422	6.34	519	3.28
11	488	1.82	853	2.37	308	1.06	671	2.41	999	2.48	1496	3.45	1821	4.77	373	2.36
12	328	1.22	309	0.86	157	0.54	346	1.24	536	1.33	688	1.59	1009	2.64	230	1.45
13	153	0.57	158	0.44	109	0.38	163	0.59	281	0.70	368	0.85	666	1.74	139	0.88
14	46	0.17	80	0.22	65	0.22	94	0.34	251	0.62	274	0.63	426	1.12	82	0.52
15	19	0.07	42	0.12	33	0.11	56	0.20	196	0.49	166	0.38	224	0.59	48	0.30
16	9	0.03	20	0.06	23	0.08	24	0.09	176	0.44	112	0.26	103	0.27	14	0.09
17	5	0.02	19	0.05	30	0.10	39	0.14	155	0.38	50	0.12	61	0.16	6	0.04
18	3	0.01	20	0.06	64	0.22	27	0.10	96	0.24	32	0.07	30	0.08	3	0.02
19	2	0.01	26	0.07	99	0.34	27	0.10	55	0.14	19	0.04	12	0.03	0	0.0
20	1	0.00	12	0.03	87	0.30	21	0.08	27	0.07	9	0.02	9	0.02	1	0.01
21	8	0.03	23	0.06	258	0.89	256	0.92	77	0.19	42	0.10	11	0.03	4	0.03

TABLE IX

2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

WIND SPEED DISTRIBUTION BY STABILITY CLASSIFICATION AT 853. FEET

SPEED AND DIRECTION DATA FOR STABLE CONDITIONS

	SECTOR 1 2.66		SECTOR 2 4.02		SECTOR 3 3.52		SECTOR 4 2.69		SECTOR 5 4.42		SECTOR 6 5.51		SECTOR 7 5.50		SECTOR 8 2.92	
SPEED	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	43.	0.02	64.	0.02	48.	0.02	40.	0.02	67.	0.03	87.	0.03	61.	0.02	39.	0.02
1.0	73.	0.03	70.	0.03	93.	0.04	59.	0.02	115.	0.04	108.	0.04	82.	0.03	54.	0.02
1.5	122.	0.05	132.	0.05	160.	0.06	105.	0.04	145.	0.06	134.	0.05	121.	0.05	91.	0.04
2.0	135.	0.05	158.	0.06	166.	0.06	131.	0.05	161.	0.06	157.	0.06	123.	0.05	125.	0.05
2.5	183.	0.07	199.	0.08	242.	0.09	187.	0.07	225.	0.09	280.	0.11	182.	0.07	204.	0.08
3.0	197.	0.08	233.	0.09	248.	0.10	208.	0.08	225.	0.09	317.	0.12	249.	0.10	164.	0.06
3.5	289.	0.11	270.	0.10	284.	0.11	224.	0.09	300.	0.12	352.	0.14	347.	0.13	217.	0.08
4.0	309.	0.12	332.	0.13	344.	0.13	257.	0.10	368.	0.14	410.	0.16	383.	0.15	254.	0.10
4.5	256.	0.10	305.	0.12	359.	0.14	279.	0.11	442.	0.17	503.	0.20	404.	0.16	221.	0.09
5.0	303.	0.12	325.	0.13	429.	0.17	260.	0.10	479.	0.19	519.	0.20	492.	0.19	285.	0.11
5.5	285.	0.11	334.	0.13	440.	0.17	227.	0.09	445.	0.17	461.	0.18	447.	0.17	269.	0.10
6.0	313.	0.12	318.	0.12	450.	0.17	266.	0.10	480.	0.19	547.	0.21	474.	0.18	240.	0.09
6.5	270.	0.10	332.	0.13	409.	0.16	324.	0.13	537.	0.21	694.	0.27	477.	0.19	266.	0.10
7.0	217.	0.08	342.	0.13	322.	0.13	399.	0.16	521.	0.20	687.	0.27	540.	0.21	235.	0.09
7.5	220.	0.09	395.	0.15	410.	0.16	342.	0.13	531.	0.21	597.	0.23	624.	0.24	266.	0.10
8.0	252.	0.10	367.	0.14	388.	0.15	337.	0.13	571.	0.22	609.	0.24	621.	0.24	264.	0.10
8.5	258.	0.10	349.	0.14	411.	0.16	330.	0.13	636.	0.25	649.	0.25	710.	0.28	255.	0.10
9.0	183.	0.07	262.	0.10	353.	0.14	294.	0.11	507.	0.20	667.	0.26	601.	0.23	238.	0.09
9.5	229.	0.09	361.	0.14	435.	0.17	352.	0.14	504.	0.20	667.	0.26	638.	0.25	291.	0.11
10.0	171.	0.07	325.	0.13	431.	0.17	312.	0.12	450.	0.17	658.	0.26	618.	0.24	217.	0.08
10.5	192.	0.07	331.	0.13	487.	0.19	277.	0.11	485.	0.19	671.	0.26	650.	0.25	199.	0.08
11.0	156.	0.06	258.	0.10	487.	0.19	299.	0.12	487.	0.19	512.	0.20	615.	0.24	230.	0.09
11.5	162.	0.06	296.	0.12	442.	0.17	259.	0.10	500.	0.19	479.	0.19	562.	0.22	223.	0.09
12.0	122.	0.05	272.	0.11	345.	0.13	173.	0.07	332.	0.13	443.	0.17	462.	0.18	147.	0.06
12.5	109.	0.04	313.	0.12	316.	0.12	176.	0.07	372.	0.14	435.	0.17	515.	0.20	186.	0.07
13.0	96.	0.04	306.	0.12	229.	0.09	154.	0.06	342.	0.13	409.	0.16	443.	0.17	187.	0.07
13.5	87.	0.03	298.	0.12	212.	0.08	142.	0.06	330.	0.13	360.	0.14	442.	0.17	140.	0.05
14.0	98.	0.04	223.	0.09	177.	0.07	127.	0.05	338.	0.13	329.	0.13	397.	0.15	124.	0.05
14.5	85.	0.03	191.	0.07	172.	0.07	116.	0.05	286.	0.11	308.	0.12	332.	0.13	103.	0.04
15.0	56.	0.02	127.	0.05	106.	0.04	102.	0.04	236.	0.09	232.	0.09	247.	0.10	61.	0.02
15.5	42.	0.02	132.	0.05	64.	0.02	76.	0.03	279.	0.11	199.	0.08	223.	0.09	48.	0.02
16.0	36.	0.01	100.	0.04	40.	0.02	40.	0.02	251.	0.10	164.	0.06	213.	0.08	27.	0.01
16.5	21.	0.01	84.	0.03	35.	0.01	12.	0.00	188.	0.07	143.	0.06	169.	0.07	30.	0.01
17.0	13.	0.01	58.	0.02	13.	0.01	20.	0.01	141.	0.05	126.	0.05	118.	0.05	26.	0.01
17.5	9.	0.00	49.	0.02	3.	0.00	11.	0.00	74.	0.03	89.	0.03	106.	0.04	6.	0.00
18.0	5.	0.00	37.	0.01	9.	0.00	12.	0.00	32.	0.01	68.	0.03	112.	0.04	4.	0.00
18.5	5.	0.00	14.	0.01	9.	0.00	8.	0.00	12.	0.00	67.	0.03	77.	0.03	2.	0.00
19.0	0.0	0.0	12.	0.00	4.	0.00	9.	0.00	17.	0.01	35.	0.01	56.	0.02	1.	0.00
19.5	0.0	0.0	5.	0.00	0.0	0.0	10.	0.00	10.	0.00	8.	0.00	35.	0.01	0.0	0.0
20.0	0.0	0.0	4.	0.00	0.0	0.0	18.	0.01	8.	0.00	6.	0.00	12.	0.00	0.0	0.0
>20.0	4.	0.00	1.	0.00	3.	0.00	34.	0.01	2.	0.00	23.	0.01	29.	0.01	0.0	0.0

TABLE X

2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

WIND SPEED DISTRIBUTION BY STABILITY CLASSIFICATION AT 230. FEET

SPEED AND DIRECTION DATA FOR STABLE CONDITIONS

	SECTOR 1	3.30	SECTOR 2	4.43	SECTOR 3	3.56	SECTOR 4	3.42	SECTOR 5	4.95	SECTOR 6	5.34	SECTOR 7	4.70	SECTOR 8	1.95
SPEED	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	158.	0.06	76.	0.03	212.	0.08	123.	0.05	125.	0.05	170.	0.07	196.	0.08	344.	0.13
1.0	118.	0.05	85.	0.03	172.	0.07	108.	0.04	249.	0.10	139.	0.05	140.	0.05	121.	0.05
1.5	164.	0.06	197.	0.08	257.	0.10	179.	0.07	512.	0.20	306.	0.12	227.	0.09	163.	0.06
2.0	219.	0.09	219.	0.09	340.	0.13	341.	0.13	634.	0.25	349.	0.14	257.	0.10	202.	0.08
2.5	260.	0.10	495.	0.19	414.	0.16	499.	0.19	573.	0.22	391.	0.15	377.	0.15	246.	0.10
3.0	306.	0.12	477.	0.19	505.	0.20	542.	0.21	744.	0.29	512.	0.20	578.	0.22	328.	0.13
3.5	315.	0.12	506.	0.20	564.	0.22	611.	0.24	797.	0.31	627.	0.24	600.	0.23	347.	0.13
4.0	358.	0.14	512.	0.20	780.	0.30	721.	0.28	853.	0.33	857.	0.33	730.	0.28	343.	0.13
4.5	436.	0.17	598.	0.23	792.	0.31	831.	0.32	1103.	0.43	1120.	0.44	762.	0.30	398.	0.15
5.0	527.	0.20	610.	0.24	818.	0.32	905.	0.35	1296.	0.50	1190.	0.46	824.	0.32	375.	0.15
5.5	494.	0.19	684.	0.27	1107.	0.43	1050.	0.41	1280.	0.50	1438.	0.56	956.	0.37	443.	0.17
6.0	545.	0.21	800.	0.31	1131.	0.44	1058.	0.41	1180.	0.46	1364.	0.53	973.	0.38	593.	0.23
6.5	564.	0.22	1019.	0.40	997.	0.39	1017.	0.40	1117.	0.43	1254.	0.49	1050.	0.41	513.	0.20
7.0	505.	0.20	895.	0.35	869.	0.34	680.	0.26	828.	0.32	1021.	0.40	853.	0.33	380.	0.15
7.5	524.	0.20	841.	0.33	848.	0.33	528.	0.21	816.	0.32	1107.	0.43	836.	0.32	361.	0.14
8.0	401.	0.16	579.	0.23	649.	0.25	349.	0.14	662.	0.26	835.	0.32	682.	0.27	247.	0.10
8.5	186.	0.07	448.	0.17	373.	0.14	168.	0.07	323.	0.13	568.	0.22	493.	0.19	148.	0.06
9.0	133.	0.05	245.	0.10	81.	0.03	67.	0.03	230.	0.09	363.	0.14	279.	0.11	88.	0.03
9.5	36.	0.01	112.	0.04	17.	0.01	26.	0.01	116.	0.05	168.	0.07	164.	0.06	37.	0.01
10.0	23.	0.01	18.	0.01	4.	0.00	19.	0.01	46.	0.02	75.	0.03	70.	0.03	19.	0.01
10.5	7.	0.00	3.	0.00	4.	0.00	14.	0.01	29.	0.01	25.	0.01	40.	0.02	13.	0.01
11.0	7.	0.00	1.	0.00	4.	0.00	4.	0.00	12.	0.00	10.	0.00	23.	0.01	4.	0.00
11.5	4.	0.00	1.	0.00	4.	0.00	5.	0.00	6.	0.00	4.	0.00	14.	0.01	0.0	0.0
12.0	4.	0.00	0.0	0.0	3.	0.00	1.	0.00	4.	0.00	2.	0.00	5.	0.00	3.	0.00
12.5	1.	0.00	0.0	0.0	1.	0.00	1.	0.00	1.	0.00	8.	0.00	3.	0.00	1.	0.00
13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.	0.00	5.	0.00	2.	0.00	0.0	0.0
13.5	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	0.0	0.0	4.	0.00	0.0	0.0	0.0	0.0
14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.	0.00	2.	0.00	0.0	0.0
14.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	1.	0.00	2.	0.00	0.0	0.0
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	0.0	0.0	1.	0.00	0.0	0.0
15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16.0	1.	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16.5	0.0	0.0	1.	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	0.0	0.0
17.0	0.0	0.0	1.	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00
17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	0.0	0.0	0.0	0.0	0.0	0.0
>20.0	0.0	0.0	2.	0.00	0.0	0.0	1.	0.00	0.0	0.0	4.	0.00	1.	0.00	0.0	0.0

TABLE XI

2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

WIND SPEED DISTRIBUTION BY STABILITY CLASSIFICATION AT 853. FEET

SPEED AND DIRECTION DATA FOR UNSTABLE CONDITIONS

	SECTOR 1	6.07	SECTOR 2	9.16	SECTOR 3	8.09	SECTOR 4	6.14	SECTOR 5	10.09	SECTOR 6	12.60	SECTOR 7	12.55	SECTOR 8	4.03
SPEED	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	221.	0.09	303.	0.12	101.	0.04	120.	0.05	150.	0.06	202.	0.08	151.	0.06	161.	0.06
1.0	243.	0.09	261.	0.10	228.	0.09	231.	0.09	224.	0.09	259.	0.10	288.	0.11	229.	0.09
1.5	358.	0.14	420.	0.16	376.	0.15	369.	0.14	385.	0.15	485.	0.19	491.	0.19	349.	0.14
2.0	541.	0.21	542.	0.21	554.	0.23	601.	0.23	702.	0.27	868.	0.34	755.	0.29	543.	0.21
2.5	762.	0.30	726.	0.28	766.	0.30	707.	0.27	950.	0.37	1233.	0.48	967.	0.38	659.	0.26
3.0	968.	0.38	1060.	0.41	901.	0.35	812.	0.32	1233.	0.48	1455.	0.57	1265.	0.49	820.	0.32
3.5	1213.	0.47	1212.	0.47	954.	0.37	903.	0.35	1290.	0.50	1600.	0.62	1338.	0.52	841.	0.33
4.0	1321.	0.51	1525.	0.59	1211.	0.47	896.	0.35	1505.	0.58	1640.	0.64	1393.	0.54	836.	0.32
4.5	1106.	0.43	1439.	0.56	1371.	0.53	874.	0.34	1465.	0.57	1573.	0.61	1369.	0.53	651.	0.25
5.0	1056.	0.41	1614.	0.63	1475.	0.57	908.	0.35	1381.	0.54	1760.	0.68	1339.	0.52	638.	0.25
5.5	959.	0.37	1679.	0.65	1387.	0.54	945.	0.37	1520.	0.59	1699.	0.66	1324.	0.51	504.	0.20
6.0	917.	0.36	1606.	0.62	1413.	0.55	957.	0.37	1381.	0.54	1798.	0.70	1331.	0.52	478.	0.19
6.5	844.	0.33	1407.	0.55	1118.	0.43	878.	0.34	1280.	0.50	1645.	0.64	1323.	0.51	368.	0.14
7.0	738.	0.29	1397.	0.54	1020.	0.40	879.	0.34	1307.	0.51	1512.	0.59	1263.	0.49	374.	0.15
7.5	706.	0.27	1257.	0.49	993.	0.39	757.	0.29	1259.	0.49	1436.	0.56	1157.	0.45	401.	0.16
8.0	652.	0.25	1029.	0.40	852.	0.33	659.	0.26	1179.	0.46	1221.	0.47	1029.	0.40	385.	0.15
8.5	581.	0.23	882.	0.34	658.	0.26	571.	0.22	924.	0.36	1170.	0.45	1090.	0.42	365.	0.14
9.0	581.	0.23	874.	0.34	730.	0.28	594.	0.23	900.	0.35	1196.	0.46	1108.	0.43	374.	0.15
9.5	478.	0.19	868.	0.34	687.	0.27	528.	0.21	824.	0.32	1139.	0.44	1176.	0.46	378.	0.15
10.0	374.	0.15	719.	0.28	636.	0.25	454.	0.18	734.	0.29	892.	0.35	1055.	0.41	368.	0.14
10.5	433.	0.17	740.	0.29	627.	0.24	350.	0.14	636.	0.25	956.	0.37	1178.	0.46	357.	0.14
11.0	367.	0.14	615.	0.24	504.	0.20	376.	0.15	602.	0.23	840.	0.33	1293.	0.50	302.	0.12
11.5	312.	0.12	585.	0.23	473.	0.18	298.	0.12	519.	0.20	884.	0.34	1384.	0.54	280.	0.11
12.0	260.	0.10	552.	0.21	403.	0.16	203.	0.08	396.	0.15	799.	0.31	1358.	0.53	298.	0.12
12.5	192.	0.07	453.	0.18	250.	0.10	162.	0.06	363.	0.14	598.	0.23	1117.	0.43	269.	0.10
13.0	160.	0.06	358.	0.14	207.	0.08	124.	0.05	271.	0.11	652.	0.25	1003.	0.39	220.	0.09
13.5	151.	0.06	286.	0.11	123.	0.05	112.	0.04	217.	0.08	541.	0.21	859.	0.33	151.	0.06
14.0	108.	0.04	244.	0.09	115.	0.04	117.	0.05	243.	0.09	506.	0.20	786.	0.31	110.	0.04
14.5	78.	0.03	161.	0.06	53.	0.02	82.	0.03	199.	0.08	375.	0.15	559.	0.22	83.	0.03
15.0	40.	0.02	153.	0.06	35.	0.01	65.	0.03	185.	0.07	353.	0.14	469.	0.18	68.	0.03
15.5	36.	0.01	92.	0.04	18.	0.01	36.	0.01	150.	0.06	314.	0.12	387.	0.15	39.	0.02
16.0	18.	0.01	92.	0.04	4.	0.00	17.	0.01	125.	0.05	227.	0.09	259.	0.10	20.	0.01
16.5	8.	0.00	70.	0.03	1.	0.00	17.	0.01	127.	0.05	226.	0.09	215.	0.08	9.	0.00
17.0	3.	0.00	44.	0.02	3.	0.00	15.	0.01	109.	0.04	125.	0.05	114.	0.04	0.0	0.0
17.5	2.	0.00	29.	0.01	5.	0.00	15.	0.01	61.	0.02	82.	0.03	100.	0.04	4.	0.00
18.0	2.	0.00	12.	0.00	2.	0.00	17.	0.01	54.	0.02	57.	0.02	65.	0.03	3.	0.00
18.5	1.	0.00	12.	0.00	0.0	0.0	13.	0.01	34.	0.01	35.	0.01	27.	0.01	0.0	0.0
19.0	0.0	0.0	4.	0.00	1.	0.00	14.	0.01	25.	0.01	20.	0.01	20.	0.01	0.0	0.0
19.5	0.0	0.0	5.	0.00	0.0	0.0	9.	0.00	21.	0.01	8.	0.00	15.	0.01	0.0	0.0
20.0	0.0	0.0	2.	0.00	0.0	0.0	6.	0.00	11.	0.00	2.	0.00	11.	0.00	0.0	0.0
>20.0	2.	0.00	4.	0.00	2.	0.00	17.	0.01	20.	0.01	15.	0.01	12.	0.00	0.0	0.0

TABLE XII

2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

WIND SPEED DISTRIBUTION BY STABILITY CLASSIFICATION AT 230. FEET

SPEED AND DIRECTION DATA FOR UNSTABLE CONDITIONS

	SECTOR 1 7.13		SECTOR 2 9.54		SECTOR 3 7.69		SECTOR 4 7.41		SECTOR 5 10.72		SECTOR 6 11.51		SECTOR 7 10.15		SECTOR 8 4.20	
SPEED	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	318.	0.12	415.	0.16	591.	0.23	497.	0.19	536.	0.21	658.	0.26	791.	0.31	550.	0.21
1.0	411.	0.16	324.	0.13	361.	0.14	383.	0.15	537.	0.21	412.	0.16	379.	0.15	297.	0.12
1.5	779.	0.30	548.	0.21	628.	0.24	747.	0.29	875.	0.34	768.	0.30	693.	0.27	489.	0.19
2.0	1068.	0.42	848.	0.33	777.	0.30	995.	0.39	1250.	0.49	1172.	0.46	1003.	0.39	692.	0.27
2.5	1413.	0.55	1269.	0.49	1094.	0.43	1291.	0.50	1710.	0.66	1745.	0.68	1460.	0.57	960.	0.37
3.0	1953.	0.76	1890.	0.73	1285.	0.50	1594.	0.62	2194.	0.85	2145.	0.83	1843.	0.72	1050.	0.41
3.5	1963.	0.76	2156.	0.84	1484.	0.58	1516.	0.59	2387.	0.93	2171.	0.84	1751.	0.68	890.	0.35
4.0	2002.	0.78	2422.	0.94	1780.	0.69	1537.	0.60	2525.	0.98	2295.	0.89	1713.	0.67	789.	0.31
4.5	1949.	0.76	2658.	1.03	1794.	0.70	1504.	0.58	2376.	0.92	2370.	0.92	1642.	0.64	664.	0.26
5.0	1731.	0.67	2631.	1.02	1757.	0.68	1325.	0.51	2287.	0.89	2258.	0.88	1546.	0.60	617.	0.24
5.5	1536.	0.60	2436.	0.95	1549.	0.60	1282.	0.50	2167.	0.84	2230.	0.87	1638.	0.64	554.	0.22
6.0	1261.	0.49	2114.	0.82	1226.	0.48	1130.	0.44	1831.	0.71	1778.	0.69	1608.	0.62	510.	0.20
6.5	1030.	0.40	1842.	0.72	1025.	0.40	1002.	0.39	1478.	0.57	1615.	0.63	1580.	0.61	440.	0.17
7.0	904.	0.35	1608.	0.62	880.	0.34	903.	0.35	1254.	0.49	1502.	0.58	1556.	0.60	367.	0.14
7.5	664.	0.26	1096.	0.43	628.	0.24	725.	0.28	886.	0.34	1231.	0.48	1427.	0.55	305.	0.12
8.0	530.	0.21	848.	0.33	442.	0.17	574.	0.22	704.	0.27	1059.	0.41	1268.	0.49	272.	0.11
8.5	357.	0.14	542.	0.21	280.	0.11	399.	0.16	523.	0.20	848.	0.33	1161.	0.45	186.	0.07
9.0	231.	0.09	347.	0.13	154.	0.06	235.	0.09	346.	0.13	704.	0.27	870.	0.34	131.	0.05
9.5	156.	0.06	216.	0.08	86.	0.03	133.	0.05	246.	0.10	598.	0.23	778.	0.30	117.	0.05
10.0	64.	0.02	130.	0.05	57.	0.02	84.	0.03	150.	0.06	493.	0.19	549.	0.21	60.	0.02
10.5	60.	0.02	87.	0.03	43.	0.02	45.	0.02	123.	0.05	377.	0.15	421.	0.16	52.	0.02
11.0	58.	0.02	41.	0.02	40.	0.02	36.	0.01	91.	0.04	307.	0.12	381.	0.15	26.	0.01
11.5	22.	0.01	27.	0.01	14.	0.01	20.	0.01	66.	0.03	172.	0.07	244.	0.09	28.	0.01
12.0	25.	0.01	11.	0.00	8.	0.00	21.	0.01	74.	0.03	149.	0.06	222.	0.09	13.	0.01
12.5	13.	0.01	9.	0.00	8.	0.00	4.	0.00	38.	0.01	108.	0.04	140.	0.05	12.	0.00
13.0	6.	0.00	5.	0.00	4.	0.00	10.	0.00	34.	0.01	97.	0.04	121.	0.05	7.	0.00
13.5	9.	0.00	1.	0.00	5.	0.00	6.	0.00	31.	0.01	47.	0.02	70.	0.03	5.	0.00
14.0	3.	0.00	3.	0.00	3.	0.00	7.	0.00	10.	0.00	37.	0.01	65.	0.03	2.	0.00
14.5	3.	0.00	0.0	0.0	1.	0.00	0.0	0.0	12.	0.00	33.	0.01	42.	0.02	3.	0.00
15.0	2.	0.00	0.0	0.0	0.0	0.0	1.	0.00	8.	0.00	18.	0.01	26.	0.01	2.	0.00
15.5	0.0	0.0	1.	0.00	0.0	0.0	2.	0.00	17.	0.01	12.	0.00	22.	0.01	2.	0.00
16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.	0.00	11.	0.00	6.	0.00	0.0	0.0
16.5	4.	0.00	0.0	0.0	0.0	0.0	0.0	0.0	5.	0.00	5.	0.00	12.	0.00	0.0	0.0
17.0	1.	0.00	0.0	0.0	1.	0.00	0.0	0.0	3.	0.00	3.	0.00	7.	0.00	2.	0.00
17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	7.	0.00	0.0	0.0
18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	0.0	0.0	2.	0.00	0.0	0.0
18.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.	0.00	1.	0.00	0.0	0.0
19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	0.0	0.0	1.	0.00	0.0	0.0
19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	0.0	0.0
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.	0.00	0.0	0.0	0.0	0.0
>20.0	4.	0.00	2.	0.00	5.	0.00	1.	0.00	3.	0.00	11.	0.00	10.	0.00	4.	0.00

TABLE XIII

2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

STABILITY ANALYSES

260-METER ANALYSIS

LAPSE RATE DEG F/100'	STABLE	PERCENT	UNSTABLE SIGA < 15	PERCENT	UNSTABLE SIGA < 30	PERCENT	UNSTABLE SIGA < 45	PERCENT	UNSTABLE SIGA > 45	PERCENT
0 TO 1	77311	30.37	162690	63.92	11866	4.66	1391	0.55	1183	0.46
1 TO 2	29	0.01	22	0.01	2	0.00	0	0.0	0	0.0
2 TO 3	15	0.01	8	0.00	0	0.0	0	0.0	0	0.0
3 TO 4	6	0.00	1	0.00	0	0.0	0	0.0	0	0.0
4 TO 5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
OVER 5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	77361	30.39	162721	63.93	11868	4.66	1391	0.55	1183	0.46

70-METER ANALYSIS

LAPSE RATE DEG F/100'	STABLE	PERCENT	UNSTABLE SIGA < 15	PERCENT	UNSTABLE SIGA < 30	PERCENT	UNSTABLE SIGA < 45	PERCENT	UNSTABLE SIGA > 45	PERCENT
0 TO 1	80716	31.68	147306	57.81	21892	8.59	2341	0.92	2351	0.92
1 TO 2	64	0.03	44	0.02	15	0.01	0	0.0	2	0.00
2 TO 3	30	0.01	18	0.01	1	0.00	1	0.00	0	0.0
3 TO 4	13	0.01	5	0.00	0	0.0	0	0.0	1	0.00
4 TO 5	11	0.00	1	0.00	0	0.0	0	0.0	0	0.0
OVER 5	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	80835	31.72	147374	57.84	21908	8.60	2342	0.92	2354	0.92

UNSTABLE AT 260, INVERSION BELOW

LAPSE MAGNITUDE DEG F/100'	EVENTS	PERCENT
0 TO 1	49516	19.45
1 TO 2	802	0.32
2 TO 3	38	0.01
3 TO 4	33	0.01
4 TO 5	11	0.00
OVER 5	15	0.01
TOTALS	50415	19.81

UNSTABLE AT 70INVERSION BELOW

LAPSE MAGNITUDE DEG F/100'	EVENTS	PERCENT
0 TO 1	11580	4.54
1 TO 2	206	0.08
2 TO 3	10	0.00
3 TO 4	22	0.01
4 TO 5	6	0.00
OVER 5	14	0.01
TOTALS	11838	4.65

NUMBER OF POTENTIAL FUMIGATION EVENTS AT 260 METERS = 31 OR 0.01 PERCENT OF 254524 SAMPLES

NUMBER OF POTENTIAL FUMIGATION EVENTS AT 70 METERS = 74 OR 0.03 PERCENT OF 254813 SAMPLES

TABLE XIV

8.00 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY DOSE FOR A RELEASE HEIGHT OF 853. FEET

	SECTOR 1 8.73		SECTOR 2 13.18		SECTOR 3 11.61		SECTOR 4 8.83		SECTOR 5 14.53		SECTOR 6 18.11		SECTOR 7 18.05		SECTOR 8 6.95	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
2.0	4263	18.98	5642	16.63	5492	18.39	4139	18.44	5227	13.98	7172	15.39	7930	17.07	3278	18.34
4.0	14373	63.99	23631	69.67	19376	64.86	14512	63.88	26069	69.72	32361	69.43	32408	69.77	11237	62.87
6.0	1985	8.84	2639	7.78	2776	9.29	2214	9.75	3684	9.85	4319	9.27	3682	7.93	1775	9.93
8.0	814	3.62	927	2.73	1063	3.56	879	3.87	1228	3.28	1383	2.97	1313	2.83	709	3.97
10.0	446	1.99	468	1.38	472	1.58	381	1.68	458	1.22	573	1.23	562	1.21	340	1.90
12.0	226	1.01	221	0.65	260	0.87	210	0.92	246	0.66	342	0.73	211	0.45	226	1.26
14.0	102	0.45	129	0.38	153	0.51	117	0.52	151	0.40	142	0.30	101	0.22	116	0.65
16.0	86	0.38	84	0.25	97	0.32	73	0.32	76	0.20	84	0.18	79	0.17	71	0.40
18.0	66	0.29	65	0.19	59	0.20	45	0.20	75	0.20	67	0.14	61	0.13	36	0.20
20.0	29	0.13	31	0.09	34	0.11	36	0.16	47	0.13	31	0.07	23	0.05	32	0.18
22.0	20	0.09	28	0.08	33	0.11	18	0.08	43	0.11	30	0.06	39	0.08	23	0.13
24.0	22	0.10	15	0.04	27	0.09	19	0.08	31	0.08	44	0.09	20	0.04	17	0.10
26.0	30	0.13	37	0.11	30	0.10	23	0.10	57	0.15	59	0.13	23	0.05	14	0.08
28.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
30.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
32.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
34.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
36.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
38.0	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	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	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292. , NORMALIZATION FACTOR = 4.000E-01

CALCULATED THYROID INHALATION DOSE FOR A RELEASE HEIGHT OF 853. FEET

	SECTOR 1 8.73		SECTOR 2 13.18		SECTOR 3 11.61		SECTOR 4 8.83		SECTOR 5 14.53		SECTOR 6 18.11		SECTOR 7 18.05		SECTOR 8 6.95	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	16246	72.33	24425	72.01	23516	78.72	17017	74.91	27341	73.12	34854	74.78	35598	76.63	13790	77.15
1.0	6167	27.46	9412	27.75	6301	21.09	5522	24.31	9959	26.63	11576	24.84	10616	22.85	4042	22.61
1.5	49	0.22	79	0.23	55	0.18	177	0.78	92	0.25	177	0.38	238	0.51	42	0.23
2.0	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
> 10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XV

8.00 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY DOSE FOR A RELEASE HEIGHT OF 230. FEET

	SECTOR 1 10.43		SECTOR 2 13.97		SECTOR 3 11.25		SECTOR 4 10.83		SECTOR 5 15.67		SECTOR 6 16.85		SECTOR 7 14.85		SECTOR 8 6.15	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
5.0	20567	76.67	26573	73.91	18139	62.64	18071	64.87	26853	66.59	29560	68.17	27206	71.22	10367	65.55
10.0	0	0.0	2	0.01	0	0.0	1	0.00	0	0.0	1	0.00	1	0.00	0	0.0
15.0	0	0.0	1	0.00	0	0.0	0	0.0	2	0.00	4	0.01	0	0.0	1	0.01
20.0	1	0.00	1	0.00	1	0.00	2	0.01	5	0.01	16	0.04	9	0.02	1	0.01
25.0	41	0.15	14	0.04	17	0.06	40	0.14	84	0.21	99	0.23	141	0.37	36	0.23
30.0	494	1.84	1031	2.87	695	2.40	389	1.40	905	2.24	1430	3.30	1204	3.15	364	2.30
35.0	1213	4.52	1917	5.33	1971	6.81	1293	4.64	1930	4.79	2410	5.56	1930	5.05	814	5.15
40.0	1016	3.79	1776	4.94	1925	6.65	1875	6.73	2070	5.13	2437	5.62	1902	4.98	1013	6.40
45.0	702	2.62	966	2.69	1545	5.34	1473	5.29	1754	4.35	1968	4.54	1334	3.49	645	4.08
50.0	624	2.33	741	2.06	990	3.42	1069	3.84	1573	3.90	1460	3.37	999	2.62	475	3.00
55.0	397	1.48	557	1.55	740	2.56	747	2.68	945	2.34	982	2.26	685	1.79	349	2.21
60.0	268	1.00	364	1.01	582	2.01	556	2.00	638	1.58	618	1.43	561	1.47	269	1.70
65.0	202	0.75	328	0.90	364	1.26	387	1.39	512	1.27	432	1.00	412	1.08	245	1.55
70.0	160	0.60	262	0.73	280	0.97	304	1.09	396	0.98	281	0.65	303	0.79	160	1.01
75.0	155	0.58	219	0.61	265	0.92	306	1.10	382	0.95	276	0.64	289	0.76	172	1.09
80.0	131	0.49	226	0.63	206	0.71	222	0.80	295	0.73	176	0.41	198	0.52	109	0.69
85.0	127	0.47	237	0.66	170	0.59	218	0.78	261	0.65	180	0.42	175	0.46	103	0.65
90.0	62	0.23	166	0.46	124	0.43	151	0.54	176	0.44	111	0.26	103	0.27	81	0.51
95.0	88	0.33	82	0.23	133	0.46	138	0.50	210	0.52	126	0.29	127	0.33	93	0.59
100.0	56	0.21	54	0.15	90	0.31	88	0.32	149	0.37	84	0.19	47	0.12	45	0.28
105.0	50	0.19	57	0.16	76	0.26	84	0.30	164	0.41	92	0.21	69	0.18	49	0.31
110.0	45	0.17	45	0.13	66	0.23	48	0.17	112	0.28	60	0.14	56	0.15	37	0.23
115.0	46	0.17	39	0.11	50	0.17	51	0.18	138	0.34	94	0.22	50	0.13	34	0.21
120.0	32	0.12	43	0.12	50	0.17	46	0.17	108	0.27	50	0.12	34	0.09	32	0.20
125.0	27	0.10	33	0.09	50	0.17	23	0.08	80	0.20	42	0.10	30	0.08	16	0.10
130.0	33	0.12	46	0.13	48	0.17	37	0.13	135	0.33	86	0.20	62	0.16	38	0.24
135.0	18	0.07	24	0.07	32	0.11	27	0.10	73	0.18	39	0.09	30	0.08	30	0.19
140.0	12	0.04	12	0.03	22	0.08	15	0.05	36	0.09	28	0.06	33	0.09	15	0.09
145.0	20	0.07	17	0.05	35	0.12	20	0.07	33	0.08	27	0.06	20	0.05	22	0.14
150.0	23	0.09	17	0.05	26	0.09	21	0.08	56	0.14	38	0.09	25	0.07	20	0.13
155.0	10	0.04	5	0.01	14	0.05	6	0.02	36	0.09	12	0.03	10	0.03	5	0.03
160.0	18	0.07	11	0.03	39	0.13	14	0.05	39	0.10	22	0.05	22	0.06	17	0.11
165.0	7	0.03	13	0.04	11	0.04	13	0.05	18	0.04	21	0.05	18	0.05	21	0.13
170.0	17	0.06	9	0.03	26	0.09	15	0.05	34	0.08	10	0.02	17	0.04	15	0.09
175.0	11	0.04	5	0.01	6	0.02	3	0.01	16	0.04	5	0.01	6	0.02	6	0.04
180.0	68	0.25	23	0.06	22	0.08	18	0.06	32	0.08	21	0.05	39	0.10	49	0.31
185.0	34	0.13	8	0.02	19	0.07	19	0.07	12	0.03	18	0.04	9	0.02	17	0.11
190.0	31	0.12	22	0.06	87	0.30	61	0.22	46	0.11	36	0.08	27	0.07	31	0.20
195.0	20	0.07	11	0.03	40	0.14	7	0.03	16	0.04	10	0.02	15	0.04	20	0.13
200.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
>200.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XVI

8.00 KM,   2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED THYROID INHALATION DOSE FOR A RELEASE HEIGHT OF 230. FEET

	SECTOR 1 10.43		SECTOR 2 13.97		SECTOR 3 11.25		SECTOR 4 10.83		SECTOR 5 15.67		SECTOR 6 16.85		SECTOR 7 14.85		SECTOR 8 6.15	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
2.5	20568	76.67	26577	73.92	18139	62.64	18072	64.87	26856	66.60	29570	68.19	27213	71.24	10368	65.55
5.0	1748	6.52	2962	8.24	2684	9.27	1724	6.19	2922	7.25	3950	9.11	3278	8.58	1215	7.68
7.5	2375	8.85	3533	9.83	4518	15.60	4498	16.15	5480	13.59	5932	13.68	4296	11.25	2156	13.63
10.0	817	3.05	1153	3.21	1596	5.51	1555	5.58	1954	4.85	1923	4.43	1557	4.08	800	5.06
12.5	407	1.52	634	1.76	689	2.38	765	2.75	1037	2.57	694	1.60	762	1.99	454	2.87
15.0	245	0.91	517	1.44	388	1.34	490	1.76	532	1.32	372	0.86	346	0.91	211	1.33
17.5	150	0.56	159	0.44	250	0.86	248	0.89	403	1.00	230	0.53	191	0.50	148	0.94
20.0	108	0.40	95	0.26	136	0.47	131	0.47	280	0.69	172	0.40	126	0.33	96	0.61
22.5	73	0.27	84	0.23	114	0.39	86	0.31	241	0.60	123	0.28	88	0.23	55	0.35
25.0	46	0.17	61	0.17	63	0.22	50	0.18	172	0.43	109	0.25	70	0.18	45	0.28
27.5	30	0.11	36	0.10	54	0.19	42	0.15	109	0.27	67	0.15	63	0.16	45	0.28
30.0	21	0.08	17	0.05	35	0.12	20	0.07	33	0.08	27	0.06	20	0.05	22	0.14
32.5	24	0.09	17	0.05	27	0.09	21	0.08	56	0.14	38	0.09	25	0.07	20	0.13
35.0	18	0.07	12	0.03	37	0.13	11	0.04	57	0.14	22	0.05	21	0.05	12	0.08
37.5	15	0.06	17	0.05	26	0.09	22	0.08	36	0.09	33	0.08	29	0.08	31	0.20
40.0	13	0.05	7	0.02	15	0.05	10	0.04	14	0.03	7	0.02	10	0.03	12	0.08
42.5	15	0.06	7	0.02	17	0.06	8	0.03	36	0.09	8	0.02	13	0.03	9	0.06
45.0	10	0.04	6	0.02	10	0.03	12	0.04	14	0.03	7	0.02	16	0.04	14	0.09
47.5	8	0.03	7	0.02	11	0.04	5	0.02	15	0.04	6	0.01	9	0.02	4	0.03
50.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
52.5	4	0.01	6	0.02	7	0.02	6	0.02	10	0.02	7	0.02	8	0.02	9	0.06
55.0	8	0.03	4	0.01	10	0.03	5	0.02	8	0.02	10	0.02	8	0.02	8	0.05
57.5	15	0.06	8	0.02	14	0.05	4	0.01	17	0.04	14	0.03	6	0.02	7	0.04
60.0	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
62.5	4	0.01	6	0.02	14	0.05	4	0.01	11	0.03	5	0.01	6	0.02	8	0.05
65.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
67.5	3	0.01	5	0.01	0	0.0	0	0.0	5	0.01	0	0.0	5	0.01	1	0.01
70.0	1	0.00	2	0.01	3	0.01	3	0.01	0	0.0	0	0.0	0	0.0	0	0.0
72.5	0	0.0	0	0.0	0	0.0	0	0.0	10	0.02	6	0.01	9	0.02	3	0.02
75.0	9	0.03	6	0.02	4	0.01	9	0.03	2	0.00	0	0.0	1	0.00	0	0.0
77.5	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	0	0.0	0	0.0	25	0.09	3	0.01	6	0.01	2	0.00	8	0.02	8	0.05
82.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
85.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
87.5	3	0.01	0	0.0	9	0.03	9	0.03	0	0.0	0	0.0	0	0.0	0	0.0
90.0	1	0.00	1	0.00	11	0.04	2	0.01	4	0.01	2	0.00	4	0.01	6	0.04
92.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
95.0	0	0.0	0	0.0	23	0.08	35	0.13	0	0.0	0	0.0	0	0.0	0	0.0
97.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
100.0	0	0.0	2	0.01	6	0.02	2	0.01	6	0.01	5	0.01	3	0.01	2	0.01
>100.0	79	0.29	12	0.03	13	0.04	14	0.05	5	0.01	19	0.04	15	0.04	39	0.25

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XVII

8.00 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY AND THYROID INHALATION DOSE FOR ALL SECTORS, 853. FOOT RELEASE HEIGHT

WHOLE BODY DOSE				THYROID INHALATION DOSE			
DOSE	EVENTS	PERCENT	ACC. PCT	DOSE	EVENTS	PERCENT	ACC. PCT
2.00	43193	16.79	16.79	0.50	192787	74.93	74.93
4.00	173967	67.61	84.40	1.00	63595	24.72	99.65
6.00	23074	8.97	93.37	1.50	909	0.35	100.00
8.00	8316	3.23	96.60	2.00	1	0.00	100.00
10.00	3700	1.44	98.04	2.50	0	0.0	100.00
12.00	1942	0.75	98.80	3.00	0	0.0	100.00
14.00	1011	0.39	99.19	3.50	0	0.0	100.00
16.00	650	0.25	99.44	4.00	0	0.0	100.00
18.00	474	0.18	99.62	4.50	0	0.0	100.00
20.00	263	0.10	99.73	5.00	0	0.0	100.00
22.00	234	0.09	99.82	5.50	0	0.0	100.00
24.00	195	0.08	99.89	6.00	0	0.0	100.00
26.00	273	0.11	100.00	6.50	0	0.0	100.00
28.00	0	0.0	100.00	7.00	0	0.0	100.00
30.00	0	0.0	100.00	7.50	0	0.0	100.00
32.00	0	0.0	100.00	8.00	0	0.0	100.00
34.00	0	0.0	100.00	8.50	0	0.0	100.00
36.00	0	0.0	100.00	9.00	0	0.0	100.00
38.00	0	0.0	100.00	9.50	0	0.0	100.00
40.00	0	0.0	100.00	10.00	0	0.0	100.00
> 40.00	0	0.0	100.00	> 10.00	0	0.0	100.00

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XVIII

8.00 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY AND THYROID INHALATION DOSE FOR ALL SECTORS, 230. FOOT RELEASE HEIGHT

WHOLE BODY DOSE				THYROID INHALATION DOSE			
DOSE	EVENTS	PERCENT	ACC. PCT	DOSE	EVENTS	PERCENT	ACC. PCT
5.00	177336	68.92	68.92	2.50	177363	68.93	68.93
10.00	5	0.00	68.93	5.00	20483	7.96	76.90
15.00	8	0.00	68.93	7.50	32788	12.74	89.64
20.00	36	0.01	68.94	10.00	11355	4.41	94.05
25.00	472	0.18	69.13	12.50	5442	2.12	96.17
30.00	6512	2.53	71.66	15.00	3101	1.21	97.37
35.00	13478	5.24	76.90	17.50	1779	0.69	98.06
40.00	14014	5.45	82.34	20.00	1144	0.44	98.51
45.00	10387	4.04	86.38	22.50	864	0.34	98.84
50.00	7931	3.08	89.46	25.00	616	0.24	99.08
55.00	5402	2.10	91.56	27.50	446	0.17	99.26
60.00	3856	1.50	93.06	30.00	195	0.08	99.33
65.00	2877	1.12	94.18	32.50	228	0.09	99.42
70.00	2146	0.83	95.01	35.00	190	0.07	99.50
75.00	2064	0.80	95.81	37.50	209	0.08	99.58
80.00	1563	0.61	96.42	40.00	88	0.03	99.61
85.00	1471	0.57	96.99	42.50	113	0.04	99.65
90.00	974	0.38	97.37	45.00	89	0.03	99.69
95.00	997	0.39	97.76	47.50	65	0.03	99.71
100.00	613	0.24	98.00	50.00	1	0.00	99.71
105.00	641	0.25	98.25	52.50	57	0.02	99.74
110.00	469	0.18	98.43	55.00	61	0.02	99.76
115.00	502	0.20	98.62	57.50	85	0.03	99.79
120.00	395	0.15	98.78	60.00	1	0.00	99.79
125.00	301	0.12	98.90	62.50	58	0.02	99.82
130.00	485	0.19	99.08	65.00	0	0.0	99.82
135.00	273	0.11	99.19	67.50	19	0.01	99.82
140.00	173	0.07	99.26	70.00	9	0.00	99.83
145.00	194	0.08	99.33	72.50	28	0.01	99.84
150.00	226	0.09	99.42	75.00	31	0.01	99.85
155.00	98	0.04	99.46	77.50	0	0.0	99.85
160.00	182	0.07	99.53	80.00	52	0.02	99.87
165.00	122	0.05	99.58	82.50	0	0.0	99.87
170.00	143	0.06	99.63	85.00	0	0.0	99.87
175.00	58	0.02	99.65	87.50	21	0.01	99.88
180.00	272	0.11	99.76	90.00	31	0.01	99.89
185.00	136	0.05	99.81	92.50	0	0.0	99.89
190.00	341	0.13	99.95	95.00	58	0.02	99.91
195.00	139	0.05	100.00	97.50	0	0.0	99.91
200.00	0	0.0	100.00	100.00	26	0.01	99.92
>200.00	0	0.0	100.00	>100.00	196	0.08	100.00

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XIX

13.50 KM,   2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY DOSE FOR A RELEASE HEIGHT OF 853. FEET

	SECTOR 1 6.73		SECTOR 2 13.18		SECTOR 3 11.61		SECTOR 4 8.83		SECTOR 5 14.53		SECTOR 6 18.11		SECTOR 7 18.05		SECTOR 8 6.95	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
1.5	15202	67.68	22600	66.63	18722	62.67	14248	62.72	22147	59.23	29513	63.32	30004	64.59	10957	61.30
3.0	3541	15.76	6793	20.03	6043	20.23	4404	19.39	9013	24.10	10001	21.46	10010	21.55	3473	19.43
4.5	1700	7.57	2340	6.90	2609	8.73	2263	9.96	3558	9.52	4105	8.81	3844	8.28	1698	9.50
6.0	921	4.10	1029	3.03	1260	4.22	821	3.61	1401	3.75	1516	3.25	1375	2.96	810	4.53
7.5	530	2.36	556	1.64	559	1.87	454	2.00	561	1.50	692	1.48	674	1.45	413	2.31
9.0	236	1.05	240	0.71	301	1.01	225	0.99	276	0.74	366	0.79	234	0.50	251	1.40
10.5	132	0.59	153	0.45	152	0.51	129	0.57	157	0.42	152	0.33	115	0.25	123	0.69
12.0	115	0.51	119	0.35	125	0.42	96	0.42	131	0.35	118	0.25	111	0.24	84	0.47
13.5	85	0.38	87	0.26	101	0.34	76	0.33	148	0.40	144	0.31	85	0.18	65	0.36
15.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
16.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
18.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
19.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
21.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
22.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
24.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
25.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
27.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
28.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
30.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
> 30.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292.

CALCULATED THYROID INHALATION DOSE FOR A RELEASE HEIGHT OF 853. FEET

	SECTOR 1 8.73		SECTOR 2 13.18		SECTOR 3 11.61		SECTOR 4 8.83		SECTOR 5 14.53		SECTOR 6 18.11		SECTOR 7 18.05		SECTOR 8 6.95	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	22374	99.61	33790	99.63	29836	99.88	22539	99.22	37279	99.70	46448	99.66	46199	99.46	17825	99.73
1.0	88	0.39	127	0.37	36	0.12	177	0.78	113	0.30	159	0.34	253	0.54	49	0.27
1.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
> 10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XX

13.50 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY DOSE FOR A RELEASE HEIGHT OF 230. FEET

	SECTOR 1 10.43		SECTOR 2 13.97		SECTOR 3 11.25		SECTOR 4 10.83		SECTOR 5 15.67		SECTOR 6 16.85		SECTOR 7 14.85		SECTOR 8 6.15	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
2.5	20567	76.67	26573	73.91	18139	62.64	18071	64.87	26853	66.59	29560	68.17	27206	71.22	10367	65.55
5.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.00	1	0.00	0	0.0	0	0.0
7.5	0	0.0	2	0.01	0	0.0	1	0.00	0	0.0	1	0.00	1	0.00	0	0.0
10.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.00	3	0.01	0	0.0	0	0.0
12.5	1	0.00	2	0.01	0	0.0	0	0.0	0	0.0	0	0.0	1	0.00	1	0.01
15.0	0	0.0	0	0.0	0	0.0	2	0.01	5	0.01	13	0.03	8	0.02	0	0.0
17.5	19	0.07	3	0.01	13	0.04	10	0.04	28	0.07	24	0.06	51	0.13	10	0.06
20.0	73	0.27	158	0.44	28	0.10	65	0.23	204	0.51	309	0.71	312	0.82	73	0.46
22.5	443	1.65	884	2.46	672	2.32	354	1.27	757	1.88	1199	2.77	982	2.57	318	2.01
25.0	883	3.29	1345	3.74	1409	4.87	858	3.08	1379	3.42	1742	4.02	1362	3.57	575	3.64
27.5	825	3.08	1531	4.26	1432	4.95	1272	4.57	1498	3.71	1813	4.18	1529	4.00	682	4.31
30.0	654	2.44	996	2.77	1341	4.63	1321	4.74	1425	3.53	1627	3.75	1187	3.11	712	4.50
32.5	496	1.85	654	1.82	1084	3.74	992	3.56	1253	3.11	1375	3.17	912	2.39	431	2.73
35.0	516	1.92	642	1.79	843	2.91	931	3.34	1266	3.14	1234	2.85	841	2.20	386	2.44
37.5	359	1.34	460	1.28	633	2.19	648	2.33	933	2.31	922	2.13	628	1.64	318	2.01
40.0	247	0.92	366	1.02	488	1.69	485	1.74	589	1.46	619	1.43	445	1.16	212	1.34
42.5	215	0.80	291	0.81	473	1.63	442	1.59	505	1.25	490	1.13	447	1.17	218	1.38
45.0	173	0.64	271	0.75	346	1.19	352	1.26	465	1.15	404	0.93	385	1.01	201	1.27
47.5	148	0.55	245	0.68	237	0.82	286	1.03	342	0.85	244	0.56	240	0.63	155	0.98
50.0	124	0.46	208	0.58	235	0.81	263	0.94	333	0.83	251	0.58	272	0.71	156	0.99
52.5	130	0.48	145	0.40	185	0.64	203	0.73	286	0.71	183	0.42	222	0.58	123	0.78
55.0	98	0.37	197	0.55	162	0.56	179	0.64	221	0.55	136	0.31	143	0.37	82	0.52
57.5	114	0.42	211	0.59	127	0.44	177	0.64	213	0.53	149	0.34	141	0.37	87	0.55
60.0	58	0.22	165	0.46	139	0.48	159	0.57	183	0.45	114	0.26	108	0.28	76	0.48
62.5	81	0.30	95	0.26	132	0.46	137	0.49	192	0.48	132	0.30	124	0.32	96	0.61
65.0	60	0.22	55	0.15	98	0.34	93	0.33	144	0.36	81	0.19	60	0.16	51	0.32
67.5	49	0.18	51	0.14	67	0.23	73	0.26	152	0.38	81	0.19	59	0.15	37	0.23
70.0	54	0.20	51	0.14	65	0.22	77	0.28	147	0.36	81	0.19	69	0.18	48	0.30
72.5	36	0.13	39	0.11	70	0.24	51	0.18	132	0.33	75	0.17	49	0.13	39	0.25
75.0	54	0.20	56	0.16	61	0.21	57	0.20	155	0.38	84	0.19	51	0.13	40	0.25
77.5	36	0.13	44	0.12	66	0.23	34	0.12	107	0.27	66	0.15	44	0.12	30	0.19
80.0	24	0.09	35	0.10	32	0.11	26	0.09	108	0.27	62	0.14	48	0.13	24	0.15
82.5	110	0.41	51	0.14	107	0.37	95	0.34	124	0.31	93	0.21	85	0.22	92	0.58
85.0	44	0.16	29	0.08	82	0.28	37	0.13	58	0.14	42	0.10	38	0.10	36	0.23
87.5	34	0.13	21	0.06	42	0.15	26	0.09	83	0.21	45	0.10	32	0.08	31	0.20
90.0	56	0.21	46	0.13	93	0.32	45	0.16	99	0.25	69	0.16	62	0.16	65	0.41
92.5	45	0.17	30	0.08	55	0.19	36	0.13	83	0.21	38	0.09	54	0.14	44	0.28
95.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
97.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
>100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXI

13.50 KM,   2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED THYROID INHALATION DOSE FOR A RELEASE HEIGHT OF 230. FEET

	SECTOR 1 10.43		SECTOR 2 13.97		SECTOR 3 11.25		SECTOR 4 10.83		SECTOR 5 15.67		SECTOR 6 16.85		SECTOR 7 14.85		SECTOR 8 6.15	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
2.5	20567	76.67	26575	73.92	18139	62.64	18072	64.87	26855	66.60	29565	68.18	27207	71.23	10367	65.55
5.0	168	0.63	276	0.77	82	0.28	106	0.38	367	0.91	547	1.26	504	1.32	132	0.83
7.5	2561	9.55	4399	12.24	4455	15.39	3405	12.22	4539	11.26	5745	13.25	4604	12.05	2046	12.94
10.0	1519	5.66	1961	5.45	2862	9.88	2886	10.36	3771	9.35	3874	8.93	2645	6.92	1296	8.19
12.5	617	2.30	926	2.58	1310	4.52	1288	4.62	1545	3.83	1541	3.55	1276	3.34	631	3.99
15.0	358	1.33	552	1.54	601	2.08	686	2.46	876	2.17	622	1.43	655	1.71	377	2.38
17.5	295	1.10	495	1.38	397	1.37	467	1.68	603	1.50	405	0.93	424	1.11	258	1.63
20.0	139	0.52	260	0.72	272	0.94	298	1.07	376	0.93	246	0.57	232	0.61	172	1.09
22.5	106	0.40	106	0.29	165	0.57	166	0.60	296	0.73	162	0.37	119	0.31	88	0.56
25.0	83	0.31	80	0.22	117	0.40	109	0.39	236	0.59	136	0.31	103	0.27	81	0.51
27.5	64	0.24	66	0.18	79	0.27	76	0.27	198	0.49	104	0.24	66	0.17	46	0.29
30.0	36	0.13	44	0.12	66	0.23	34	0.12	107	0.27	66	0.15	44	0.12	30	0.19
32.5	34	0.13	45	0.13	49	0.17	38	0.14	151	0.37	77	0.18	62	0.16	45	0.28
35.0	20	0.07	26	0.07	37	0.13	30	0.11	66	0.16	52	0.12	49	0.13	24	0.15
37.5	21	0.08	17	0.05	35	0.12	20	0.07	33	0.08	27	0.06	20	0.05	22	0.14
40.0	24	0.09	17	0.05	27	0.09	21	0.08	56	0.14	38	0.09	25	0.07	20	0.13
42.5	18	0.07	11	0.03	37	0.13	11	0.04	57	0.14	22	0.05	21	0.05	12	0.08
45.0	10	0.04	7	0.02	15	0.05	9	0.03	18	0.04	12	0.03	11	0.03	10	0.06
47.5	18	0.07	18	0.05	26	0.09	23	0.08	32	0.08	28	0.06	28	0.07	33	0.21
50.0	4	0.01	2	0.01	11	0.04	5	0.02	20	0.05	3	0.01	7	0.02	3	0.02
52.5	11	0.04	5	0.01	6	0.02	3	0.01	16	0.04	5	0.01	6	0.02	6	0.04
55.0	10	0.04	6	0.02	10	0.03	12	0.04	14	0.03	7	0.02	16	0.04	14	0.09
57.5	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	8	0.03	7	0.02	11	0.04	5	0.02	15	0.04	6	0.01	9	0.02	4	0.03
62.5	5	0.02	6	0.02	7	0.02	6	0.02	10	0.02	7	0.02	8	0.02	9	0.06
65.0	7	0.03	4	0.01	10	0.03	5	0.02	8	0.02	10	0.02	8	0.02	8	0.05
67.5	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
70.0	15	0.06	8	0.02	14	0.05	4	0.01	17	0.04	14	0.03	6	0.02	7	0.04
72.5	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
75.0	4	0.01	6	0.02	14	0.05	4	0.01	11	0.03	5	0.01	6	0.02	8	0.05
77.5	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	3	0.01	5	0.01	9	0.03	3	0.01	9	0.02	6	0.01	4	0.01	9	0.06
82.5	2	0.01	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
85.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
87.5	5	0.02	0	0.0	5	0.02	1	0.00	1	0.00	2	0.00	3	0.01	3	0.02
90.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
92.5	6	0.02	0	0.0	1	0.00	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0
95.0	4	0.01	6	0.02	24	0.08	2	0.01	6	0.01	2	0.00	8	0.02	8	0.05
97.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
100.0	3	0.01	0	0.0	9	0.03	9	0.03	0	0.0	0	0.0	0	0.0	0	0.0
>100.0	80	0.30	15	0.04	53	0.18	53	0.19	15	0.04	26	0.06	22	0.06	47	0.30

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXII

13.50 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY AND THYROID INHALATION DOSE FOR ALL SECTORS, 853. FOOT RELEASE HEIGHT

WHOLE BODY DOSE				THYROID INHALATION DOSE			
DOSE	EVENTS	PERCENT	ACC. PCT	DOSE	EVENTS	PERCENT	ACC. PCT
1.50	163393	63.50	63.50	0.50	256290	99.61	99.61
3.00	53278	20.71	84.21	1.00	1002	0.39	100.00
4.50	22117	8.60	92.81	1.50	0	0.0	100.00
6.00	9133	3.55	96.36	2.00	0	0.0	100.00
7.50	4439	1.73	98.08	2.50	0	0.0	100.00
9.00	2129	0.83	98.91	3.00	0	0.0	100.00
10.50	1113	0.43	99.34	3.50	0	0.0	100.00
12.00	899	0.35	99.69	4.00	0	0.0	100.00
13.50	791	0.31	100.00	4.50	0	0.0	100.00
15.00	0	0.0	100.00	5.00	0	0.0	100.00
16.50	0	0.0	100.00	5.50	0	0.0	100.00
18.00	0	0.0	100.00	6.00	0	0.0	100.00
19.50	0	0.0	100.00	6.50	0	0.0	100.00
21.00	0	0.0	100.00	7.00	0	0.0	100.00
22.50	0	0.0	100.00	7.50	0	0.0	100.00
24.00	0	0.0	100.00	8.00	0	0.0	100.00
25.50	0	0.0	100.00	8.50	0	0.0	100.00
27.00	0	0.0	100.00	9.00	0	0.0	100.00
28.50	0	0.0	100.00	9.50	0	0.0	100.00
30.00	0	0.0	100.00	10.00	0	0.0	100.00
> 30.00	0	0.0	100.00	> 10.00	0	0.0	100.00

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXI

13.50 KM,   2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED THYROID INHALATION DOSE FOR A RELEASE HEIGHT OF 230. FEET

	SECTOR 1 10.43		SECTOR 2 13.97		SECTOR 3 11.25		SECTOR 4 10.83		SECTOR 5 15.67		SECTOR 6 16.85		SECTOR 7 14.85		SECTOR 8 6.15	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
2.5	20567	76.67	26575	73.92	18139	62.64	18072	64.87	26855	66.60	29565	68.18	27207	71.23	10367	65.55
5.0	168	0.63	276	0.77	82	0.28	106	0.38	367	0.91	547	1.26	504	1.32	132	0.83
7.5	2561	9.55	4399	12.24	4455	15.39	3405	12.22	4539	11.26	5745	13.25	4604	12.05	2046	12.94
10.0	1519	5.66	1961	5.45	2862	9.88	2886	10.36	3771	9.35	3874	8.93	2645	6.92	1296	8.19
12.5	617	2.30	926	2.58	1310	4.52	1288	4.62	1545	3.83	1541	3.55	1276	3.34	631	3.99
15.0	358	1.33	552	1.54	601	2.08	686	2.46	876	2.17	622	1.43	655	1.71	377	2.38
17.5	295	1.10	495	1.38	397	1.37	467	1.68	603	1.50	405	0.93	424	1.11	258	1.63
20.0	139	0.52	260	0.72	272	0.94	298	1.07	376	0.93	246	0.57	232	0.61	172	1.09
22.5	106	0.40	106	0.29	165	0.57	166	0.60	296	0.73	162	0.37	119	0.31	88	0.56
25.0	83	0.31	80	0.22	117	0.40	109	0.39	236	0.59	136	0.31	103	0.27	81	0.51
27.5	64	0.24	66	0.18	79	0.27	76	0.27	198	0.49	104	0.24	66	0.17	46	0.29
30.0	36	0.13	44	0.12	66	0.23	34	0.12	107	0.27	66	0.15	44	0.12	30	0.19
32.5	34	0.13	45	0.13	49	0.17	38	0.14	151	0.37	77	0.18	62	0.16	45	0.28
35.0	20	0.07	26	0.07	37	0.13	30	0.11	66	0.16	52	0.12	49	0.13	24	0.15
37.5	21	0.08	17	0.05	35	0.12	20	0.07	33	0.08	27	0.06	20	0.05	22	0.14
40.0	24	0.09	17	0.05	27	0.09	21	0.08	56	0.14	38	0.09	25	0.07	20	0.13
42.5	18	0.07	11	0.03	37	0.13	11	0.04	57	0.14	22	0.05	21	0.05	12	0.08
45.0	10	0.04	7	0.02	15	0.05	9	0.03	18	0.04	12	0.03	11	0.03	10	0.06
47.5	18	0.07	18	0.05	26	0.09	23	0.08	32	0.08	28	0.06	28	0.07	33	0.21
50.0	4	0.01	2	0.01	11	0.04	5	0.02	20	0.05	3	0.01	7	0.02	3	0.02
52.5	11	0.04	5	0.01	6	0.02	3	0.01	16	0.04	5	0.01	6	0.02	6	0.04
55.0	10	0.04	6	0.02	10	0.03	12	0.04	14	0.03	7	0.02	16	0.04	14	0.09
57.5	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	8	0.03	7	0.02	11	0.04	5	0.02	15	0.04	6	0.01	9	0.02	4	0.03
62.5	5	0.02	6	0.02	7	0.02	6	0.02	10	0.02	7	0.02	8	0.02	9	0.06
65.0	7	0.03	4	0.01	10	0.03	5	0.02	8	0.02	10	0.02	8	0.02	8	0.05
67.5	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
70.0	15	0.06	8	0.02	14	0.05	4	0.01	17	0.04	14	0.03	6	0.02	7	0.04
72.5	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
75.0	4	0.01	6	0.02	14	0.05	4	0.01	11	0.03	5	0.01	6	0.02	8	0.05
77.5	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	3	0.01	5	0.01	9	0.03	3	0.01	9	0.02	6	0.01	4	0.01	9	0.06
82.5	2	0.01	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
85.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
87.5	5	0.02	0	0.0	5	0.02	1	0.00	1	0.00	2	0.00	3	0.01	3	0.02
90.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
92.5	6	0.02	0	0.0	1	0.00	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0
95.0	4	0.01	6	0.02	24	0.08	2	0.01	6	0.01	2	0.00	8	0.02	8	0.05
97.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
100.0	3	0.01	0	0.0	9	0.03	9	0.03	0	0.0	0	0.0	0	0.0	0	0.0
>100.0	80	0.30	15	0.04	53	0.18	53	0.19	15	0.04	26	0.06	22	0.06	47	0.30

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXIII

13.50 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY AND THYROID INHALATION DOSE FOR ALL SECTORS, 230. FOOT RELEASE HEIGHT

WHOLE BODY DOSE				THYROID INHALATION DOSE			
DOSE	EVENTS	PERCENT	ACC. PCT	DOSE	EVENTS	PERCENT	ACC. PCT
2.50	177336	68.92	68.92	2.50	177347	68.93	68.93
5.00	2	0.00	68.92	5.00	2182	0.85	69.78
7.50	5	0.00	68.93	7.50	31754	12.34	82.12
10.00	4	0.00	68.93	10.00	20814	8.09	90.21
12.50	5	0.00	68.93	12.50	9134	3.55	93.76
15.00	28	0.01	68.94	15.00	4727	1.84	95.59
17.50	158	0.06	69.00	17.50	3344	1.30	96.89
20.00	1222	0.47	69.48	20.00	1995	0.78	97.67
22.50	5609	2.18	71.66	22.50	1208	0.47	98.14
25.00	9553	3.71	75.37	25.00	945	0.37	98.51
27.50	10582	4.11	79.48	27.50	699	0.27	98.78
30.00	9263	3.60	83.08	30.00	427	0.17	98.94
32.50	7197	2.80	85.88	32.50	501	0.19	99.14
35.00	6659	2.59	88.47	35.00	304	0.12	99.26
37.50	4901	1.90	90.37	37.50	195	0.08	99.33
40.00	3451	1.34	91.71	40.00	228	0.09	99.42
42.50	3081	1.20	92.91	42.50	189	0.07	99.49
45.00	2597	1.01	93.92	45.00	92	0.04	99.53
47.50	1897	0.74	94.66	47.50	206	0.08	99.61
50.00	1842	0.72	95.37	50.00	55	0.02	99.63
52.50	1477	0.57	95.95	52.50	58	0.02	99.65
55.00	1218	0.47	96.42	55.00	89	0.03	99.69
57.50	1219	0.47	96.90	57.50	0	0.0	99.69
60.00	1002	0.39	97.29	60.00	65	0.03	99.71
62.50	989	0.38	97.67	62.50	58	0.02	99.74
65.00	642	0.25	97.92	65.00	60	0.02	99.76
67.50	569	0.22	98.14	67.50	1	0.00	99.76
70.00	592	0.23	98.37	70.00	85	0.03	99.79
72.50	491	0.19	98.56	72.50	1	0.00	99.79
75.00	558	0.22	98.78	75.00	58	0.02	99.82
77.50	427	0.17	98.94	77.50	0	0.0	99.82
80.00	359	0.14	99.08	80.00	48	0.02	99.84
82.50	757	0.29	99.38	82.50	3	0.00	99.84
85.00	366	0.14	99.52	85.00	0	0.0	99.84
87.50	314	0.12	99.64	87.50	20	0.01	99.84
90.00	535	0.21	99.85	90.00	0	0.0	99.84
92.50	385	0.15	100.00	92.50	8	0.00	99.85
95.00	0	0.0	100.00	95.00	60	0.02	99.87
97.50	0	0.0	100.00	97.50	0	0.0	99.87
100.00	0	0.0	100.00	100.00	21	0.01	99.88
>100.00	0	0.0	100.00	>100.00	311	0.12	100.00

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXIV

40.00 KM,   2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY DOSE FOR A RELEASE HEIGHT OF 853. FEET

	SECTOR 1 8.73		SECTOR 2 13.18		SECTOR 3 11.61		SECTOR 4 8.83		SECTOR 5 14.53		SECTOR 6 18.11		SECTOR 7 18.05		SECTOR 8 6.95	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	16874	75.12	25338	74.71	20422	68.37	15693	69.08	25054	67.00	32574	69.89	32596	70.17	11970	66.97
1.0	42	0.19	83	0.24	10	0.03	141	0.62	52	0.14	79	0.17	116	0.25	23	0.13
1.5	527	2.35	1573	4.64	1025	3.43	848	3.73	2471	6.61	2468	5.30	2930	6.31	726	4.06
2.0	1376	6.13	2517	7.42	3396	11.37	2180	9.60	3745	10.02	4619	9.91	4690	10.10	1784	9.98
2.5	1193	5.31	1750	5.16	1869	6.26	1683	7.41	2726	7.29	3131	6.72	2863	6.16	1262	7.06
3.0	1040	4.63	1148	3.38	1508	5.05	887	3.90	1642	4.39	1764	3.78	1620	3.49	907	5.07
3.5	911	4.06	980	2.89	1055	3.53	819	3.61	1124	3.01	1308	2.81	1166	2.51	734	4.11
4.0	499	2.22	528	1.56	587	1.97	465	2.05	578	1.55	664	1.42	471	1.01	468	2.62
4.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
> 10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292.

CALCULATED THYROID INHALATION DOSE FOR A RELEASE HEIGHT OF 853. FEET

	SECTOR 1 8.73		SECTOR 2 13.18		SECTOR 3 11.61		SECTOR 4 8.83		SECTOR 5 14.53		SECTOR 6 18.11		SECTOR 7 18.05		SECTOR 8 6.95	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	21950	97.72	33367	98.38	25268	97.98	22232	97.87	36736	98.25	45918	98.52	45963	98.95	17404	97.37
1.0	425	1.89	459	1.35	501	1.68	408	1.80	504	1.35	543	1.17	402	0.87	402	2.25
1.5	57	0.25	54	0.16	73	0.24	53	0.23	95	0.25	87	0.19	64	0.14	54	0.30
2.0	24	0.11	29	0.09	26	0.09	20	0.09	46	0.12	51	0.11	19	0.04	9	0.05
2.5	6	0.03	8	0.02	4	0.01	3	0.01	11	0.03	8	0.02	4	0.01	5	0.03
3.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
4.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
8.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
9.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
> 10.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXV

40.00 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY DOSE FOR A RELEASE HEIGHT OF 230. FEET

	SECTOR 1 10.43		SECTOR 2 13.97		SECTOR 3 11.25		SECTOR 4 10.83		SECTOR 5 15.67		SECTOR 6 16.85		SECTOR 7 14.85		SECTOR 8 6.15	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.5	20567	76.67	26573	73.91	18139	62.64	18071	64.87	26854	66.60	29561	68.17	27206	71.22	10367	65.55
1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3.0	0	0.0	2	0.01	0	0.0	1	0.00	0	0.0	1	0.00	1	0.00	0	0.0
3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.01	0	0.0	0	0.0
4.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0
4.5	0	0.0	2	0.01	0	0.0	0	0.0	0	0.0	0	0.0	1	0.00	1	0.01
5.0	1	0.00	0	0.0	0	0.0	0	0.0	2	0.00	2	0.00	3	0.01	0	0.0
5.5	0	0.0	0	0.0	0	0.0	2	0.01	3	0.01	13	0.03	5	0.01	0	0.0
6.0	10	0.04	1	0.00	9	0.03	7	0.03	11	0.03	13	0.03	21	0.05	5	0.03
6.5	15	0.06	6	0.02	7	0.02	20	0.07	49	0.12	51	0.12	82	0.21	21	0.13
7.0	89	0.33	185	0.51	34	0.12	56	0.20	205	0.51	299	0.69	297	0.78	70	0.44
7.5	269	1.00	562	1.56	401	1.38	204	0.73	472	1.17	797	1.84	630	1.65	203	1.28
8.0	590	2.20	959	2.67	1006	3.47	545	1.96	986	2.45	1269	2.93	1052	2.75	393	2.48
8.5	736	2.74	1183	3.29	1150	3.97	844	3.03	1134	2.81	1441	3.32	1130	2.96	497	3.14
9.0	658	2.45	1208	3.36	1165	4.02	1116	4.01	1232	3.06	1487	3.43	1228	3.21	588	3.72
9.5	573	2.14	858	2.39	1202	4.15	1143	4.10	1280	3.17	1444	3.33	1044	2.73	630	3.98
10.0	494	1.84	684	1.90	1102	3.81	1050	3.77	1280	3.17	1438	3.32	956	2.50	443	2.80
10.5	523	1.95	608	1.69	816	2.82	900	3.23	1295	3.21	1189	2.74	824	2.16	375	2.37
11.0	380	1.42	501	1.39	672	2.32	686	2.46	955	2.37	968	2.23	641	1.68	342	2.16
11.5	307	1.14	471	1.31	710	2.45	662	2.38	706	1.75	765	1.76	609	1.59	263	1.66
12.0	322	1.20	423	1.18	570	1.97	557	2.00	813	2.02	661	1.52	649	1.70	383	2.42
12.5	329	1.23	469	1.30	546	1.89	544	1.95	773	1.92	545	1.26	541	1.42	355	2.24
13.0	441	1.64	657	1.83	636	2.20	687	2.47	1047	2.60	697	1.61	676	1.77	405	2.56
13.5	439	1.64	585	1.63	729	2.52	701	2.52	1211	3.00	692	1.60	580	1.52	428	2.71
14.0	3	0.01	0	0.0	9	0.03	9	0.03	0	0.0	0	0.0	0	0.0	0	0.0
14.5	1	0.00	1	0.00	34	0.12	37	0.13	4	0.01	2	0.00	4	0.01	6	0.04
15.0	0	0.0	2	0.01	6	0.02	2	0.01	6	0.01	5	0.01	3	0.01	2	0.01
15.5	29	0.11	2	0.01	12	0.04	13	0.05	2	0.00	11	0.03	1	0.00	8	0.05
16.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
16.5	50	0.19	10	0.03	1	0.00	1	0.00	3	0.01	8	0.02	14	0.04	31	0.20
17.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
17.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
18.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
18.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
19.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
19.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
> 20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXVI

40.00 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED THYROID INHALATION DOSE FOR A RELEASE HEIGHT OF 230. FEET

	SECTOR 1 10.43		SECTOR 2 13.97		SECTOR 3 11.25		SECTOR 4 10.83		SECTOR 5 15.67		SECTOR 6 16.85		SECTOR 7 14.85		SECTOR 8 6.15	
DOSE	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT	EVENTS	PERCT
0.7	20567	76.67	26575	73.92	18139	62.64	18072	64.87	26854	66.60	29562	68.17	27207	71.23	10367	65.55
1.5	1	0.00	2	0.01	0	0.0	1	0.00	6	0.01	16	0.04	9	0.02	1	0.01
2.2	383	1.43	754	2.10	450	1.55	288	1.03	737	1.83	1162	2.68	1029	2.69	299	1.89
3.0	2125	7.92	3598	10.01	3672	12.68	2823	10.13	3728	9.25	4576	10.55	3686	9.65	1670	10.56
3.7	1360	5.07	1834	5.10	2652	9.16	2627	9.43	3244	8.04	3516	8.11	2410	6.31	1186	7.50
4.5	727	2.71	972	2.70	1388	4.79	1384	4.97	1793	4.45	1800	4.15	1291	3.38	646	4.08
5.2	384	1.43	570	1.59	699	2.41	759	2.72	968	2.40	831	1.92	788	2.06	431	2.73
6.0	261	0.97	405	1.13	479	1.65	527	1.89	664	1.65	471	1.09	511	1.34	273	1.73
6.7	254	0.95	425	1.18	331	1.14	389	1.40	506	1.25	342	0.79	354	0.93	210	1.33
7.5	117	0.44	264	0.73	236	0.82	250	0.90	322	0.80	200	0.46	200	0.52	136	0.86
8.2	125	0.47	113	0.31	191	0.66	210	0.75	318	0.79	175	0.40	141	0.37	123	0.78
9.0	68	0.25	72	0.20	93	0.32	107	0.38	196	0.49	114	0.26	89	0.23	65	0.41
9.7	51	0.19	56	0.16	88	0.30	65	0.23	171	0.42	98	0.23	69	0.18	47	0.30
10.5	68	0.25	74	0.21	96	0.33	67	0.24	198	0.49	103	0.24	73	0.19	49	0.31
11.2	33	0.12	41	0.11	57	0.20	36	0.13	131	0.32	79	0.18	52	0.14	33	0.21
12.0	23	0.09	30	0.08	23	0.08	26	0.09	84	0.21	45	0.10	32	0.08	33	0.21
12.7	31	0.12	36	0.10	59	0.20	42	0.15	87	0.22	64	0.15	60	0.16	36	0.23
13.5	20	0.07	13	0.04	26	0.09	13	0.05	31	0.08	28	0.06	19	0.05	16	0.10
14.2	22	0.08	16	0.04	27	0.09	22	0.08	73	0.18	37	0.09	25	0.07	19	0.12
15.0	10	0.04	6	0.02	24	0.08	5	0.02	21	0.05	10	0.02	11	0.03	7	0.04
15.7	15	0.06	18	0.05	26	0.09	22	0.08	36	0.09	33	0.08	29	0.08	31	0.20
16.5	13	0.05	7	0.02	15	0.05	10	0.04	14	0.03	7	0.02	10	0.03	12	0.08
17.2	9	0.03	2	0.01	11	0.04	5	0.02	20	0.05	3	0.01	7	0.02	3	0.02
18.0	6	0.02	5	0.01	6	0.02	3	0.01	16	0.04	5	0.01	6	0.02	6	0.04
18.7	10	0.04	6	0.02	10	0.03	12	0.04	14	0.03	7	0.02	16	0.04	14	0.09
19.5	8	0.03	7	0.02	11	0.04	5	0.02	15	0.04	6	0.01	9	0.02	4	0.03
20.2	5	0.02	6	0.02	7	0.02	6	0.02	10	0.02	7	0.02	8	0.02	9	0.06
21.0	8	0.03	4	0.01	10	0.03	5	0.02	8	0.02	10	0.02	8	0.02	8	0.05
21.7	15	0.06	8	0.02	14	0.05	4	0.01	17	0.04	14	0.03	6	0.02	7	0.04
22.5	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
23.2	4	0.01	6	0.02	14	0.05	4	0.01	11	0.03	5	0.01	6	0.02	8	0.05
24.0	3	0.01	5	0.01	9	0.03	3	0.01	9	0.02	6	0.01	4	0.01	9	0.06
24.7	2	0.01	0	0.0	1	0.00	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
25.5	5	0.02	0	0.0	5	0.02	1	0.00	1	0.00	2	0.00	3	0.01	3	0.02
26.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
27.0	10	0.04	6	0.02	25	0.09	3	0.01	6	0.01	2	0.00	8	0.02	8	0.05
27.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
28.5	3	0.01	0	0.0	9	0.03	9	0.03	0	0.0	0	0.0	0	0.0	0	0.0
29.2	1	0.00	1	0.00	11	0.04	2	0.01	4	0.01	2	0.00	4	0.01	6	0.04
30.0	0	0.0	0	0.0	23	0.08	35	0.13	0	0.0	0	0.0	0	0.0	0	0.0
> 30.0	79	0.29	14	0.04	19	0.07	16	0.06	11	0.03	24	0.06	18	0.05	41	0.26

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXVII

40.00 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY AND THYROID INHALATION DOSE FOR ALL SECTORS, 853. FOOT RELEASE HEIGHT

WHOLE BODY DOSE				THYROID INHALATION DOSE			
DOSE	EVENTS	PERCENT	ACC. PCT	DOSE	EVENTS	PERCENT	ACC. PCT
0.50	180521	70.16	70.16	0.50	252838	98.27	98.27
1.00	546	0.21	70.37	1.00	3644	1.42	99.69
1.50	12568	4.88	75.26	1.50	537	0.21	99.89
2.00	24307	9.45	84.71	2.00	224	0.09	99.98
2.50	16477	6.40	91.11	2.50	49	0.02	100.00
3.00	10516	4.09	95.20	3.00	0	0.0	100.00
3.50	8097	3.15	98.34	3.50	0	0.0	100.00
4.00	4260	1.66	100.00	4.00	0	0.0	100.00
4.50	0	0.0	100.00	4.50	0	0.0	100.00
5.00	0	0.0	100.00	5.00	0	0.0	100.00
5.50	0	0.0	100.00	5.50	0	0.0	100.00
6.00	0	0.0	100.00	6.00	0	0.0	100.00
6.50	0	0.0	100.00	6.50	0	0.0	100.00
7.00	0	0.0	100.00	7.00	0	0.0	100.00
7.50	0	0.0	100.00	7.50	0	0.0	100.00
8.00	0	0.0	100.00	8.00	0	0.0	100.00
8.50	0	0.0	100.00	8.50	0	0.0	100.00
9.00	0	0.0	100.00	9.00	0	0.0	100.00
9.50	0	0.0	100.00	9.50	0	0.0	100.00
10.00	0	0.0	100.00	10.00	0	0.0	100.00
> 10.00	0	0.0	100.00	> 10.00	0	0.0	100.00

NUMBER OF RECORDS IN THIS SURVEY = 257292.

TABLE XXVIII

40.00 KM, 2 YEARS DATA FROM MARCH 1966 TO MARCH 1968

CALCULATED WHOLE BODY AND THYROID INHALATION DOSE FOR ALL SECTORS, 230. FOOT RELEASE HEIGHT

WHOLE BODY DOSE				THYROID INHALATION DOSE			
DOSE	EVENTS	PERCENT	ACC. PCT	DOSE	EVENTS	PERCENT	ACC. PCT
0.50	177338	68.92	68.92	0.75	177343	68.93	68.93
1.00	0	0.0	68.92	1.50	36	0.01	68.94
1.50	0	0.0	68.92	2.25	5102	1.98	70.92
2.00	0	0.0	68.92	3.00	25878	10.06	80.98
2.50	0	0.0	68.92	3.75	18829	7.32	88.30
3.00	5	0.00	68.93	4.50	10001	3.89	92.19
3.50	3	0.00	68.93	5.25	5430	2.11	94.30
4.00	1	0.00	68.93	6.00	3591	1.40	95.69
4.50	4	0.00	68.93	6.75	2811	1.09	96.79
5.00	8	0.00	68.93	7.50	1725	0.67	97.46
5.50	23	0.01	68.94	8.25	1396	0.54	98.00
6.00	77	0.03	68.97	9.00	804	0.31	98.31
6.50	251	0.10	69.07	9.75	645	0.25	98.56
7.00	1235	0.48	69.55	10.50	728	0.28	98.84
7.50	3538	1.38	70.92	11.25	462	0.18	99.02
8.00	6800	2.64	73.57	12.00	296	0.12	99.14
8.50	8115	3.15	76.72	12.75	415	0.16	99.30
9.00	8682	3.37	80.10	13.50	166	0.06	99.36
9.50	8174	3.18	83.27	14.25	241	0.09	99.46
10.00	7447	2.89	86.17	15.00	94	0.04	99.49
10.50	6530	2.54	88.70	15.75	210	0.08	99.58
11.00	5145	2.00	90.70	16.50	88	0.03	99.61
11.50	4493	1.75	92.45	17.25	60	0.02	99.63
12.00	4378	1.70	94.15	18.00	53	0.02	99.65
12.50	4102	1.59	95.75	18.75	89	0.03	99.69
13.00	5246	2.04	97.79	19.50	65	0.03	99.71
13.50	5365	2.09	99.87	20.25	58	0.02	99.74
14.00	21	0.01	99.88	21.00	61	0.02	99.76
14.50	89	0.03	99.91	21.75	85	0.03	99.79
15.00	26	0.01	99.92	22.50	1	0.00	99.79
15.50	78	0.03	99.95	23.25	58	0.02	99.82
16.00	0	0.0	99.95	24.00	48	0.02	99.84
16.50	118	0.05	100.00	24.75	3	0.00	99.84
17.00	0	0.0	100.00	25.50	20	0.01	99.84
17.50	0	0.0	100.00	26.25	0	0.0	99.84
18.00	0	0.0	100.00	27.00	68	0.03	99.87
18.50	0	0.0	100.00	27.75	0	0.0	99.87
19.00	0	0.0	100.00	28.50	21	0.01	99.88
19.50	0	0.0	100.00	29.25	31	0.01	99.89
20.00	0	0.0	100.00	30.00	58	0.02	99.91
> 20.00	0	0.0	100.00	> 30.00	222	0.09	100.00

NUMBER OF RECORDS IN THIS SURVEY = 257292.

END OF OUTPUT DATA

REFERENCES

1. "Reactor Site Criteria" Title 10, Code of Federal Regulations, Part 100, February 11, 1961.

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3. F. V. Brock and D. J. Provine. "A Standard Deviation Computer." J. Appl. Meteor. 1, 81 (1962).

4. W. S. Durant, R. C. Milham, D. R. Muhlbaier, and A. H. Peters. Activity Confinement System of the Savannah River Plant. USAEC Report DP-1071, E. I. du Pont de Nemours and Co., Savannah River Laboratory, Aiken, S. C. (1966).

5. I. A. Singer, J. A. Frizzola, and M. E. Smith. "A Simplified Method of Estimating Atmospheric Diffusion Parameters." J. Air Pollution Control Assoc. 16(11), 594 (1966).

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APPENDIX A

DATA HANDLING PROCEDURES

The large amount of data handling resulting from collecting data at two towers at very frequent intervals requires carefully planned procedures to ensure data security and proper compilation. The established processing sequence minimizes confusion and computer processing time. A block diagram of this procedure is shown in Figure A-1.

Data are accumulated and stored in three forms; punched paper tape, temporary magnetic tape, and high density permanent magnetic tape. The high density tapes are capable of containing data for 1 year, which means the consolidation period required to generate the tape covers a year also. During this period several precautions are taken to ensure data security:

a) High density tapes are compiled in duplicate. The first tape must be compiled successfully before the duplicate tape is called by the IBM System 360/65 to receive additions.

b) After the duplicate tape is successfully compiled, a third, or backup tape, is updated. This backup tape is independent of a) above to minimize the chances of losing all data when both tapes of the duplicate system are on line in a nonfile-protected mode as in a).

c) Updated tapes are monitored before job completion; this visual check of the monitor program output rapidly assesses tape contents to verify successful job execution.

d) All temporary magnetic tapes are retained until a successful updating of the backup tape has been verified.

e) All paper tapes are held for the entire consolidation period to circumvent the possibility that the above procedure fails.

Unless specifically stated otherwise, all following requirements and processes apply to both tower installations individually.

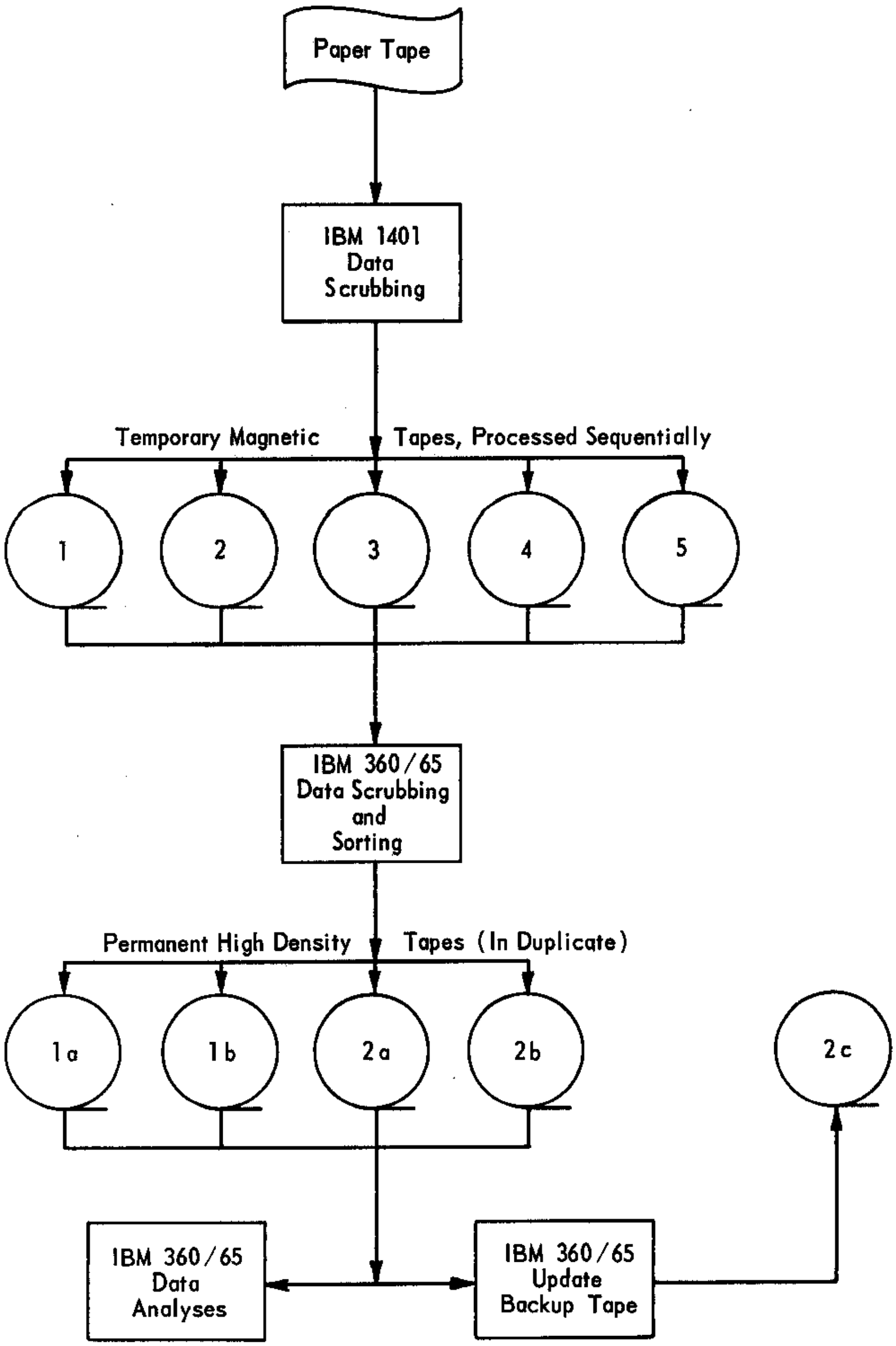

FIG. A-1 DATA PROCESSING SEQUENCE

Punched paper tapes (each containing a nominal 480 samplings of all tower data) are accumulated on a daily basis. Figure A-2 shows the paper tape format for the tall tower system. The two tower systems are identical in format and Table A-I lists the data acquired from each tape. These tapes are processed on the IBM 1401 computer on a weekly basis for preliminary data scrubbing. During the IBM 1401 processing, the data are checked for parity and illegal character formation. The entire sample for a particular sampling period is rejected if either of these checks fail. The data are then transferred to magnetic tape in a form compatible with the IBM System 360/65. Tape density and computer compatibility requirements limit the capacity of these tapes to about 1 week's data. The magnetic tapes generated by this process are filed for subsequent processing on the IBM System 360/65, where more stringent data checks are made before being accepted as permanent data. An output listing of all raw data as shown in Table A-II is provided to permit an immediate visual assessment of data and to make corrections if needed. Magnetic tapes are written as 16-word records to conform to the longest record on the punched tape. Records less than 16 words long are padded with zeros and the last record on each tape is followed by 4 records padded with 9's.

The temporary tapes are processed on the IBM System 360/65 on a monthly basis. Each record is subjected to data checks that are designed to reject bad samples resulting from data acquisition system malfunctions. No computer checks of individual sensor output are performed to prevent rejection of useful data. As each of the temporary tapes are processed, the accepted data are compiled in duplicate on high density permanent tapes and an output listing of all data is provided. The final output listing as shown in Table A-III is carefully scrutinized visually to flag bad data from the individual sensors. At data analysis processing time, the sample containing the flagged data will be bypassed or alternate data within the same sample will be designated, depending on the type of analysis being made.

SYSTEM 360 PROCESSING PROCEDURES

In processing the meteorology data from each tower with the IBM System 360/65, there are several job configurations involving one or more job steps within each configuration. The more likely configurations are described in detail to provide a checking procedure to ensure successful execution of each job with minimum computer requirements. Table A-IV is a descriptive list of the FORTRAN IV programs involved in job processing for both towers. Table A-V shows several possible job configurations and the names of the associated programs to be used. FORTRAN listings of these programs (METT and METS, located in Appendix B) are included.

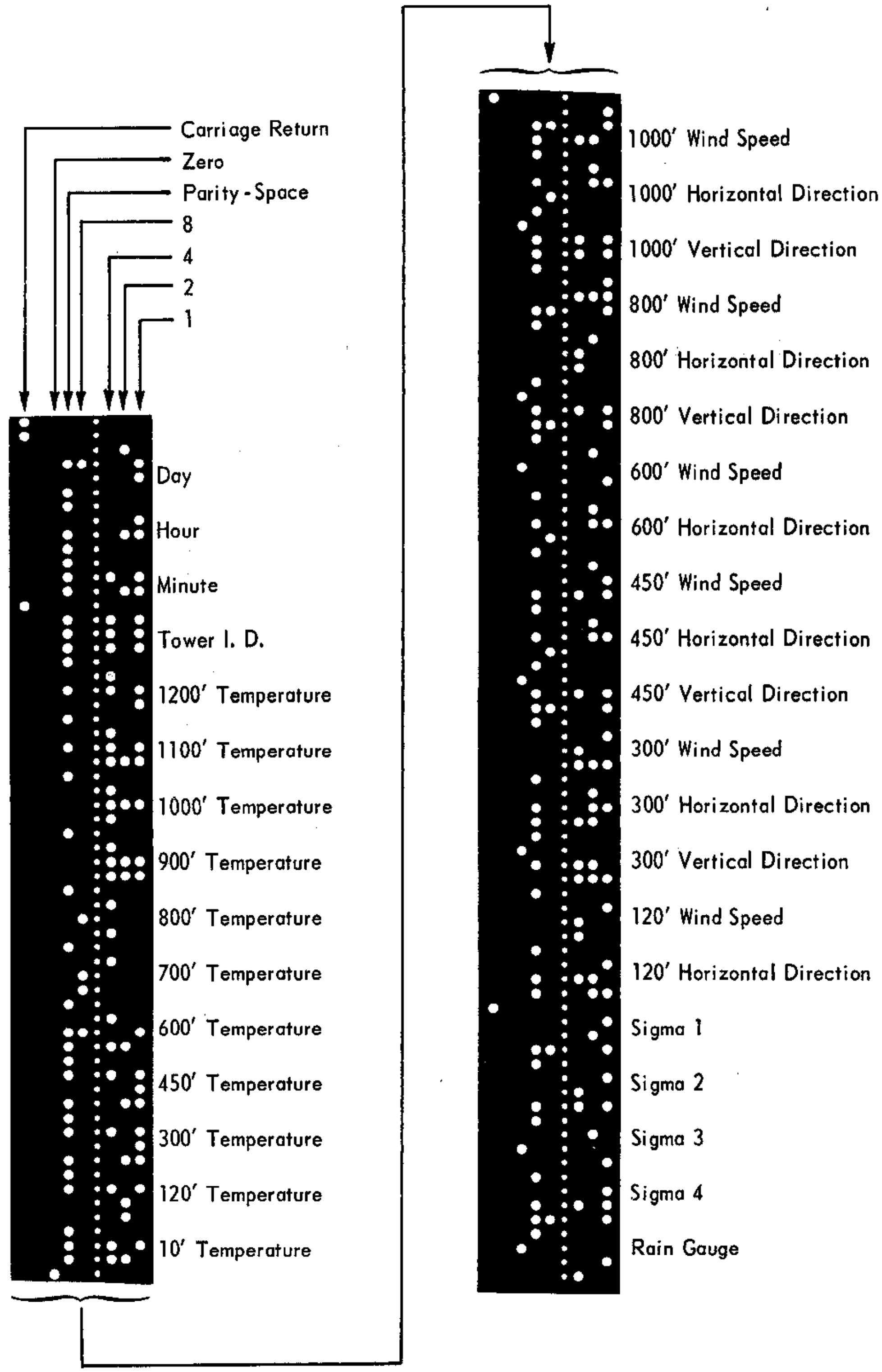

FIG. A-2 WJBF-TV TOWER PAPER TAPE FORMAT

TABLE A-I

Punched Paper Tape Format

Word Number	Word Length	Tall Tower	Short Tower
1	3	Day of Year	Day of Year
2	2	Hour	Hour
3	2	Minute	Minute
4	3	Tower ID	Tower ID
5	3	1200' Temp	110' Temp
6	3	1100' Temp	75' Temp
7	3	1000' Temp	15' Temp
8	3	900' Temp	Not Used
9	3	800' Temp	Not Used
10	3	700' Temp	Not Used
11	3	600' Temp	Not Used
12	3	450' Temp	Not Used
13	3	300' Temp	Not Used
14	3	120' Temp	Not Used
15	3	10' Temp	Not Used
16	3	1000' Speed	110' Speed
17	3	1000' Hor Dir	110' Hor Dir
18	3	1000' Ver Dir	110' Ver Dir
19	3	800' Speed	75' Speed
20	3	800' Hor Dir	75' Hor Dir
21	3	800' Ver Dir	75' Ver Dir
22	3	600' Speed	15' Speed
23	3	600' Hor Dir	15' Hor Dir
24	3	450' Speed	15' Ver Dir
25	3	450' Hor Dir	Not Used
26	3	450' Ver Dir	Not Used
27	3	300' Speed	Not Used
28	3	300' Hor Dir	Not Used
29	3	300' Ver Dir	Not Used
30	3	120' Speed	Not Used
31	3	120' Hor Dir	Not Used
32	3	Sigma No. 1	Not Used
33	3	Sigma No. 2	Not Used
34	3	Sigma No. 3	Not Used
35	3	Sigma No. 4	Not Used
36	3	Rain Gauge	Dew Point Temp

TABLE A-II

Raw Data Listing from IBM 1401 Computer

WJBF-TV Tower

```
1    279  09  39
2    552 663 672 673 684 684 684 684 684 654 654 701
3    100 290 073 088 287 063 078 268 079 241 063 043 240 054 053 213
4    008 087 036 018 020
1    279  09  42
2    548 663 664 681 681 681 681 681 681 653 653 701
3    116 288 071 082 277 072 072 253 084 236 066 074 238 073 044 238
4    012 091 034 034 009
1    279  09  45
2    547 662 662 674 683 683 683 683 683 653 653 701
3    106 288 071 091 283 075 075 258 074 243 064 064 258 067 049 242
4    007 088 032 032 018
1    279  09  48
2    552 662 662 675 679 679 679 679 679 653 653 698
3    113 287 067 088 276 072 072 246 082 245 066 045 244 071 045 257
4    010 085 047 040 023
```

Line 1 - Day of year, hour, minute
Line 2 - Tower ID number, eleven temperatures
Line 3 - Wind speed and direction data (16)
Line 4 - Four sigmas, rain gauge

Cassel's Fire Tower

```
1    172  11  27
2    153 773 803 805 006 005 005 005 005 005 006 006
3    082 144 063 066 133 072 038 123 084 001 001 000 000 000 001 001
4    057 077 117 177 999
1    172  11  30
2    151 772 801 807 006 006 006 006 006 006 006 006
3    079 171 074 072 168 080 055 144 079 001 001 000 000 000 000 000
4    021 037 078 094 998
1    172  11  33
2    153 774 804 813 007 007 007 007 007 005 005 005
3    062 185 047 039 164 025 024 204 078 000 001 000 000 000 000 000
4    133 207 175 326 999
1    172  11  36
2    153 773 811 814 005 005 005 006 006 006 006 006
3    085 159 064 097 154 062 042 466 061 001 001 001 001 001 001 001
4    171 163 241 275 997
```

Line 1 - Day of year, hour, minute
Line 2 - Tower ID number, three temperatures, eight unused positions
Line 3 - Nine wind data numbers, seven unused positions
Line 4 - Four sigmas, dew point

TABLE A-III

IBM System 360/65 Processed Data Listing

WJBF-TV Tower

Date		Temperatures, Top To Bottom											Wind Speed						Horizontal Directions						Vertical Dir				Sigmas				Rain
279	939	663	672	673	684	684	684	684	684	654	654	701	100	88	78	79	43	53	290	287	268	241	240	213	73	63	63	54	8	87	36	18	20
279	942	663	664	681	681	681	681	681	681	653	653	701	116	82	72	84	74	44	288	277	253	236	238	238	71	72	66	73	12	91	34	34	9
279	945	662	662	674	683	683	683	683	683	653	653	701	106	91	75	74	64	49	288	283	258	243	258	242	71	75	64	67	7	88	32	32	18
279	948	662	662	679	679	679	679	679	679	653	653	698	113	88	72	82	45	45	287	276	246	245	244	257	67	72	66	71	10	85	47	40	23
279	951	659	668	674	682	682	682	682	682	655	655	709	124	91	73	84	47	50	281	279	247	243	262	242	72	73	69	70	10	85	53	53	19
279	954	657	668	674	682	682	682	682	682	662	662	708	132	94	76	73	61	52	286	279	260	243	232	272	69	76	61	77	8	86	59	59	17
279	957	654	674	674	681	681	681	681	681	664	664	708	124	94	70	70	68	31	288	277	260	245	230	277	69	71	59	79	16	78	70	78	20
27910	0	656	672	673	682	682	682	682	682	664	664	711	117	94	69	91	66	33	288	278	257	238	214	249	69	69	66	95	8	85	69	84	17
27910	3	659	669	669	669	686	685	671	670	660	669	707	120	93	74	82	45	28	286	282	247	229	228	280	73	74	67	80	8	81	72	88	20
27910	6	656	667	667	682	682	668	657	667	667	667	712	127	87	73	73	47	59	294	282	264	229	209	240	68	74	47	41	8	87	113	150	22

Cassel's Fire Tower

Date			Temp			Wind Speed			Not Used			Horiz. Dir			Vert. Dir.			Sigmas				D/P
172	12	27	807	828	838	60	63	47	1	1	1	181	169	184	77	74	97	66	123	180	187	998
172	12	30	821	839	844	41	31	30	2	2	2	179	112	449	38	110	79	117	136	227	230	996
172	12	33	817	842	859	71	62	63	0	0	0	109	110	116	76	82	67	63	80	135	181	999
172	12	36	819	839	851	63	67	31	1	0	0	115	106	129	48	78	83	74	152	848	294	996
172	12	39	822	847	852	79	63	49	2	1	1	125	143	196	63	81	48	247	135	303	226	997
172	12	45	831	862	867	77	85	81	0	0	0	102	91	100	44	69	84	78	93	133	188	995
172	12	48	820	841	866	90	51	28	1	0	0	132	137	114	62	75	67	143	115	130	264	997
172	12	51	815	833	856	85	96	62	1	1	1	130	148	116	70	71	65	23	39	139	120	997
172	12	54	818	839	850	77	71	26	1	1	1	96	77	437	51	54	99	230	131	319	313	998
172	12	57	820	845	855	84	59	32	2	1	0	133	110	100	58	67	51	176	101	102	163	997

TABLE A-IV

IBM System 360/65 Programs

WJBF-TV Tower	Program Description	Cassel's Tower
METT	Sequentially processes the IBM 1401 generated tapes for data scrubbing and storage on high density labeled tapes in duplicate	METS
MOPT	Monitors tapes for content and lists the number of records by date count	MOPS
BUTT	Tape copy program for generating duplicate tapes to provide adequate data security during data consolidation	BUTS
WOPT	Provides an output listing of data over specified time intervals	WOPS
WTPT	Converts data to BCD and transfers to an auxiliary tape for off-plant use	WTPS
MATT	Monitors auxiliary BCD tapes generated by WTPS or WTPT	MATS

TABLE A-V

Job Configurations

Job Description	Job Step	Programs[(a)] Called Cassel	Programs[(a)] Called WJBF-TV
1. Process Low Density IBM 1401 Tapes and Monitor	A	METS	METT
	B	MSTS	MOPT
2. Tape Copy, List New Data by Record Number and Monitor	A	BUTS	BUTT
	B	WOPS	WOPT
	C	MSTS	MOPT
3. Tape Copy Program for Backup or Regenerating Bad Tapes and Monitor	A	BUTS	BUTT
	B	MSTS	MOPT
4. Write BCD 7-Track Tapes and Monitor	A	WTPS	WTPT
	B	MATS	MATT

(a) All programs have been compiled, link edited, and placed on the SRL programs file.

JOB CONFIGURATIONS

1. Processing of Low Density IBM 1401 Tapes

Step A - Data are converted from Binary Coded Decimal (BCD) to Extended Binary Coded Decimal Interchange Code (EBCDIC) information, scrubbed, and stored on high density labeled tapes in duplicate. Particular attention should be directed to the question of whether the data are the first to be consolidated on the high density tapes or are being added to previous consolidations. This consideration is explained in Appendix B.

Step B - The tapes involved in Step A are monitored, and all records are counted and listed as output by data count for each tape. This output should be carefully checked to ensure successful job execution.

2. Tape Copy and List

Step A - Compiled data from Job 1 above are copied onto a third or backup tape during the consolidation period.

Step B - An output listing of specified data is obtained to maintain a complete printed record of all data in a form suitable for visual checking.

Step C - Same as Step B of Job 1.

3. Tape Copy

Step A - Same as Step A of Job 2. This configuration is normally necessary only to regenerate duplicate tapes that have been mishandled or inadvertently overwritten with extraneous data.

Step B - Same as Step B of Job 1.

4. Convert and Copy

Step A - Data are converted to BCD information before transferring to a low density tape. This process generates data tapes that are compatible with other computer facilities.

Step B - The tape created in Step A are monitored to ensure validity.

APPENDIX B

METT-METS DATA COMPILATION PROGRAMS

METT and METS are FORTRAN IV programs (for the 1200- and 110-ft towers, respectively) that process the IBM 1401 generated tapes for consolidation onto the high density permanent data tapes. Several checks are performed in these processes to reject invalid data attributable to malfunctions in the data acquisition systems. Since the programs are similar with respect to context and function, the following discussion is valid for both programs unless noted otherwise.

A complete set of data on the low density tapes has 4 records of 16 words each. Each record is individually processed to perform validity checks and to determine the type of data constituting each record. These checks test system operability where feasible, thereby minimizing the time required to visually monitor all data before performing analyses. Checks are as follows:

a) TID Variance - The first number on the second line is the tower identification number, nominally 555 for the 1200-ft tower and 500 for the 110-ft tower. This signal is generated simply by a resistor network within the main control instrumentation. A deviation in this number indicates possible difficulties in power supply and/or analog-to-digital conversion. Any deviation greater than ±010, corresponding to an error of approximately 2%, will result in data rejection.

b) No Variance - This check compares all data on each record to the first number of the record to reject data when they are all equal. This condition would result from electronic or mechanical failure.

c) Parity error and illegal character - This is simply a rejection of data that has been flagged during the IBM 1401 process.

Many internal checks are made to properly identify information on each record in order to transfer a complete set of information to the high density tapes in the proper sequence. It is recognized that some checks may reject valid data, but at such a low frequency of occurrence as to be insignificant compared to the quantity of data being accumulated. Each group of 4 records (constituting a complete set of data for each sampling period) is transferred to the high density tape as a single record.

All processed data that are accepted as valid are listed as output along with edited information that shows the number of records transferred and the number of records rejected due to each test. This information is used to inventory the data and to evaluate acquisition efficiency. In addition, a wind speed frequency analysis as a function of elevation is provided to evaluate seasonal differences in the distribution.

Although these programs (METT and METS) are very similar, the data sorting procedures are different enough to warrant the inclusion of both programs as a matter of reference.

A complete listing of the FORTRAN program is included at the conclusion of this appendix.

INPUT PREPARATION

Required input information consists of only 2 data cards as listed below.

Card Type 1 (20A4) Title Card

Alphanumeric information used to identify output.

Card Type 2 (I2, I7) Control Data

NTAPS - Number of low density tapes being processed in this job. Up to 6 tapes may be processed in sequence.

IREC - This is the record number of the last record transferred to high density tape on a previous run. It is very important that this number be entered correctly since the high density tape will be positioned to begin accepting data beyond this record.

```
//RECT3362 JOB (3362,L058,070,17,0000,,,,8314-1H,L5365-01,T,03),          C
//                'L C HALL             ',MSGLEVEL=1
//STEPA EXEC FURTCLG
//FORT.SYSIN DD *
      DIMENSION INUM(16),IFLAG(8)
      DIMENSION ITEMP(11),NS(6)                                          TAL40020
      DIMENSION NDH(6),NDV(4)                                            TAL40030
      DIMENSION NSIGMA(4),TITLE(20)
      DIMENSION NBAD(9),NEL(6)                                           TAL40050
      DIMENSION NSP(21,6),P(21,12),NDAT(36)
C                                                                        TAL70010
      NT5=5                                                              TAL70020
      NT6=6                                                              TAL70030
      NT9=9                                                              TAL70040
      NTOUT=10                                                           TAL70060
      NEL(1)=1000                                                        TAL70070
      NEL(2)=800                                                         TAL70080
      NEL(3)=600                                                         TAL70090
      NEL(4)=450                                                         TAL70100
      NEL(5)=300                                                         TAL70110
      NEL(6)=120                                                         TAL70120
      NOW=2                                                              TAL70130
      IDAY=0                                                             TAL70140
      IHR=0                                                              TAL70150
      IMIN=0                                                             TAL70160
      ITIMES=0                                                           TAL70170
      IPROB=0                                                            TAL70180
      NBAD(9)=0                                                          TAL70200
      NGOOD=0                                                            TAL70210
      CALL SETBTF
      DO 14 I=1,8                                                        TAL70220
      IFLAG(I)=0                                                         TAL70230
      NBAD(I)=0                                                          TAL70240
   14 CONTINUE                                                           TAL70250
      DO 200 J=1,6                                                       TAL70260
      DO 200 I=1,21                                                      TAL70270
      NSP(I,J)=0                                                         TAL70280
  200 CONTINUE                                                           TAL70290
C                                                                        TAL70300
    1 READ (NT5,999)TITLE                                                TAL70310
      WRITE(6,1001)TITLE
 1001 FORMAT('1',20A4,//)
  999 FORMAT (20A4)
   11 READ (NT5,997)NTAPS,IREC
      NREC=IREC
      IF(NTAPS.EQ.0) GO TO 333
      IF(IREC.EQ.0) GO TO 778
  777 READ (10,END=779) (NDAT(I),I=1,36)
      IF(NDAT(1).NE.IREC) GO TO 777
      GO TO 778
  779 WRITE(6,801)
  801 FORMAT (' IMPROPER RECORD NUMBER')
      GO TO 803
  778 CONTINUE
  997 FORMAT (I2,I7)
C                                                                        TAL70580
   16 IF (ITIMES-4)18,120,120                                            TAL70590
   18 ICOUNT=0                                                           TAL70600
      ITIMES=ITIMES+1                                                    TAL70610
```

```
C                                                                       TAL70620
C             READ 16 WORD RECORD                                       TAL70630
   23 CONTINUE
  310 READ(NT9,1111,END=134,ERR=23)(INUM(I),I=1,16)
 1111 FORMAT (16(I3,1X))
    6 DO 8 I=1,16                                                       TAL70660
      IF (INUM(I)-999)10,8,10                                           TAL70670
    8 CONTINUE                                                          TAL70680
      GO TO 310
C                                                                       TAL70700
C        CHECKS FOR PARITY ERROR                                        TAL70710
C                                                                       TAL70720
   10 DO 12 I=1,3                                                       TAL70730
      IF (INUM(I)-888)19,12,19                                          TAL70740
   12 CONTINUE                                                          TAL70750
   15 IFLAG(6)=1                                                        TAL70760
      IF(ITIMES-4)300,301,300
  301 IPROB=0
  300 GO TO 16
C                                                                       TAL70780
C             COUNT NON-ZERO WORDS AND ZEROS THAT ARE BETWEEN ZEROS     TAL70790
   19 DO 24 I=1,16                                                      TAL70800
      IF (INUM(I))20,24,20                                              TAL70810
   20 ICOUNT=ICOUNT+1                                                   TAL70820
      IF (I-1)21,24,21                                                  TAL70830
   21 IJ=I-1                                                            TAL70840
C                                                                       TAL70850
      IF (INUM(IJ))24,22,24                                             TAL70860
   22 ICOUNT=ICOUNT+1                                                   TAL70870
   24 CONTINUE                                                          TAL70880
      IF (ICOUNT-1)34,34,242                                            TAL70890
C                                                                       TAL70900
  242 IEQ=ICOUNT-1                                                      TAL70910
      DO 25 I=1,IEQ                                                     TAL70920
      IF (INUM(I)-INUM(I+1))26,25,26                                    TAL70930
   25 CONTINUE                                                          TAL70940
      IFLAG(8)=1                                                        TAL70950
C                                                                       TAL70960
C             SENDS TO PROPER PORTION OF CODE FOR SCRUBBING             TAL70970
   26 IF (ICOUNT-10)28,28,30                                            TAL70980
C               1   2   3   4    5    6    7    8    9   10             TAL70990
   28 GO TO (34,34,34,112,112,96,96,96,96,50),ICOUNT                    TAL71000
C                                                                       TAL71010
   30 ICOUNT=ICOUNT-10                                                  TAL71020
C             11  12  13  14  15  16                                    TAL71030
      GO TO (50,50,96,96,96,96),ICOUNT                                  TAL71040
C                                                                       TAL71050
C             ARRIVE HERE IF ICOUNT=3 -DATE AND SITE DATA               TAL71060
   34 IF (IPROB)112,35,112                                              TAL71070
   35 IPROB=1                                                           TAL71080
C                                                                       TAL71090
   44 IDAY=INUM(1)                                                      TAL71100
      IHR=INUM(2)                                                       TAL71110
      IMIN=INUM(3)                                                      TAL71120
      IF (IDAY-100)48,46,46                                             TAL71130
   46 IF (IDAY-283)47,47,48                                             TAL71140
   47 IGO=1                                                             TAL71150
      GO TO 16                                                          TAL71160
   48 IGO=2                                                             TAL71170
```

```
      GO TO 16
C
C           ARRIVE HERE IF ICOUNT=4 OR 12   TEMPERATURE DATA
C
C           SELECTS INDEX FOR TEMP LOOP
C
   50 IF (IABS(INUM(1)-555)-10)51,51,52
   51 IN=11
      GO TO 58
   52 IFLAG(7)=1
   58 DO 60 I=1,IN
   60 ITEMP(I)=INUM(I+1)
      GO TO 16
C
C           ARRIVE HERE IF ICOUNT= 9 OR 16   DIR AND SPEED DATA
   96 NS(1)=INUM(1)
      NS(2)=INUM(4)
      NS(3)=INUM(7)
C
      NDH(1)=INUM(2)
      NDH(2)=INUM(5)
      NDH(3)=INUM(8)
C
      NDV(1)=INUM(3)
      NDV(2)=INUM(6)
      NDV(3)=INUM(11)
C
C
   98 NS(4)=INUM(9)
      NS(5)=INUM(12)
      NS(6)=INUM(15)
      NDH(4)=INUM(10)
      NDH(5)=INUM(13)
      NDH(6)=INUM(16)
      NDV(4)=INUM(14)
      GO TO 16
C
C           ARRIVE HERE IF 5 WORDS
  112 IPROB=0
      DO 114 I=1,4
  114 NSIGMA(I)=INUM(I)
C
  115 DP=INUM(5)
      IF (IN-3)120,116,120
  116 DP=DP/10.0
C
C           THIS IS THE EDIT SECTION
  120 ITIMES=0
  149 IG=0
  150 DO 152 I=6,8
      IF (IFLAG(I))151,152,151
  151 NBAD(I)=NBAD(I)+1
      IG=1
  152 CONTINUE
      IF (IG)154,553,154
  553 IF (IDAY-366)554,554,154
  554 IF (IDAY)153,154,153
  153 NGOOD=NGOOD+1
      NREC=NREC+1
```

```
      NRN=DP
      WRITE (NTOUT)NREC,IDAY,IHR,IMIN,(ITEMP(I),I=1,11),(NS(J),J=1,6),( TAL71770
     1NDH(K),K=1,6),(NDV(L),L=1,4),(NSIGMA(M),M=1,4),NRN
      GO TO (156,202),NOW                                               TAL71790
  202 NOW=1                                                             TAL71800
      IBEN=IDAY                                                         TAL71810
      GO TO 156                                                         TAL71820
  156 DO 160 J=1,6                                                      TAL71830
      WS=NS(J)                                                          TAL71840
      WS=WS*0.447027                                                    TAL71850
      NS(J)=WS                                                          TAL71860
      IF (NS(J)-199)157,157,158                                         TAL71870
  157 K=NS(J)/10+1                                                      TAL71880
      GO TO 159                                                         TAL71890
  158 K=21                                                              TAL71900
  159 NSP(K,J)=NSP(K,J)+1                                               TAL71910
 1000 FORMAT(1X,I3,2I2,27I4,1X,5I3)
  160 CONTINUE                                                          TAL71920
      GO TO 126                                                         TAL71930
C                                                                       TAL71940
  154 NBAD(9)=NBAD(9)+1                                                 TAL71950
C                                                                       TAL71960
  126 DO 128 I=1,11                                                     TAL71970
  128 ITEMP(I)=0                                                        TAL71980
C                                                                       TAL71990
      DO 130 I=1,6                                                      TAL72000
      NS(I)=0                                                           TAL72010
      IFLAG(I)=0                                                        TAL72020
  130 NDH(I)=0                                                          TAL72030
      IFLAG(7)=0                                                        TAL72040
      IFLAG(8)=0                                                        TAL72050
C                                                                       TAL72060
      DO 132 I=1,4                                                      TAL72070
      NDV(I)=0                                                          TAL72080
  132 NSIGMA(I)=0                                                       TAL72090
      GO TO 16                                                          TAL72100
  134 CONTINUE                                                          TAL72160
      REWIND 10
      IF(IREC.EQ.0) GO TO 333
  660 READ (10) (NDAT(I),I=1,36)
      IF (NDAT(1).NE.IREC) GO TO 660
  333 READ (10,END=135) (NDAT(I),I=1,36)
      WRITE (11) (NDAT(I),I=1,36)
      IF (NTAPS.EQ.0) GO TO 333
      WRITE(6,1000) (NDAT(I),I=2,36)
      GO TO 333
  135 REWIND 10
      REWIND 11
      IF (NTAPS.EQ.0) GO TO 700
      DO 136 I=1,6
      NS(I)=INUM(I)                                                     TAL72200
  136 CONTINUE                                                          TAL72210
      DO 137 I=1,9                                                      TAL72220
      ITEMP(I)=NBAD(I)                                                  TAL72230
  137 CONTINUE                                                          TAL72240
      ITEMP(10)=NGOOD                                                   TAL72250
  996 FORMAT (11H0END OF JOB)                                           TAL72320
      WRITE (NT6,995)                                                   TAL72330
      WRITE (NT6,985)                                                   TAL72340
```

```
      WRITE (NT6,984)(NEL(I),I=1,6),(NEL(I),I=1,6),(NEL(I),I=1,6)
  994 FORMAT (50H1RUSCHE -COOPER WEATHER INFO. GOOD VS. BAD RECORDS)
  992 FORMAT (11I6)
  995 FORMAT (1H1,33X,63HFREQUENCY OF WIND SPEED IN METERS PER SEC. BY E
     1LEVATION IN FEET)
  985 FORMAT (1H0,24X,9HELEVATION,10X,34HPERCENT AT EACH SPEED BY ELEVAT
     1ION,6X,42HACCUMULATIVE PERCENT BY SPEED BY ELEVATION)
  984 FORMAT (10H0   SPEED ,2X6I5,2X,6(I6,1X),2X,6(I6,1X))
  983 FORMAT (1H ,I3,3H TO,I3,2X6I5,2X6F7.4,2X6F7.4)
  982 FORMAT (10H  OVER 20 ,2X6I5,2X6F7.4,2X6F7.4)
  981 FORMAT (46H0TOTAL NUMBER OF SAMPLES IN ABOVE DISTRIBUTION,I6,6X,
     123HPERIOD COVERED FROM DAY,I4,7H TO DAY,I4)
  980 FORMAT (1H0)
      PGD=NGOOD
      DO 146 K=1,21
      DO 138 L=1,6
      M=L+6
      P(K,L)=NSP(K,L)
      P(K,L)=P(K,L)/PGD
      KK=K-1
      IF (KK)142,140,142
  140 P(K,M)=P(K,L)
      GO TO 138
  142 P(K,M)=P(KK,M)+P(K,L)
  138 CONTINUE
      IF (K-21)143,144,144
  143 WRITE (NT6,983)KK,K,(NSP(K,I),I=1,6),(P(K,N),N=1,12)
      GO TO 146
  144 WRITE (NT6,982)(NSP(K,I),I=1,6),(P(K,N),N=1,12)
  146 CONTINUE
      WRITE (NT6,980)
      WRITE (NT6,981)NGOOD,IBEN,IDAY
      WRITE (NT6,994)
      WRITE (NT6,992)NREC,NGOOD,NBAD(9),(NBAD(I),I=1,8)
  700 CONTINUE
      WRITE (NT6,996)
C
C      DP-DEWPOINT. DEG F OR RAIN NUMBER
C      IDAY=DAY OF YEAR DATA RECORDED
C     IDEL-TEMP. DIFFERENCE BETWEEN MAX AND MIN
C      IFLAG(1)- OVER 40 DEG TEMPERATURE SPREAD
C      IFLAG(2)- TEMPERATURE OUTSIDE LIMITS
C      IFLAG(3)- OVER 15 DEG DIFFERENCE IN ADJ TEMPERATURES
C      IFLAG(4)- WIND SPEED OR HOR. DIRECTION OVER LIMITS
C      IFLAG(5)- VERT WIND DIR OVER 120 DEG
C      IFLAG(6)= PARITY ERROR
C      IFLAG(7)- POWER VARIANCE
C      IHR=HOUR IN WHICH DATA RECORDED
C      IMAX-INDEX OF MAX TEMP READING
C      IMI-INDEX OF MIN TEMP READING
C      IMIN=MINUTE DATA STARTED TO BE RECORDED
C     IQA-MAX. TEMP READING
C     IQI-MIN. TEMP READING
C     ITEMP-TEMPERATURE-DE F (ELEVATION)
C     ITP-TEMP. DIFFERENCE BETWEEN ADJACENT ELEVATIONS
C     NDH-WIND DIRECTION HORIZONTAL (ELEVATION)
C     NDV-WIND DIRECTION VERTICAL (ELEVATION)
C     NSIGMA-SIGMA
  803 STOP
      END
```

```
/*
//LKED.PROGRAM DD DSNAME=SRL.TESTPGMS(METT3362)
//LKED.SYSIN DD *
      ENTRY MAIN
      NAME METT3362(R)
/*
//GO.FT09F001 DD UNIT=TAPE27,LABEL=(,NL),DSNAME=LCIN,                          X
//               DCB=(,TRTCH=ET,RECFM=UA,LRECL=136,BLKSIZE=1360),               X
//               VOLUME=(,,,6,SER=(NA0091,0092,0093,0094,0095,0096))            X
//               DISP=(OLD,KEEP)
//GO.FT10F001 DD UNIT=(2400,1),LABEL=(,SL),DSNAME=TALL,                         X
//               DCB=(,RECFM=VB,LRECL=148,BLKSIZE=5924),                        X
//               VOLUME=SER=LW0003,DISP=(OLD,PASS)
//GO.FT11F001 DD UNIT=(2400,1),LABEL=(,SL),DSNAME=TALL,                         X
//               DCB=(,RECFM=VB,LRECL=148,BLKSIZE=5924),                        X
//               VOLUME=SER=LW0004,DISP=(MOD,PASS)
//GO.SYSIN DD *
TALL TOWER       SER=LW0003 AND LW0004
06+046517
/*
//STEPB EXEC FORTCLG
//FORT.SYSIN DD *
      DIMENSION NDAT(36), WORDS(20),NDC(500),KDAY(500)
    5 FORMAT (I2,19A4)
    6 FORMAT ('1',///,19A4,///)
    7 FORMAT (10(I8,I4))
   30 FORMAT (///,' TOTAL NUMBER OF RECORDS ON THIS TAPE IS',I7)
    8 FORMAT (///,' LAST RECORD NUMBER AND DATE READ IN IS',I6,3I4)
   20 READ (5,5)NT,(WORDS(I),I=1,19)
      NTC=0
      K1=1
      IF (NT.EQ.0)GO TO 9
      DO 11 I=1,500
   11 NDC(I)=0
    1 READ(NT,END=41,ERR=3) (NDAT(I),I=1,36)
      NTC=NTC+1
      IDAY=NDAT(2)
      IF (NTC-1)18,18,13
   13 IF (KDAY(K1)-IDAY)16,18,16
   16 K1=K1+1
   18 KDAY(K1)=IDAY
      NDC(K1)=NDC(K1)+1
      GO TO 1
   41 WRITE (6,6)(WORDS(I),I=1,19)
      WRITE (6,7)(KDAY(K),NDC(K),K=1,K1)
      WRITE (6,30)NTC
      GO TO 33
    3 WRITE (6,35)NT
   35 FORMAT (' ERROR ENCOUNTERED IN READING TAPE',I3)
   33 WRITE (6,8)(NDAT(I),I=1,4)
      GO TO 20
    9 STOP
      END


/*
//LKED.PROGRAM DD DSNAME=SRL.TESTPGMS(MOPT3362)
//LKED.SYSIN DD *
     ENTRY MAIN
     NAME MOPT3362(R)
/*
//GO.FT10F001 DD UNIT=(2400,1),LABEL=(,SL),DSNAME=TALL,                         X
//               DCB=(,RECFM=VB,LRECL=148,BLKSIZE=5924),                        X
//               VOLUME=SER=LW0003,DISP=(OLD,KEEP)
//GO.FT11F001 DD UNIT=(2400,1),LABEL=(,SL),DSNAME=TALL,                         X
//               DCB=(,RECFM=VB,LRECL=148,BLKSIZE=5924),                        X
//               VOLUME=SER=LW0004,DISP=(OLD,KEEP)
//GO.SYSIN DD *
10 LISTING OF DATA ON LW0003 BY DAY AND BY COUNT
11 LISTING OF DATA ON LW0004 BY DAY AND BY COUNT

/*
```

```
//METS3362 JOB (3362,L058,060,17,0000,,,,8314-1H,L5365-01,T,08),          C
//               ' R E COOPER          ',MSGLEVEL=1
//STEPA EXEC FORTCLG
//FORT.SYSIN DD *
      DIMENSION INUM(16),IFLAG(8)
      DIMENSION ITEMP(11),NS(6)
      DIMENSION NDH(6),NDV(4)
      DIMENSION NSIGMA(4),TITLE(20)
      DIMENSION NBAD(9),NEL(3)
      DIMENSION NSP(21,3),P(21,6),NDAT (24)
C
      NT5=5
      NT6=6
      NT9=9
      NTOUT=10
      NEL(1)=110
      NEL(2)=75
      NEL(3)=15
      NOW=2
      IDAY=0
      IHR=0
      IMIN=0
      ITIMES=0
      IPROB=0
      NBAD(9)=0
      NGOOD=0
      CALL SETBTF
      DO 14 I=1,8
      IFLAG(I)=0
      NBAD(I)=0
   14 CONTINUE
      DO 200 J=1,3
      DO 200 I=1,21
      NSP(I,J)=0
  200 CONTINUE
C
    1 READ (NT5,999)TITLE
      WRITE (6,1001)TITLE
 1001 FORMAT ('1',20A4,//)
  999 FORMAT (20A4)
   11 READ (NT5,997)NTAPS,IREC
      IF(NTAPS.EQ.0)GO TO 333
      NREC=IREC
  997 FORMAT (I2,I7)
      IF(IREC.EQ.0)GO TO 778
  777 READ (10) (NDAT(I),I=1,24)
      IF (NDAT(1).NE.IREC)GO TO 777
  778 CONTINUE
C
   16 IF (ITIMES-4)18,120,120
   18 ICOUNT=0
      ITIMES=ITIMES+1
C
C           READ 16 WORD RECORD
  310 READ(NT9,1111,END=134)(INUM(I),I=1,16)
 1111 FORMAT (16(I3,1X))
    6 DO 8 I=1,16
      IF (INUM(I)-999)10,8,10
    8 CONTINUE
```

```
      GO TO 310
C
C     CHECKS FOR PARITY ERROR
C
   10 DO 12 I=1,3
      IF (INUM(I)-888)19,12,19
   12 CONTINUE
   15 IFLAG(6)=1
      IF(ITIMES-4)300,301,300
  301 IPROB=0
  300 GO TO 16
C
C           COUNT NON-ZERO WORDS AND ZEROS THAT ARE BETWEEN ZEROS
   19 DO 24 I=1,16
      IF (INUM(I))20,24,20
   20 ICOUNT=ICOUNT+1
      IF (I-1)21,24,21
   21 IJ=I-1
C
      IF (INUM(IJ))24,22,24
   22 ICOUNT=ICOUNT+1
   24 CONTINUE
      IF (ICOUNT-1)34,34,242
C
  242 IEQ=ICOUNT-1
      DO 25 I=1,IEQ
      IF (INUM(I)-INUM(I+1))26,25,26
   25 CONTINUE
      IFLAG(8)=1
C
C           SENDS TO PROPER PORTION OF CODE FOR SCRUBBING
   26 IF (ICOUNT-10)28,28,30
C             1   2   3 . 4   5   6   7   8   9  10
   28 GO TO (34,34,34, 56,112,96,96,96,96,56),ICOUNT
C
   30 ICOUNT=ICOUNT-10
C            11 12 13 14 15 16
      GO TO (56,56,96,96,96,96),ICOUNT
C
C     .     ARRIVE HERE IF ICOUNT=3 -DATE AND SITE DATA
   34 IF (IPROB)112,35,112
   35 IPROB=1
      ITIMES=1
C
   44 IDAY=INUM(1)
      IHR=INUM(2)
      IMIN=INUM(3)
      IF (IDAY-100)48,46,46
   46 IF (IDAY-283)47,47,48
   47 IGO=1
      GO TO 16
   48 IGO=2
      GO TO 16
C
C           ARRIVE HERE IF ICOUNT=4 OR 12   TEMPERATURE DATA
C
C           SELECTS INDEX FOR TEMP LOOP
C
   56 IF (ITIMES-2) 16,50,96
```

```
   50 IF (IABS(INUM(1)-155)-15)51,51,52
   51 IN=3                                                                SH071230
      GO TO 58                                                            SH071240
   52 IFLAG(7)=1                                                          SH071250
   58 DO 60 I=1,IN                                                        SH071260
   60 ITEMP(I)=INUM(I+1)                                                  SH071270
      GO TO 16                                                            SH071280
C                                                                         SH071290
C         ARRIVE HERE IF ICOUNT= 9 OR 16   DIR AND SPEED DATA             SH071300
   96 IF(ITIMES-3)56,97,112
   97 NS(1)=INUM(1)
      NS(2)=INUM(4)                                                       SH071320
      NS(3)=INUM(7)                                                       SH071330
      DO 662 I=1,3
      IF((NS(I).GT.900).OR.(NS(I).LT.5)) NS(I)=0
  662 CONTINUE
C                                                                         SH071340
      NDH(1)=INUM(2)                                                      SH071350
      NDH(2)=INUM(5)                                                      SH071360
      NDH(3)=INUM(8)                                                      SH071370
C                                                                         SH071380
      NDV(1)=INUM(3)                                                      SH071390
      NDV(2)=INUM(6)                                                      SH071400
      NDV(3)=INUM(9)                                                      SH071410
C                                                                         SH071420
C                                                                         SH071430
   98 NS(4)=INUM(10)                                                      SH071440
      NS(5)=INUM(11)                                                      SH071450
      NS(6)=INUM(12)                                                      SH071460
      GO TO 16                                                            SH071470
C                                                                         SH071480
C         ARRIVE HERE IF 5 WORDS                                          SH071490
  112 IF(ITIMES-4)56,113,16
  113 IPROB=0
      DO 114 I=1,4                                                        SH071510
  114 NSIGMA(I)=INUM(I)                                                   SH071520
C                                                                         SH071530
  115 DP=INUM(5)                                                          SH071540
      IF (IN-3)120,116,120                                                SH071550
  116 CONTINUE
C                                                                         SH071570
C         THIS IS THE EDIT SECTION                                        SH071580
  120 ITIMES=0                                                            SH071590
  149 IG=0                                                                SH071610
  150 DO 152 I=6,8                                                        SH071620
      IF (IFLAG(I))151,152,151                                            SH071630
  151 NBAD(I)=NBAD(I)+1                                                   SH071640
      IG=1                                                                SH071650
  152 CONTINUE                                                            SH071660
      IF (IG)154,553,154                                                  SH071670
  553 IF (IDAY)554,154,554                                                SH071680
  554 IF (IDAY-366)153,153,154                                            SH071690
  153 NGOOD=NGOOD+1                                                       SH071700
      NREC=NREC+1
      NDP=DP
      WRITE (NTOUT)NREC,IDAY,IHR,IMIN,(ITEMP(I),I=1,3),(NS(J),J=1,6),(    SH071710
     1NDH(K),K=1,3),(NDV(L),L=1,3),(NSIGMA(M),M=1,4),NDP
      GO TO (156,202),NOW                                                 SH071730
  202 NOW=1                                                               SH071740
```

```
      IBEN=IDAY                                                         SH071750
      GO TO 156                                                         SH071760
  156 DO 160 J=1,3                                                      SH071770
      WS=NS(J)                                                          SH071780
      WS=WS*0.447027                                                    SH071790
      NS(J)=WS                                                          SH071800
      IF (NS(J)-199)157,157,158                                         SH071810
  157 K=NS(J)/10+1                                                      SH071820
      GO TO 159                                                         SH071830
  158 K=21                                                              SH071840
  159 NSP(K,J)=NSP(K,J)+1                                               SH071850
 1000 FORMAT (I8,I4,2I3,1X,3I4,1X,3I4,1X,3I4,1X,3I4,1X,3I4,1X,5I4)
  160 CONTINUE                                                          SH071860
      GO TO 126                                                         SH071870
C                                                                       SH071880
  154 NBAD(9)=NBAD(9)+1                                                 SH071890
C                                                                       SH071900
  126 DO 128 I=1,3                                                      SH071910
  128 ITEMP(I)=0                                                        SH071920
C                                                                       SH071930
      DO 130 I=1,6                                                      SH071940
      NS(I)=0                                                           SH071950
      IFLAG(I)=0                                                        SH071960
  130 NDH(I)=0                                                          SH071970
      IFLAG(7)=0                                                        SH071980
      IFLAG(8)=0                                                        SH071990
C                                                                       SH072000
      DO 132 I=1,4                                                      SH072010
      NDV(I)=0                                                          SH072020
  132 NSIGMA(I)=0                                                       SH072030
      GO TO 16                                                          SH072040
  134 CONTINUE                                                          SH072100
      REWIND 10
      IF(IREC.EQ.0) GO TO 333
  660 READ (10) (NDAT(I),I=1,24)
      IF(NDAT(1).NE.IREC) GO TO 660
  333 READ (10,END=135) (NDAT(I),I=1,24)
      WRITE (11) (NDAT(I),I=1,24)
      IF(NTAPS.EQ.0)GO TO 333
      WRITE(6,1000) (NDAT(I),I=1,24)
      GO TO 333
  135 IF (NTAPS.EQ.0) GO TO 700
      DO 136 I=1,6
      NS(I)=INUM(I)                                                     SH072140
  136 CONTINUE                                                          SH072150
      DO 137 I=1,9                                                      SH072160
      ITEMP(I)=NBAD(I)                                                  SH072170
  137 CONTINUE                                                          SH072180
      ITEMP(10)=NGOOD                                                   SH072190
  996 FORMAT (11HOEND OF JOB)                                           SH072260
      WRITE (NT6,995)                                                   SH072270
      WRITE (NT6,985)                                                   SH072280
      WRITE (NT6,984)(NEL(I),I=1,3),(NEL(I),I=1,3),(NEL(I),I=1,3)       SH072290
  994 FORMAT (50HIRUSCHE -COOPER WEATHER INFO. GOOD VS. BAD RECORDS)    SH072300
  992 FORMAT (1116)                                                     SH072310
  995 FORMAT (1H1,33X,63HFREQUENCY OF WIND SPEED IN METERS PER SEC. BY ESH072320
     1LEVATION IN FEET)                                                 SH072330
  985 FORMAT (1H0,24X,9HELEVATION,10X,34HPERCENT AT EACH SPEED BY ELEVATSH072340
     1ION,6X,42HACCUMULATIVE PERCENT BY SPEED BY ELEVATION)             SH072350
```

```
984 FORMAT (9H0    SPEED,12X3I5,15X3(I6,1X),22X3(I6,1X))                   SH072360
983 FORMAT (1H0,I3,3H TO,I3,11X3I5,15X2P3F7.2,22X3F7.2)                    SH072370
982 FORMAT (10H0 OVER 20 ,11X3I5,15X2P3F7.2,22X3F7.2)                      SH072380
981 FORMAT (46H0TOTAL NUMBER OF SAMPLES IN ABOVE DISTRIBUTION,I6,6X,      SH072390
   123HPERIOD COVERED FROM DAY,I4,7H TO DAY,I4)                            SH072400
980 FORMAT (1H0)                                                           SH072410
    PGD=NGOOD                                                              SH072420
    DO 146 K=1,21                                                          SH072430
    DO 138 L=1,3                                                           SH072440
    M=L+3                                                                  SH072450
    P(K,L)=NSP(K,L)                                                        SH072460
    P(K,L)=P(K,L)/PGD                                                      SH072470
    KK=K-1                                                                 SH072480
    IF (KK)142,140,142                                                     SH072490
140 P(K,M)=P(K,L)                                                          SH072500
    GO TO 138                                                              SH072510
142 P(K,M)=P(KK,M)+P(K,L)                                                  SH072520
138 CONTINUE                                                               SH072530
    IF (K-21)143,144,144                                                   SH072540
143 WRITE (NT6,983)KK,K,(NSP(K,I),I=1,3),(P(K,N),N=1,6)                    SH072550
    GO TO 146                                                              SH072560
144 WRITE (NT6,982)(NSP(K,I),I=1,3),(P(K,N),N=1,6)                         SH072570
146 CONTINUE                                                               SH072580
    WRITE (NT6,980)                                                        SH072590
    WRITE (NT6,981)NGOOD,IBEN,IDAY                                         SH072600
    WRITE (NT6,994)                                                        SH072610
    WRITE (NT6,992)NREC,NGOOD,NBAD(9),(NBAD(I),I=1,8)                      SH072620
    WRITE(NT6,996)
700 CONTINUE
C                                                                          SH072640
C      DP-DEWPOINT. DEG F OR RAIN NUMBER                                   SH072650
C      IDAY=DAY OF YEAR DATA RECORDED                                      SH072660
C     IDEL-TEMP. DIFFERENCE BETWEEN MAX AND MIN                            SH072670
C      IFLAG(1)- OVER 40 DEG TEMPERATURE SPREAD                            SH072680
C      IFLAG(2)- TEMPERATURE OUTSIDE LIMITS                                SH072690
C      IFLAG(3)- OVER 15 DEG DIFFERENCE IN ADJ TEMPERATURES                SH072700
C      IFLAG(4)- WIND SPEED OR HOR. DIRECTION OVER LIMITS                  SH072710
C      IFLAG(5)- VERT WIND DIR OVER 120 DEG                                SH072720
C      IFLAG(6)= PARITY ERROR                                              SH072730
C      IFLAG(7)- POWER VARIANCE                                            SH072740
C      IHR=HOUR IN WHICH DATA RECORDED                                     SH072750
C      IMAX-INDEX OF MAX TEMP READING                                      SH072760
C      IMI-INDEX OF MIN TEMP READING                                       SH072770
C      IMIN=MINUTE DATA STARTED TO BE RECORDED                             SH072780
C     IQA-MAX. TEMP READING                                                SH072790
C     IQI-MIN. TEMP READING                                                SH072800
C     ITEMP-TEMPERATURE-DE F (ELEVATION)                                   SH072810
C     ITP-TEMP. DIFFERENCE BETWEEN ADJACENT ELEVATIONS                     SH072820
C     NDH-WIND DIRECTION HORIZONTAL (ELEVATION)                            SH072830
C     NDV-WIND DIRECTION VERTICAL (ELEVATION)                              SH072840
C     NSIGMA-SIGMA                                                         SH072850
    STOP
    END                                                                    SH072870
```

```
/*
//LKED.PROGRAM DD DSNAME=SRL.TESTPGMS(METS3362)
//LKED.SYSIN DD *
    ENTRY MAIN
    NAME METS3362(R)
/*                                                                      X
//GO.FT09F001 DD UNIT=TAPE27,LABEL=(,NL),DSNAME=LCIN,                   X
//              DCB=(,TRTCH=ET,RECFM=UA,LRECL=100,BLKSIZE=5000),        X
//              VOLUME=(,,,6,SER=(NA1049,1057,1058,1085,1087,1088)),
//              DISP=(OLD,KEEP)                                         X
//GO.FT10F001 DD UNIT=(2400,1),LABEL=(,SL),DSNAME=SHORT,                X
//              DCB=(RECFM=VB,LRECL=100,BLKSIZE=6004),
//              VOLUME=SER=LW0019,DISP=(OLD,PASS)                       X
//GO.FT11F001 DD UNIT=(2400,1),LABEL=(,SL),DSNAME=SHORT,                X
//              DCB=(,RECFM=VB,LRECL=100,BLKSIZE=6004),
//              VOLUME=SER=LW0020,DISP=(MOD,PASS)
//GO.SYSIN DD *
TALL TOWER SER=LW0019 AND LW0020
06+068375
/*
//STEPB EXEC FORTCLG
//FORT.SYSIN DD *
      DIMENSION NDAT(24),WORDS(20),NDC(500),KDAY(500)
    5 FORMAT (I2,19A4)
    6 FORMAT ('1',///,19A4,///)
    7 FORMAT (10(I8,I4))
   30 FORMAT (///,' TOTAL NUMBER OF RECORDS ON THIS TAPE IS',I7)
    8 FORMAT (///,' LAST RECORD NUMBER AND DATE READ IN IS',I6,3I4)
   20 READ (5,5)NT,(WORDS(I),I=1,19)
      NTC=0
      K1=1
      IF (NT.EQ.0)GO TO 9
      DO 11 I=1,500
   11 NDC(I)=0
    1 READ(NT,END=41,ERR=3) (NDAT(I),I=1,24)
      NTC=NTC+1
      IDAY=NDAT(2)
      IF (NTC-1)18,18,13
   13 IF (KDAY(K1)-IDAY)16,18,16
   16 K1=K1+1
   18 KDAY(K1)=IDAY
      NDC(K1)=NDC(K1)+1
      GO TO 1
   41 WRITE (6,6)(WORDS(I),I=1,19)
      WRITE (6,7)(KDAY(K),NDC(K),K=1,K1)
      WRITE (6,30)NTC
      GO TO 33
    3 WRITE (6,35)NT
   35 FORMAT (' ERROR ENCOUNTERED IN READING TAPE',I3)
   33 WRITE (6,8)(NDAT(I),I=1,4)
      GO TO 20
    9 STOP
      END

/*
//LKED.PROGRAM DD DSNAME=SRL.TESTPGMS(MOPS3362)
//LKED.SYSIN DD *
    ENTRY MAIN
    NAME MOPS3362(R)
/*                                                                      X
//GO.FT10F001 DD UNIT=(2400,1),LABEL=(,SL),DSNAME=SHORT,                X
//              DCB=(,RECFM=VB,LRECL=100,BLKSIZE=6004),
//              VOLUME=SER=LW0019,DISP=(OLD,KEEP)                       X
//GO.FT11F001 DD UNIT=(2400,1),LABEL=(,SL),DSNAME=SHORT,                X
//              DCB=(,RECFM=VB,LRECL=100,BLKSIZE=6004),
//              VOLUME=SER=LW0020,DISP=(OLD,KEEP)
//GO.SYSIN DD *
10 LISTING OF DATA ON LW0019 BY DAY AND BY COUNT
11 LISTING OF DATA ON LW0020 BY DAY AND BY COUNT

/*
```

APPENDIX C

CHRONOLOGY AND SYSTEM PERFORMANCE

CHRONOLOGY

The meteorological program at the Savannah River Laboratory was initiated in October 1964 to acquire local data in support of the SRP reactor safety program. The objective of the program was to sufficiently instrument two tower facilities such that the frequency distribution of atmospheric dispersion properties could be determined as a function of elevation up to 1000 ft. A discussion of the chronological order of establishing the SRL meteorological facility is presented to provide a permanent record of events and to provide some insight into the difficulties associated with establishing and operating a system of sensors that are relatively inaccessible for maintenance. A brief chronological outline is shown in Table C-I.

TABLE C-I

Chronology

Request for Project	10-15-64
Approval	11-18-64
Instrument Requisition to Climet Inst., Inc.	12-21-64
Approval (AEC-SROO) of WJBF-TV Tower Agreement	1-11-65
Contract to Kline Iron and Steel Co.	Jun 1965
Initial Installation	Jul 1965
Interim Checkout	Jul '65 - Oct '65
Installed Analog Recording System	Aug 1965
Installation Complete	Nov 1965
Debugged and Routine Operation	Feb 1966
Modified Sigma Computers	Aug 1966
Changed to 1-Volt System	Aug 1966

Specifications for both tower instrument configurations were established by SRL personnel in consultation with the meteorology staff of the Lockheed-Georgia Company, a division of Lockheed Aircraft Corporation. All instruments, both tower mounted and ground based, were obtained from Climet Instruments, Inc. of Sunnyvale, California, as this was the only company at the time that was offering a completely integrated system for sensing and readout equipment.

The project was approved in November 1964, and the purchase requisition was submitted to Climet the following month.

Requests were submitted to the owners of both TV stations in the area (WJBF, Channel 6, and WRDW, Channel 12) for permission to rent space on the towers for mounting the instruments. Permission was obtained from both stations, but since WJBF-TV was the first to respond to the request and since both towers are comparable in height, an agreement was established to use the WJBF-TV tower. AEC-SROO approved this agreement in January 1965. Negotiations were then directed toward obtaining a contract for fabricating and installing the instrument mounting booms, instruments, and associated hardware. This contract was established with Kline Iron and Steel Company of Columbia, S. C., and the initial installation of all tower mounted equipment and partial ground-based equipment was made in June 1965.

An interim checkout program was initiated after the tower equipment was mounted to evaluate sensor performance and to become familiar with the system. An analog recording system was installed during this period that was expanded to allow the simultaneous recording of 5 selected data points as a further check on system performance.

The remainder of the instrumentation was installed in November 1965, and the complete system was essentially debugged and in routine operation in February 1966.

Data acquisition was interrupted for about 3 weeks in late February 1966 due to an ice fall at the tall tower. Since this time the equipment has been operating continuously except for short periods of minor difficulties and the regularly scheduled maintenance periods.

The sigma computers were removed in June 1966 and completely rebuilt to obtain longer averaging capability. They were reinstalled in August 1966. In this same month, all analog signal levels to the digital converter were increased from a 0 to 10 mv range to 0 to 1 volt.

The usually expected difficulties associated with a new system were encountered, but discussions here will be limited to functional performance of the equipment and major changes.

Wind Speed Transmitters - It became apparent almost immediately that the wind speed transmitters were not performing properly since a normally expected speed profile was not obtained, and in some instances after only a very few weeks the transmitters would cease to function. The speed transmitters were found to have failed bearings on the anemometer shaft. These instruments were renovated and replaced by Climet on the premise that possible mishandling might have occurred during installation. Subsequent rapid failures indicated a more severe problem, and the transmitters were again removed for a more thorough investigation. Inspection revealed that the bearings were failing due to an accumulation of foreign material deposits and some possible corrosion. These particular bearings were 400 series stainless steel, lubricated and centrifuged to remove excess lubrication to obtain very low starting torque. Climet replaced the original bearings with "Teflon"* sealed bearings to more effectively exclude foreign material. This increased the threshold velocity of the anemometer assembly from 0.5 mph to 0.75 to 1.0 mph, but this threshold was considered satisfactory for our purposes. Subsequently, no bearing failures have occurred between the 3-month inspection intervals, at which time the bearings are replaced as a precautionary measure.

Wind Direction Instrument - The wind direction instrument performance was at first unsatisfactory for two reasons. The wind vanes did not exhibit the expected longevity characteristics and the potentiometers used as direction sensors proved to be inadequate for analog sigma computers.

The wind vanes are constructed of expanded polystyrene plastic and have low inertia and excellent water-shedding ability when new. Similar vanes were reported to have endured service in various environments in excess of a year without apparent damage. It was therefore surprising that the vanes seemed to be suffering an erosion effect that was quite noticeable after a few months service. As shown in Figure C-1, this erosion condition was only apparent on surfaces that were exposed to sunlight. In the case of the bivanes, a considerable amount of surface area is exposed to direct sunlight and results in a significant loss of mass from the vane over a relatively short period. These vanes require delicate balancing for proper indication in very light winds and especially in cases where the transmitted signal is used directly for analog sigma computation. The vanes on the transmitters that measure only the horizontal direction are not as susceptible to this condition because the surface area exposed to prolonged direct sunlight is small and vane balance is not a significant consideration. Erosion of the vanes has been essentially eliminated by covering with a thin (0.00015 inch) film of "Mylar"** aluminized on both surfaces. This effectively excludes sunlight from the surface of the vane material while retaining the desirable characteristics of low inertia and water-shedding ability.

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* "Teflon" - Du Pont trademark for fluorocarbon resins.

**"Mylar" - Du Pont trademark for polyester film.

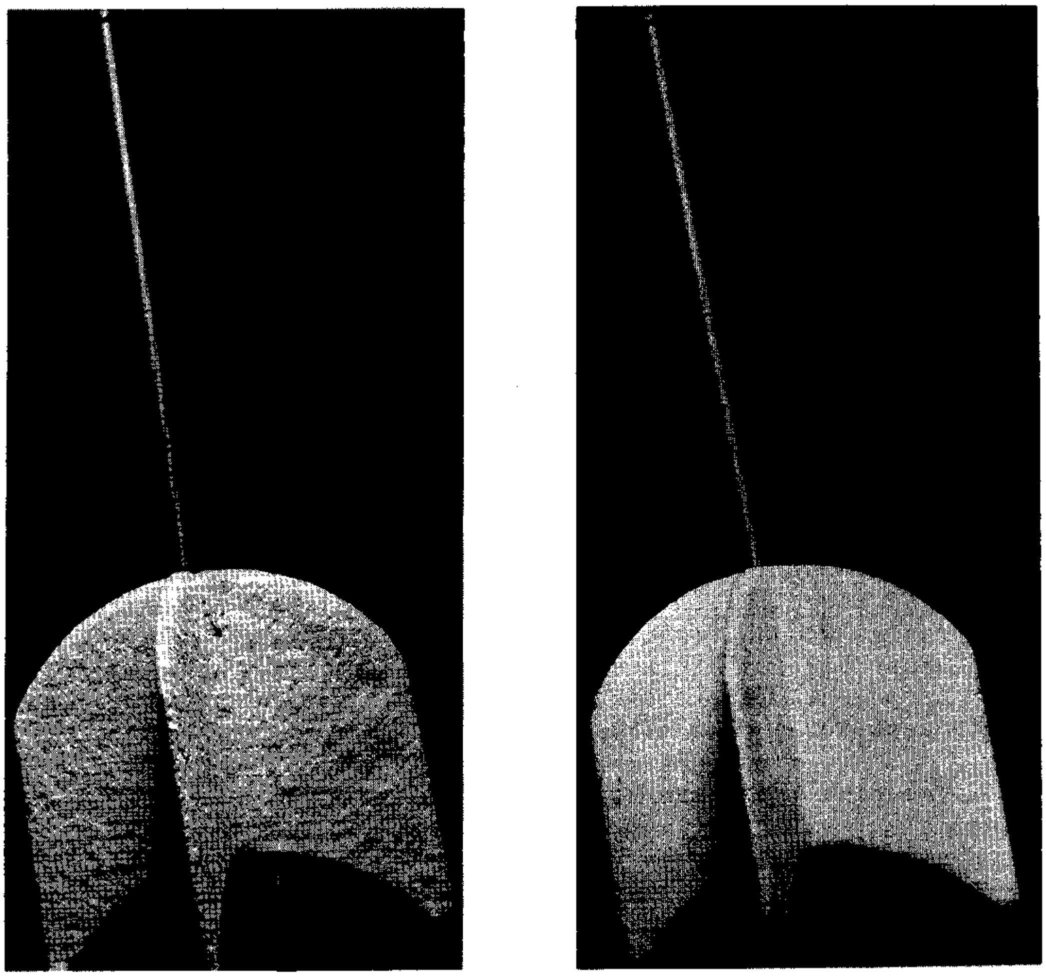

FIG. C-1 WIND BIVANES (UPPER SIDE, LOWER SIDE)

The potentiometers used in the direction transmitters were considered adequate until the on-line sigma computers were installed. It was found that in some instances the potentiometer wiper noise was a larger contributor to the computed sigma than the actual deviation of wind direction. A preparation program was therefore initiated to improve all potentiometers used in direction transmitters supplying a signal to the sigma computers. At about three-month intervals, each potentiometer is completely disassembled and thoroughly cleaned in an ultrasonic bath. During reassembly the wiper contacts are properly adjusted for tension, and the slidewires are lubricated with a noise suppressing contact lubricant. The potentiometers are then tested under simulated operating conditions before installation. A periodic check of the operating system prevents the utilization of data after a sudden onset of noisy conditions.

Temperature System - The temperature system has presented the most difficult calibration problem. Three-lead platinum wire resistance thermometers are installed up to a height of 1200 ft. In the original temperature measuring circuit the resistance of each resistance thermometer was measured by Wheatstone bridges with individual zero offset and a common range adjustment. Differences in individual resistance thermometers and especially the large differences in total lead resistance to each sensor made it necessary to install individual range resistors also. Considerable effort was made to accurately determine lead resistances to each sensor and a check of each temperature sensor was made by the SRL Standards Laboratory. In addition to these checks, a resistance thermometer contained in an ice bath was hooked up at each sensor location to obtain the proper zero correction due to unbalanced sensor lead resistances. A detailed description of temperature calibration procedures is given in Appendix D.

The temperature measurements as punched out are considered to be accurate to within ±0.3°F on a relative basis except for one sensor that seems to require a zero correction that is a function of ambient temperature. Four-lead thermometers would have facilitated calibration considerably since sensor resistance could be more accurately determined by auxiliary equipment.

System Modifications - The original system used a standard output signal level of 0 to 10 mv for analog-to-digital conversion. This was the maximum voltage obtainable from the temperature sensors without introducing significant electrical heating within the resistance element. All signals are digitized by a common analog-to-digital conversion circuit, and the temperature output voltage limitations were imposed on the wind signals also. The wind signal translators use much higher currents than those in the temperature circuits; therefore, a proper zero reference as compared to the 0 to 10 mv range is difficult to obtain. This situation was remedied by increasing the wind translator output to a 0 to 1 volt range. Concurrently, a highly stabilized operational amplifier was added to raise the temperature signals to this same range prior to analog-to-digital conversion.

Original specifications for the sigma computers called for the capability of computing the standard deviation of wind direction with an averaging time of 10 sec. Subsequent analyses and consultations indicated that an averaging time of 10 min or more would be more appropriate since this corresponds to the time required for a release from the reactor building at normal air flow. As a result, the sigma computers were completely rebuilt with highly stabilized operational amplifiers and components capable of averaging times up to 30 min without significant drift when subjected to the normal range of ambient temperatures. A schematic diagram of the computer circuit in use is shown as Figure 11 in the main body of this report.

A particular hazard associated with an instrumented tall tower is falling ice. Although the formation of ice on the tower is infrequent, it is very damaging. In February 1966, melting ice fell from the tower and completely crippled the wind sensors when the anemometer wind cups and direction vanes were stripped from the transmitters. A similar occurrence was experienced in February 1968.

Useful data has been acquired almost continuously since March 1966 with a progressive upgrading of data quality. Although some tower instruments are inoperable during short periods of minor difficulties and regularly scheduled maintenance, there is sufficient redundancy to usually ensure a continuing data analysis program.

APPENDIX D

CALIBRATION AND MAINTENANCE

GENERAL

All ground-based equipment is calibrated every month. At this time all the incoming signals are monitored to evaluate sensor performance. Particular attention is given to signals that are used for input to the sigma computers to detect any extraneous noise conditions that might adversely affect data quality. The sigma input signals are checked once a week. It is also useful to visually inspect the tower instruments. At the tall tower this inspection is done with a quality high power telescope since the instruments are accessible only to professional tower climbers.

Calibration procedures and techniques are given, with the exception of the temperature system, in the Systems Operating Manual as supplied by the vendor. The temperature measuring system at the tall tower will be discussed thoroughly to indicate conditions that are unique to this system and to define the calibration procedure.

The use of solid-state components in all electronic equipment has resulted in a system that is essentially maintenance free electronically. Mechanical components such as relays, stepping switches, and motors are the primary source of problems. Enough spare components are kept on hand to minimize downtime from these sources.

All wind sensors are removed from the towers every 3 months for complete preventative maintenance programs and performance checks. Wind speed anemometer bearings and the direction transmitter potentiometers are replaced at this time as a precautionary measure. All instruments at the tall tower can be completely removed, renovated, and reinstalled in two days. All tower work has been performed by Hamilton Erection, Inc. of York, S. C.

TEMPERATURE SYSTEM AND CALIBRATION

There are eleven platinum resistance thermometers at the tall tower at elevations up to 1200 ft. Resistances are nominally 100 ohms at $32^{\circ}F$. All resistance thermometers have 3 leads, a measuring lead and current leads on each side of the thermometer to compensate for lead resistance. A typical measuring circuit is shown in Figure D-1. To calibrate the system properly it is necessary to determine:

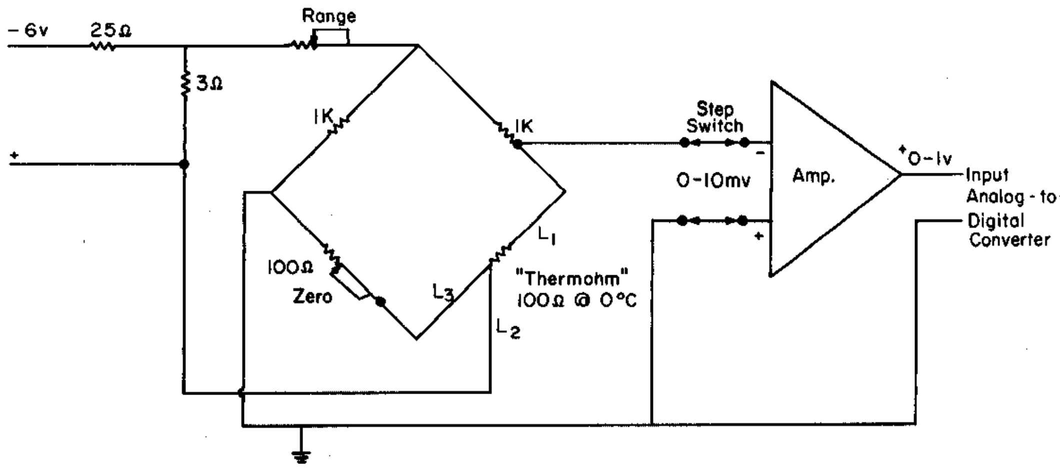

FIG. D-1 TYPICAL TEMPERATURE MEASURING CIRCUIT

1) The actual resistance of each resistance thermometer at the reference temperature of 32°F and the change in resistance as a function of temperature.

2) The lead resistance from the tower base measuring circuit to each thermometer and the difference in resistance of each current lead.

The measuring system originally had a common range adjustment and individual zero-offset adjustments. Laboratory measurements revealed differences in individual thermometers that were significant enough to warrant individual range adjustments in each measuring circuit. Figure D-2 shows the expected error when the differences in reference resistances are at the two extreme values. The relative error, assuming proper zero adjustment at 50°F (mid-range), is 0.43°F.

Data from the manufacturer (Minco Products Inc., Minneapolis, Minn.) were used in computing a zero offset and range adjustment for each resistance thermometer. Figure D-3 shows the resistance as a function of temperature divided by the nominal 100-ohm resistance at 0°C. Table D-I is a corresponding set of tabular values to 5 decimal places over the same range. Since the range for this application is from 0 to 100°F, the tabular values between -20 and 40°C were used to determine a polynomial fit to obtain comparable accuracy in conversion to Fahrenheit. A 2nd degree polynomial was used to account for a slight nonlinearity in the resistance per degree relationship. The relationship is:

$$R = 92.897 + 0.22245T - 0.0000172T^2 \qquad (1)$$

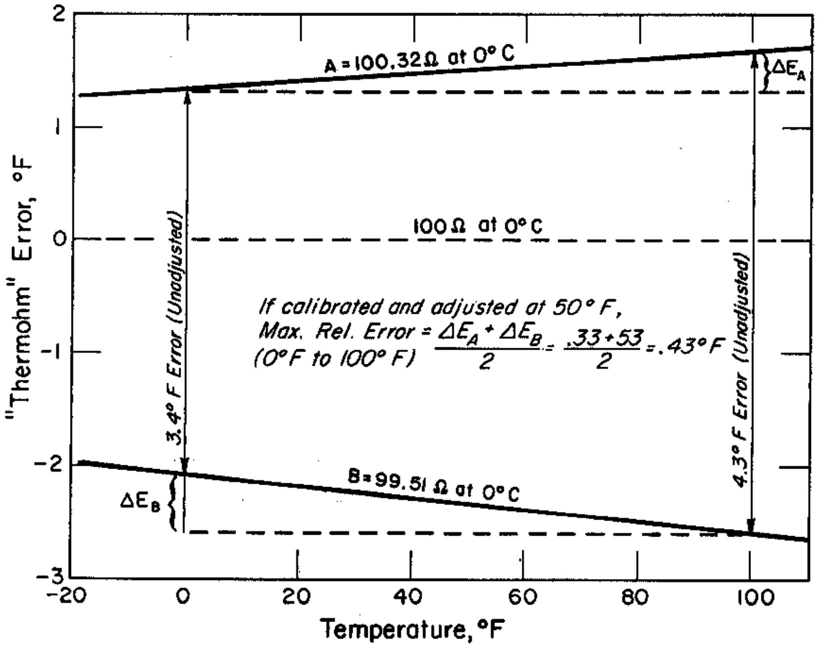

FIG. D-2 ESTIMATED ERROR FOR COMMON RANGE ADJUSTMENT

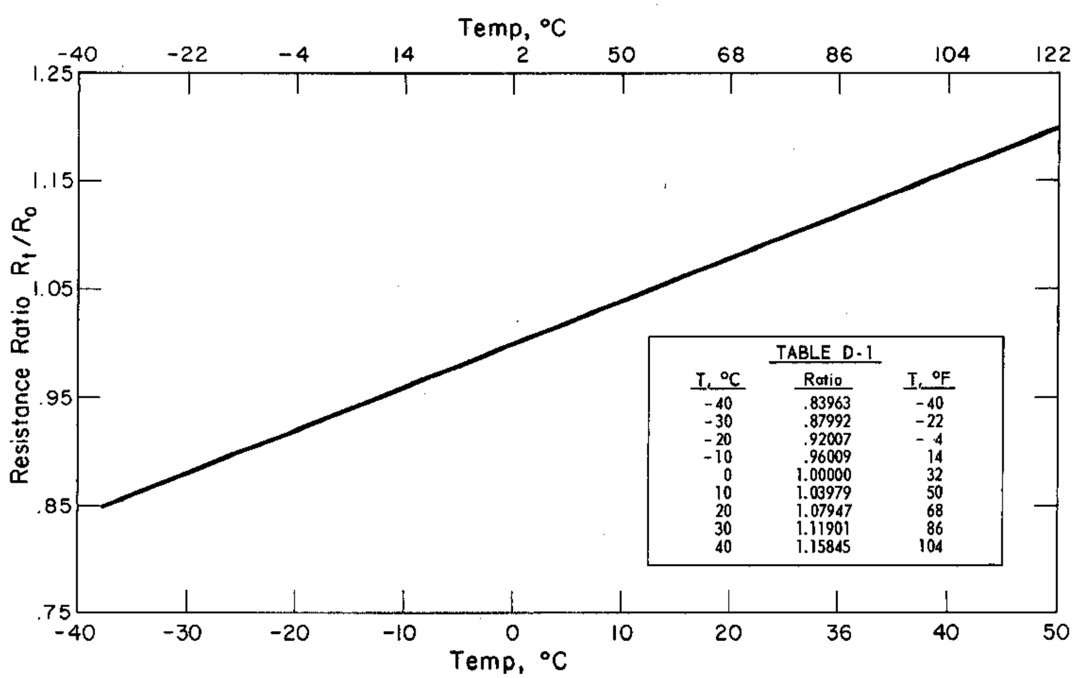

TABLE D-1

T, °C	Ratio	T, °F
-40	.83963	-40
-30	.87992	-22
-20	.92007	-4
-10	.96009	14
0	1.00000	32
10	1.03979	50
20	1.07947	68
30	1.11901	86
40	1.15845	104

FIG. D-3 RESISTANCE RATIO VS. TEMPERATURE for $0 \leqslant T \leqslant 100^oF$ and R in ohms. From this equation the resistances were determined to be 92.897 ohms at 0^oF and 114.969 ohms at 100^oF. The resistance of each thermometer was determined by:

$$R_{0,i} = \frac{92.897\ R_{32,i}}{R} \quad \text{and} \quad R_{100,i} = \frac{114.969\ R_{32,i}}{R} \qquad (2)$$

where R = resistance of reference thermometer at 32^oF = 100 ohms

$R_{0,i}$ = resistance of thermometer i at 0^oF

$R_{100,i}$ = resistance of thermometer i at 100^oF

$R_{32,i}$ = resistance of thermometer i at 32^oF (Standards Laboratory of SRL)

Equation (2) may be stated simply as:

$$R_{0,i} = 0.92897\ R_{32,i} \text{ and } R_{100,i} = 1.14969\ R_{32,i}$$

To calibrate the system, two sets of calibration resistors were constructed. One set has a resistor near 93 ohms for each temperature channel and the other set has resistors near 115 ohms. Each set is plugged into the system in turn to adjust the zero and range of each measuring circuit. Each calibration resistor was also measured by Standards Laboratory of SRL to correlate between the individual thermometers and resistors for each channel. The zero adjustment for each measuring circuit was obtained as follows:

$$T_{z,i} = \frac{R_{32,i}}{R}\ (R_{c,i} - R_{0,i})\ \frac{dT}{dR} \text{ for T near } {}^oF \qquad (3)$$

where $T_{z,i}$ = temperature calibration point near the zero end for each channel i, ^oF

$R_{c,i}$ = resistance of calibration resistor i, ohms

dT/dR = temperature derivative near 93 ohms for the reference thermometer

Values of T_i calculated by this method will be the temperature at which the particular channel should be set by the zero adjustment. However, this will not be the total zero offset as explained later.

The range of each measuring circuit is determined as follows:

$$T_{s,i} = \frac{R_{32,i}}{R}\ (R_{c,i} - R_{100,i})\ \frac{dT}{dR} \text{ for T near } 100^oF \qquad (4)$$

where $T_{s,i}$ = temperature calibration point at the upper end for each channel i, ^oF

To determine the total zero offset, a resistance thermometer of known calibration was placed in a Dewar and kept at the ice point temperature. This thermometer was put into each measuring circuit, in turn, at the elevation of measurement. This permitted a determination of the correction that must be made to account for differences in lead resistances for the two current leads of each resistance thermometer. This correction is a signed value and must be added algebraically to the zero offset determined earlier. Before this determination can be made accurately, it is necessary to adjust the zero and range of each measuring circuit to the values determined for the particular thermometer being used as a reference. This correction is determined by

$$L_i = (32 - T_{c,i}) - T_{z,i} \qquad (5)$$

where L_i = lead resistance correction for channel i, ^oF

$T_{c,i}$ = indicated temperature with reference thermometer at elevation i, ^oF

$T_{z,i}$ = known zero offset if channel i was not calibrated to exactly zero for the reference thermometer, ^oF

Presumably, this determination will only be necessary to establish initial calibration corrections, and should remain constant for all conditions.

To summarize, the calibration procedure is performed according to the following steps:

1. Determine zero offset due to lead resistance.

   a) Calibrate all channels to the resistance thermometer being used as a reference. Set $T_{z,i}$ and $T_{s,i}$ according to Equations 3 and 4, respectively.

2. Determine zero calibration point.

$$T_{z,i} = \frac{R_{32,i}}{R} (R_{c,i} - R_{0,i}) \frac{dT}{dR} - L_i, \quad \frac{dT}{dR} = 4.494 \ ^oF/ohm$$

3. Determine range calibration point.

$$T_{s,i} = \frac{R_{32,i}}{R} (R_{c,i} - R_{100,i}) \frac{dT}{dR} - L_i, \quad \frac{dT}{dR} = 4.568 \ ^oF/ohm$$

This method of calibration accounts for errors introduced by differences in lead resistances and differences in individual resistance thermometers. After calibration, the indicated temperature from each elevation should be real and no further corrections should be necessary. Table D-II is a complete calibration calculation for all elevations at the tall tower. The absolute temperatures measured with this system are expected to be within ±0.5°F, and the relative temperatures to be within ±0.3°F.

TABLE D-II

Temperature Calibration Data

Elev., ft	Indicated Temp with Reference Thermometer, °F	Ice Point Correction, °F	Zero Calibration Offset, °F	Range Calibration Offset, °F	(Plug-in Resistors) Zero Calibration	(Plug-in Resistors) Range Calibration
1200	33	-1.0	0.51	-0.6	-0.5	98.9
1100	32.5	-0.5	2.72	+1.2	2.2	101.2
1000	32.9	-0.9	-0.25	-2.7	-1.2	97.3
900	32.2	-0.2	-0.62	-2.0	-0.6	98.0
800	32.4	-0.4	0.25	-1.7	-0.1	98.3
700	32.0	-0.0	-0.31	+2.9	-0.3	102.9
600	32.5	-0.5	2.33	+0.4	1.8	100.4
450	32.5	-0.5	-1.3	-0.4	-1.8	99.6
300	32.8	-0.8	-0.25	-3.1	-1.0	96.9
120	32.8	-0.8	0.49	-2.1	-0.3	97.9
10	31.1	+0.9	0.29	-1.7	1.1	98.3

APPENDIX E

WRED - DATA ANALYSIS PROGRAM

CODE DESCRIPTION

WRED is a FORTRAN IV code written specifically to analyze the SRL meteorological data and estimate probability distributions of whole body gamma and thyroid inhalation doses, and is being used on the SRP IBM System 360/65 computer. This code processes complete data samples individually and compiles statistical information according to specified input options. Options available are:

Option 1 - Wind Speed and Direction - Wind speed frequency distributions are determined for each of the 6 wind set elevations, and, in addition, the wind speed frequency distributions are tabulated by eight 45° wind sectors each for 2 selected elevations.

Option 2 - Stability Classifications - Temperature gradients and wind speeds at 2 elevations are used to determine stability conditions for each data set. Results are classified according to lapse rate magnitude in °F/100 ft and the calculated horizontal dispersion angle, σ_a. Negative or zero lapse rates are considered unstable, and positive lapse rates stable.

The number of unstable conditions with an inversion below are determined for each elevation and tabulated according to inversion intensity.

The number of possible fumigation events, defined as the number of times the lapse rate at each elevation changes from positive to negative with magnitude greater than 1°F/100 ft, are also listed.

Wind speed frequency distributions by stability classification are tabulated for each elevation by eight 45° wind sectors.

Option 3 - Dose Calculations, Upper Level - The frequency of occurrence of both whole body and thyroid doses may be determined as a function of downwind distance or either type dose distribution may be obtained separately by specifying the proper option.

Option 4 - Dispersion Parameters, Upper Elevation - Measured dispersion angles, σ_a and σ_e, may be specified or may be derived from wind speed and temperature data according to the BNL method.

Option 5 - Dose Calculations, Lower Elevation - Same as Option 3.

Option 6 - Dispersion Parameters, Lower Elevation - Same as Option 4.

Option 7 - Include Previous Statistics - Provision is made to consolidate statistical data from previous jobs by input from punched cards. Considerable caution should be exercised to ensure that all statistical data correspond to the same elevations and downwind distances and that selected options are compatible.

Option 8 - Punch Statistics - Compiled statistics are provided on punched cards for inclusion in subsequent jobs. Each category is suitably identified to facilitate input deck makeup.

Option 9 - Whole Body Gamma Source - The gamma source term may be derived from individual isotope input or from tabular values included within the program. Tabular values reflect a 1000 MW release inventory of 100% of the noble gases and 0.05% of the iodines.

Option 10 - Time Averaging - Instead of treating each data sample individually, this option allows data to be averaged over a specified number of samples to estimate doses.

Option 12 - Edit Previously Punched Cards - This option allows an edit of any complete set of punched cards that have been obtained from periodic data processing.

Additional details of the various input options may be found in the Input Data Preparation Section of this appendix.

The code is composed of several subroutine programs that are controlled by the main program. A discussion of each program is presented in the same order that data processing is done with regard to each data sample. Figure E-1 is a flow chart showing the data processing sequence. A complete listing of the FORTRAN source deck is included at the end of this appendix.

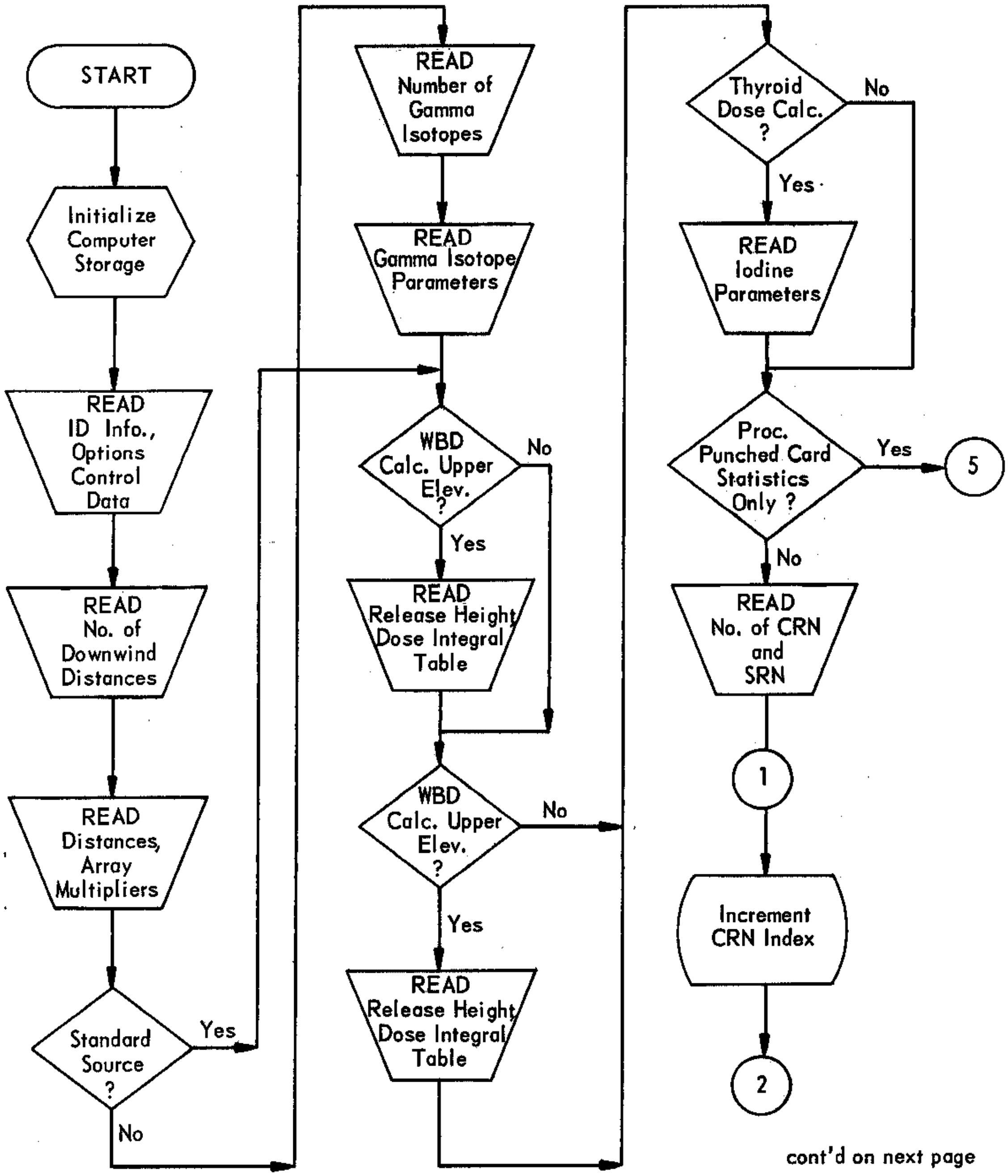

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FIG. E-1 WRED FLOW CHART

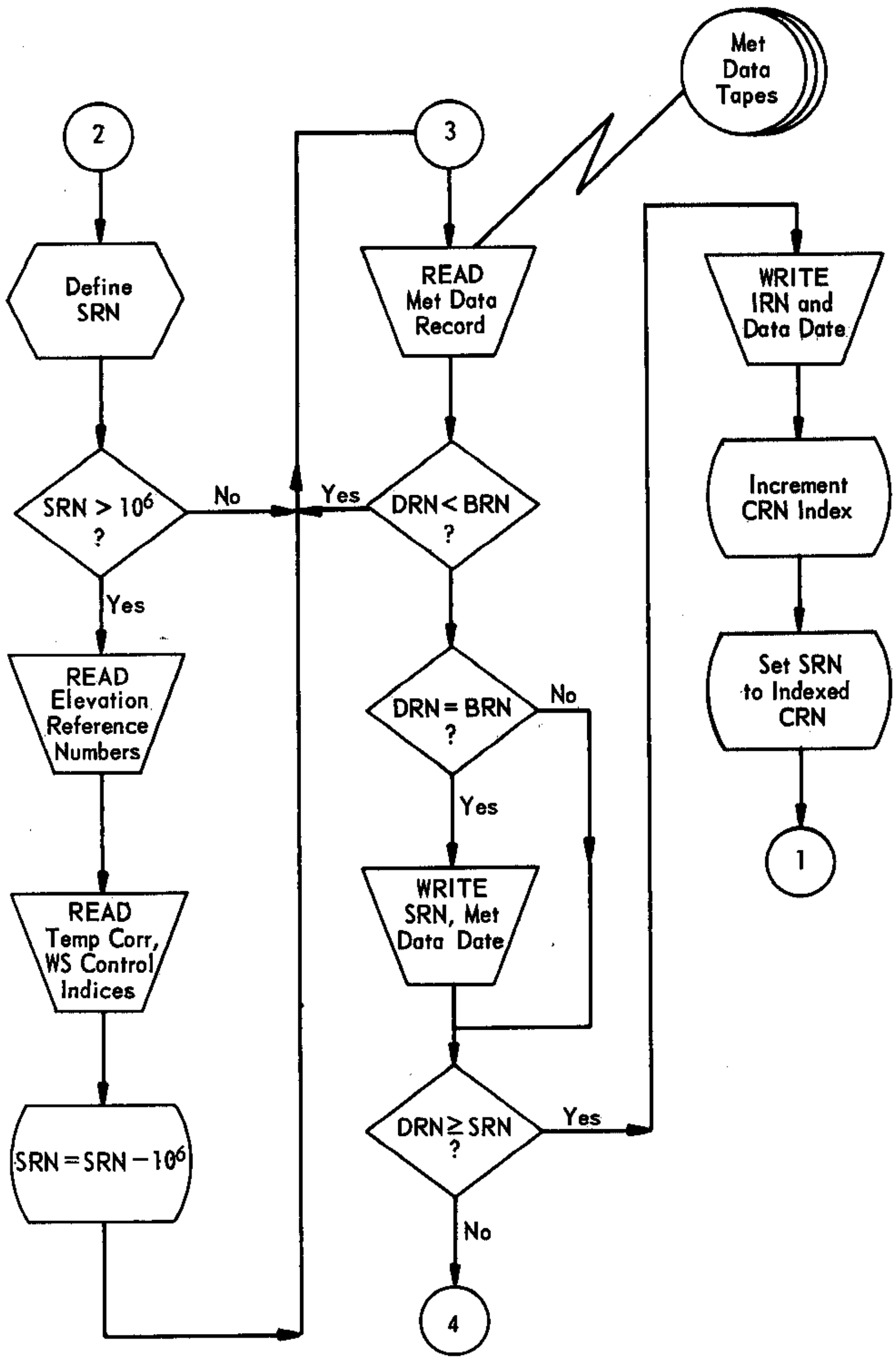

FIG. E-1 WRED FLOW CHART (CONT'D)

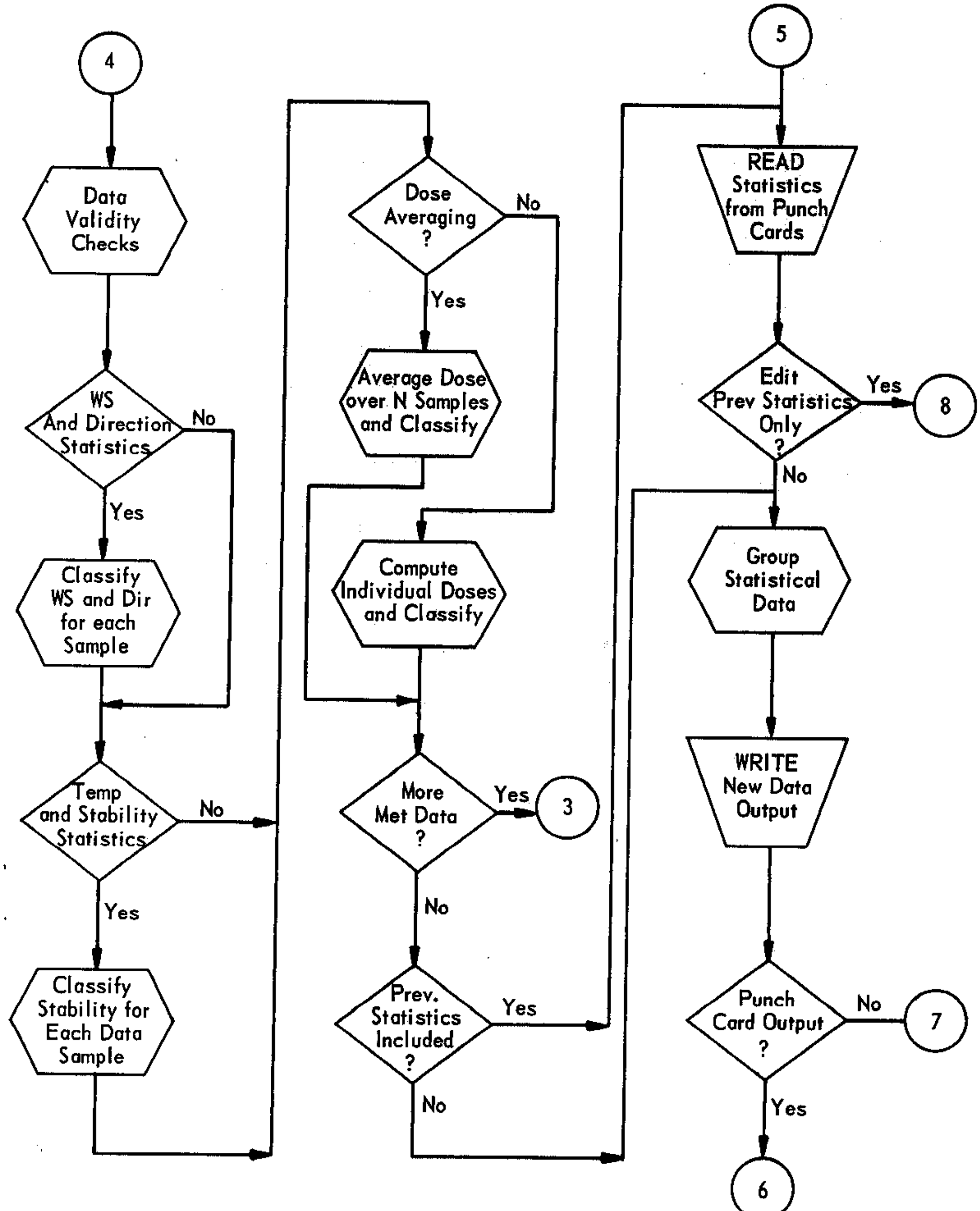

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FIG. E-1 WRED FLOW CHART (CONT'D)

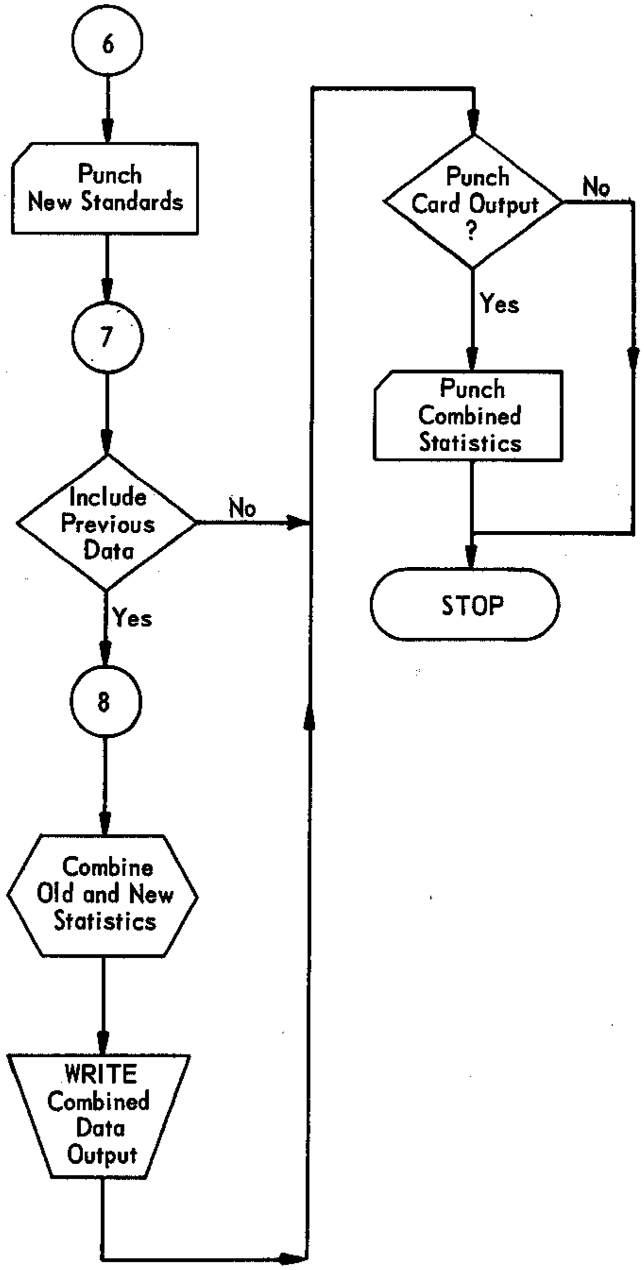

FIG. E-1 WRED FLOW CHART (CONT'D)

MAIN PROGRAM

The main program controls all input data, cards and tape, within the program except for the data as specified in Option 7 and controls all logical data processing and output data with subroutine programs. After computer core initialization and all card input data are read in, the processing of the meteorological data samples (from magnetic tape or tapes) continues until one of three conditions occur:

1) The last data time interval (as specified by input control cards) has been processed.

2) A volume end of file is encountered on the magnetic data tape being processed. This condition will occur when the tape end of file is encountered on the last tape of a sequential processing of one or more data tapes constituting the volume (or may occur erroneously if the Job Control Cards are improperly punched).

3) An error is encountered in attempting to read the data tape. This may signify either tape error or computer error.

Upon the termination of individual data sample processing, the accumulated statistics from all samples are processed and provided as output according to the options specified. This output will pertain only to the data processed in the current job. If previous statistics have been supplied, they will be combined with the currently processed statistics, and the complete output based on previous and current results are provided.

SUBROUTINE ZERO

Clears pertinent areas of core storage and initializes certain arrays that are used in the program.

The following routines are called in sequence by the main program for each data sample assuming dose calculations for only one release height.

SDDAT - Classifies wind speed at 6 elevations in increments of 1 meter/sec and wind direction at 2 selected elevations by azimuth in eight 45° sectors.

TDAT - Stability classifications are determined by computing temperature lapse rate from 6 elevations. This subroutine processes the data for stable conditions. Unstable data are processed by called subroutines.

CAT1 - Processes stability data for the upper elevation if determined to be unstable by TDAT.

CAT2 - Same as CAT1, for lower elevation.

DOSE - Estimated doses are calculated assuming a release of fission products and also assuming the meteorological parameters of the current data sample persist indefinitely. The dispersion parameters are dependent on the stability conditions determined in TDAT and specified input options. This subroutine utilizes subroutines SIGMA, THY, and RAD.

SIGMA - Dispersion coefficients are determined from measured data using the BNL correlations. σ_y and σ_z are determined as a function of wind speed and stability or are taken as the values measured by the sigma computer.

THY - Thyroid doses are estimated from the computed ground level concentrations of iodine isotopes and classified according to dose magnitude and wind direction.

RAD - Whole body gamma doses are estimated as the product of the total gamma source, the appropriate space distribution integral as determined in DBTERP, and the dose conversion factor. Estimated doses are classified according to dose magnitude and wind direction. If the standard 1000 MW release inventory is specified by Options 4 and 6, the gamma source is determined by tabular values of the total gamma source as a function of wind speed and downwind distance. Interpolation between tabular values is accomplished by Newton's forward interpolation method. This subroutine determines the total source for wind speeds between 0.5 and 32 meters/sec.

DBTERP - This is a double interpolation routine that uses tabulated values of the space distribution integral to determine the proper integral to be associated with the meteorological parameters of the current data set. These tabulated integrals are supplied as input and are unique for each release height of interest. Tables are constructed as a function of σ_y and the ratio σ_z/σ_y by the mathematical procedures described in RADOS.[9]

DAVE - If Option 10 is used, a running average of N dose estimates is updated for each data sample and release height, where N is an input parameter.

After processing has been completed for the individual data samples, the following sequence of routines are called by the main program:

REED - If previous statistics are to be included with current results, this information is read in from punched cards.

DATGP - Currently compiled statistics are processed to determine percentages, etc., and prepared for output.

OUT - A complete output listing is provided that pertains to the currently compiled data only.

REED - Currently compiled statistics are provided as punched card data for use in subsequent jobs.

DATGP - Combines old and new statistics that are reprocessed for listing as output.

OUT - The combined data are listed.

REED - Combined statistics are provided as punched card data for subsequent use as input.

INPUT DATA PREPARATION

Input data requirements are listed by card type in the sequence required for proper job execution. Input formats are given for each card type.

Card Type 1 (20A4) Title Card

Alphanumeric information to supply identification information for output data.

Card Type 2 (21I3) Options

NOP(1) - Wind speed frequency distributions and wind direction distributions

0 - No
1 - Yes

NOP(2) - Stability classifications and inversion data

- 0 - No
- 1 - Yes

NOP(3) - Dose calculations for upper elevation

- 0 - No calculations
- 1 - Whole body gamma dose only
- 2 - Whole body gamma and thyroid dose calculations
- 3 - Thyroid doses only

NOP(4) - Horizontal and vertical dispersion sigmas for upper elevation

- 0 - Calculate sigmas
- 1 - Use measured sigmas

NOP(5) - Same as NOP(3), lower elevation

NOP(6) - Same as NOP(4), lower elevation

NOP(7) - Read in previous statistics

- 0 - No
- 1 - Yes

NOP(8) - Statistics output on punched cards

- 0 - No
- 1 - Yes

NOP(9) - Gamma source term

- 0 - Use tabulated source
- 1 - Compute source from isotope input

NOP(10) - Data averaging

- 0 - No
- 1 - Yes

NOP(12) - Edit previously punched cards only

- 0 - No
- 1 - Yes

NOP(13) - NOP(20) - Not used

NAV - Number of samples over which data is averaged

Card Type 3 (I3) Number of Downwind Distance ($1 \leqslant NDST \leqslant 4$)

Card Type 4[a] (5E10.5) Distances and Normalization Factors

TDIST(N) - Downwind distance at which dose estimates are calculated

FACT(1,N) - Normalization factor for whole body gamma dose, upper elevation

FACT(2,N) - Normalization factor for thyroid inhalation dose, upper elevation

FACT(3,N) - Normalization factor for whole body gamma dose, lower elevation

FACT(4,N) - Normalization factor for thyroid inhalation dose, lower elevation

One set of parameters per card, up to N cards.

Card Type 5[b] (I3) Number of Gamma Decay Chains

NGAM - Number of decay chains ($1 \leqslant NGAM \leqslant 20$) used to determine total gamma source

Card Type 6[b] (6E10.5) Gamma Source and Related Constants for Decay Chains ($1 \leqslant N \leqslant 20$)

GAM(N) - Parent source, Mev/sec

DEC(N) - Parent decay constant, sec^{-1}

ENG(N) - Parent decay energy, Mev

DGAM(N) - Daughter source, Mev/sec

DDEC(N) - Daughter decay constant, sec^{-1}

DENG(N) - Daughter decay energy, Mev

One decay chain per card, up to 20 cards.

Card Type 7[c] (8E10.5) Integral Table Definition (upper elevation)

STKH1 - Height in meters of upper release elevation

XIN1 - Number of X-coordinate entries, maximum = 50

YIN1 - Number of Y-coordinate entries, maximum = 50

HX1 - σ_y increment

HY1 - σ_z/σ_y increment

Card Type 8[c] (8E10.5) Integral Table (upper elevation)

Z1(I,J) - Source distribution integrals entered 8 per card
All X-coordinate entries (I) for a given Y-coordinate (J) are made before the J index is varied.

Card Type 9[d] (8E10.5) Integral Table (lower elevation)

STKH2) -
XIN2) -
YIN2) - Same as Card Type 6
HX2) -
HY2) -

Card Type 10[d] (8E10.5) Integral Table (lower elevation)

Z2(I,J) - Same as Card Type 7

Card Type 11[e] (I3) Number of Iodine Isotopes

ISO - Number of iodine isotopes ($1 \leqslant$ ISO $\leqslant 5$) that are used in estimating thyroid dose

Card Type 12[e] (8E10.3) Iodine Source at Release Point and Related Constants ($1 \leqslant N \leqslant 5$)

COMSOR(N) - Source, Mev/sec

AMDA(N) - Decay constant, sec^{-1}

BIEN(N) - Biological elimination rate

EGMM(N) - Effective beta energy, Mev

2 isotopes per card, up to 3 cards.

When data are being processed it is necessary to specify the data record number at which the processing is to begin. In addition, it frequently becomes necessary to skip certain records depending on the type of analyses being performed if particular sensors have known malfunctions or errors. The method used to control data selection is to read in an array of record numbers that may be interpreted as single record skips or block record skips. The record number may also be flagged to cause information to be read in that will designate which tower sensors to use for the data analyses as indicated below.

Card Type 13 (I4, I10) Data Control Parameters

NST - Number of record numbers to be read in

NSTART - Record number at which data processing is to begin

Card Type 14 (8I10) Data Control Record Numbers

NDAT(N) - Record numbers ($1 \leqslant N \leqslant 500$) entered in sequence and interpreted by the code as follows:

a) If NDAT(N) is positive and less than 10^6, NDAT(N) is interpreted as a record skip. When data have been processed up to record NDAT(N), this record is skipped and data processing continues to record NDAT(N+1).

b) If NDAT(N) is negative and its absolute value is less than 10^6, NDAT(N) is interpreted as a block skip. When data have been processed up to record NDAT(N), all records to record NDAT(N+1) are skipped and processing continues to record NDAT(N+2).

c) If the record NDAT(N) is entered as (Record number + 10^6), this directs the computer to read input information designating which data shall be used in the analyses. This condition is always required for NDAT(1). Data processing continues as in a) or b) above.

Card Type 15[f] (I9) Wind Set and Temperature Elevations

KS1 - Wind set elevation reference number for upper elevation

KS2 - Wind set elevation reference number for lower elevation

KS3 - Wind set elevation reference number for computing wind speed at an elevation of 100 meters (U_{100}) as required in the BNL correlations.

NT(N) - Temperature elevation reference numbers required for stability analyses. Temperatures at NT(1) and NT(2) should be above and below the upper elevation of interest. Temperatures at NT(4) and NT(5) should be above and below the lower elevation. NT(6) should be 11, the lowest temperature elevation. Six temperature reference numbers must be entered.

Card Type 16 (6I3) Temperature Corrections

NCOR(N) - Zero corrections may be applied to the temperatures corresponding to the elevation reference number entered on Card 13. Corrections are entered in integer form to tenths of a degree fahrenheit. Fill-in with zeros or leave blank if no corrections are desired.

Card Type 17 (6I3) Wind Speed Data Rejection Elevations

NPD(N) - Wind speed data from malfunctioning speed sensors may be excluded from the speed frequency analyses by entering a number greater than 0 in the field corresponding to the wind set reference number. This exclusion will be effective during any given time interval as explained in the preceding Card Type 14.

Card Types 15-17 constitute a data set that must be supplied for each data control record number (Card Type 14) that is entered as (Record number + 10^6).

Superscript Definition

a - Required if Option 3 or 5 is >0.
b - Required if Option 3 or 5 is >0 and <3.
c - Required if Option 3 is >0 and <3.
d - Required if Option 5 is >0 and <3.
e - Required if Option 3 or 5 is >1.
f - Sensor elevation reference numbers are shown in Table E-I.

TABLE E-I

Sensor Elevation Reference Numbers

Temperature Sensors Elevation, feet	Reference Number	Wind Sets Elevation, feet
1200	1	1000
1100	2	800
1000	3	600
900	4	450
800	5	300
700	6	120
600	7	
450	8	
300	9	
120	10	
10	11	

In addition to the above input requirements, if previously compiled statistics are to be included with the current job these data must be supplied on punched cards. It is generally only necessary to insert these cards at the end of the above data in the same sequence as punched by the program. Particular care should be given to ensure that downwind distances and normalization factors for the previous and current job are compatible in both magnitude and sequence. If dose calculations are performed, the specified release heights must also be the same.

If tabular values of the gamma source as a function of wind speed are specified in Option 9, the downwind distances must correspond to the distances for which these values were computed. These distances are 2, 8, 13.5, and 40 km, and must be entered on this same sequence up to the greatest distance entered.

```
COMPILER OPTIONS - NAME=  MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID
C      WEATHER REDUCTION PROGRAM - TALL TOWER DATA
C
      COMMON Z1(50,50),Z2(50,50),XIN1,XIN2,YIN1,YIN2,HX1,HX2,HY1,HY2,
     1       NIXM,NIYM,MIXM,MIYM,NREC
      COMMON /SPD1/ NS(6),NDH(6),KD1,KD2,KH1,KH2,KS1,KS2,KS3,NORP,WSM(6)
     1              ,NSPD(6)
      COMMON /TEM1/ TEMP(6),DH(6),TEL(11),NT(6)
      COMMON /DOS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /DOS2/ DSTX(4),DUSTX(4),TDIST(4),STKH1,STKH2,NDST,HSQ1,HSQ2
     1              ,HHSQ1,HHSQ2,FSTK1,FSTK2,FACT(4,4)
      COMMON /GAMM/ NGAM,GNU,GAM(20),DEC(20),ENG(20),DGAM(20),DDEC(20),
     1              DENG(20)
      COMMON /THYD/ COMSOR(5),BIEN(5),EGMM(5),AMDA(5),ISO
      COMMON /TTLE/ WORDS(20)
      COMMON /DAV/ LZO(4,4),NAV,SAV
      DATA T/'R'/
      REAL*8 TIM1,TIM2,TIM3,TIM
      CALL TIME (T,TIM1)
      CALL EFTM(8)
      DIMENSION NDV(6),ITEMP(11),NDAT(999),NCOR(6)
      NERR=0
      NDCT=0
      KST=0
      GNU=.5361E-13
      KREC=0
      NDRP=0
      DO 230 I=1,4
      DO 230 J=1,4
  230 LZO(I,J)=0
      CALL SETBTF
      CALL ZERO
    1 READ (5,2) (WORDS(I),I=1,20)
    2 FORMAT (20A4)
      WRITE (6,201) (WORDS(I),I=1,20)
  201 FORMAT ('1',30X,20A4)
      READ (5,8) (NOP(I),I=1,20),NAV
      SAV=NAV
      IF((NOP(3).EQ.0).AND.(NOP(5).EQ.0))GO TO 3
      READ (5,8) NDST
      DO 7 I=1,NDST
      READ (5,20) TDIST(I),(FACT(N,I),N=1,4)
      DSTX(I)=.15*TDIST(I)**.71
    7 DUSTX(I)=.045*TDIST(I)**.86
      IF(NOP(9).EQ.0) GO TO 65
      READ (5,8) NGAM
      DO 70 I=1,NGAM
   70 READ (5,20) (GAM(I),DEC(I),ENG(I),DGAM(I),DDEC(I),DENG(I)
     1       )
   65 IF((NOP(3).LT.1).OR.(NOP(3).GT.2)) GO TO 16
      READ (5,20) STKH1,XIN1,YIN1,HX1,HY1
      HSQ1=STKH1**2
      HHSQ1=HSQ1/2.
      FSTK1=STKH1*3.28
      NIXM=XIN1+.1
      NIYM=YIN1+.1
      DO 31 I=1,NIXM
   31 READ (5,20) (Z1(I,J),J=1,NIYM)
   16 IF((NOP(5).LT.1).OR.(NOP(5).GT.2))GO TO 3
      READ (5,20) STKH2,XIN2,YIN2,HX2,HY2
      HSQ2=STKH2**2
      HHSQ2=HSQ2/2.
      FSTK2=STKH2*3.28
      MIXM=XIN2+.1
      MIYM=YIN2+.1
      DO 41 I=1,MIXM
   41 READ (5,20) (Z2(I,J),J=1,MIYM)
    3 IF((NOP(3).LT.2).OR.(NOP(5).LT.2)) GO TO 24
      READ (5,8) ISO
      READ (5,20) (COMSOR(I),AMDA(I),BIEN(I),EGMM(I),I=1,ISO)
      IF(NOP(12).GT.0)GO TO 4
   24 READ (5,90) NST,NSTART
      READ (5,90) (NDAT(I),I=1,NST)
```

```
101 KST=KST+1
    NSTP=IABS(NDAT(KST))
    IF(NSTP.EQ.0) GO TO 4
    IF(NSTP.LT.1000000) GO TO 5
    READ(5,8,END=50) KH1,KH2,KS1,KS2,KS3,(NT(I),I=1,6)
    READ (5,8) (NCOR(I),I=1,6)
    READ (5,8) (NSPD(I),I=1,6)
    NSTP=NSTP-1000000
 90 FORMAT (8I10)
    DO 19 I=1,5
    KM1=NT(I)
    KM2=NT(I+1)
 19 DH(I)=TEL(KM1)-TEL(KM2)
  5 READ (20,END=4,ERR=49) NREC,IDAY,IHR,IMIN,(ITEMP(I),I=1,11),
   1(NS(J),J=1,6),(NDH(K),K=1,6),(NDV(L),L=1,4),(NSIGMA(M),M=1,4),NRN
 60 FORMAT (I8,17I4/10I4)
    NDCT=NDCT+1
    IF(NREC.LT.NSTART)GO TO 5
    IF(NREC.EQ.NSTART) WRITE(6,202) NREC,IDAY,IHR,IMIN
202 FORMAT (' DATA PROCESSING BEGINS AT RECORD NUMBER',I7,3I4)
    IF(NREC-NSTP)180,170,170
170 WRITE (6,204) NREC,IDAY,IHR,IMIN
204 FORMAT(' DATA PROCESSING WAS INTERRUPTED ON RECORD NUMBER',I7,3I4)
    IF(NDAT(KST))171,5,101
171 KST=KST+1
    NSTART=NDAT(KST)
    GO TO 101
180 DO 111 I=1,6
    J=NT(I)
    IF(ITEMP(J).LT.20) GO TO 5
111 TEMP(I)=ITEMP(J)+NCOR(I)
    IF(NOP(1).GT.0) CALL SODAT(&5,&13)
 13 IF(NOP(2).GT.0) CALL TDAT
    IF((NOP(3)+NOP(5)).GT.0) CALL DOSE
    GO TO 5
 49 WRITE (6,42) NDCT
    IF(NERR.GT.3) GO TO 44
    WRITE (5,43) NERR
 44 NERR=NERR+1
    IF(NERR.LT.10) GO TO 5
    WRITE (6,47)
 47 FORMAT (' BAD TAPE ON UNIT 20, OR IT IS BEING READ IMPROPERLY')
    WRITE (6,48) IDAY,IHR,IMIN
 48 FORMAT (' LAST DATE AND TIME READ IN IS',I4,2I3)
    GO TO 4
 50 WRITE(6,51) NREC,IDAY,IHR,IMIN,NSTP
 51 FORMAT(' INSUFFICIENT INPUT DATA,LAST RECORD PROCESSED WAS',I6,3I4
   1,'NEXT INDICATED STOP WAS',I6)
  4 CALL TIME (T,TIM2)
    STIM=(TIM2-TIM1)/6000.
    CALL REED (1)
    IF(NDCT.LE.1) GO TO 721
    CALL DATGP(1)
    CALL OUT(1)
    IF(NOP(8).GT.0) CALL OPEN(3362)
    CALL REED(2)
    IF(NOP(7).EQ.0) GO TO 12
721 CALL DATGP(2)
    CALL OUT(2)
    IF (NOP(8).GT.0) CALL OPEN(3362)
    CALL REED(3)
    IF(NOP(8).GT.0) CALL OPEN(3362)
  8 FORMAT (21I3)
 12 CALL TIME (T,TIM3)
    PTIM=(TIM3-TIM2)/6000.
    WRITE (6,45) STIM
    WRITE (6,46) PTIM
 42 FORMAT (' ERROR OCCURRED IN READING RECORD NUMBER',I6)
 43 FORMAT (' NUMBER OF READING ERRORS ENCOUNTERED IS',I6)
 45 FORMAT ('1DATA PROCESSING TIME IS',F7.2,' MINUTES')
 46 FORMAT (' JOB OUTPUT STEP TIME IS',F7.2,' MINUTES')
  9 FORMAT (2(I4,2I3),I3)
 11 FORMAT (6I3,5F6.0)
 20 FORMAT (8E10.5)
    STOP
    END
```

```
COMPILER OPTIONS - NAME=  MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

      SUBROUTINE ZERO
      COMMON /STAB1/ LUN1(4,6),LUN2(4,6),LUNIV1(6),LUNIV2(6),LSTA1(6),
     2              LSTA2(6),NF1,NF2,NCT1,NCT2,CTTEM,LFUM1,LFUM2,
     3              PFUM1,PFUM2
      COMMON /DOS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /DOS3/ RDS1(4,8,21),TDS1(4,8,21),RDS2(4,8,41),TDS2(4,8,41),
     1              CTWBD1,CTWBD2,CTTYD1,CTTYD2,TMX1(4),TMX2(4),RMX1(4),
     1              RMX2(4),MGAM1(4),MGAM2(4),MTHY1(4),MTHY2(4)
      COMMON /DOS4/ UN850(8,41),ST850(8,41),UN200(8,41),ST200(8,41),
     1              PU850(8,41),PS850(8,41),PU200(8,41),PS200(8,41)
      COMMON /DINC/ NINC(21),NONC(41),NTIN(41)
      COMMON /DGP2/ NSR(21,6),M3(8),M4(8),MSP3(8,21),MSP4(8,21),LUN3(4,6
     1              ),LUN4(4,6),LUNIV3(6),LUNIV4(6),LSTA3(6),LSTA4(6),
     2              NF3,NF4,NCT3,NCT4,TEMCT,WBD1CT,WBD2CT,TYD1CT,TYD2CT
     3         ,UNUP(8,41),STUP(8,41),UNLO(8,41),STLO(8,41),RDS3(4,8,21),
     4          TDS3(4,8,21),RDS4(4,8,41),TDS4(4,8,41),WSDCT,NCTWS(6)
      COMMON /TEM1/ TEMP(6),DH(6),TEL(11),NT(6)
      COMMON /SPD2/ NSP(21,6),M1(8),M2(8),MSP1(8,21),MSP2(8,21),CTWSD
      REAL*4 NONC
      CALL CLEAR(NSP,485)
      CALL CLEAR(NSR,5846)
      CALL CLEAR(LUN1,81)
      CALL CLEAR(RDS1,4004)
      CALL CLEAR(UN850,2624)
      TEL(1)=120.
      TEL(2)=110.
      TEL(3)=100.
      TEL(4)=90.
      TEL(5)=80.
      TEL(6)=70.
      TEL(7)=60.
      TEL(8)=45.
      TEL(9)=30.
      TEL(10)=12.
      TEL(11)=1.0
      EL(1)=1000.
      EL(2)=800.
      EL(3)=600.
      EL(4)=450.
      EL(5)=300.
      EL(6)=120.
      NINC(1)=5
      DO 35 I=2,20
   35 NINC(I)=NINC(I-1)+5
      NINC(21)=100
      NONC(1)=2.5
      DO 41 I=2,40
   41 NONC(I)=NONC(I-1)+2.5
      NONC(41)=100.
      RETURN
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE SDDAT(*,*)
      COMMON /SPD1/ NS(6),NDH(6),KD1,KD2,KH1,KH2,KS1,KS2,KS3,NDRP,WSM(6)
     1              ,NSPD(6)
      COMMON /SPD2/ NSP(21,6),M1(8),M2(8),MSP1(8,21),MSP2(8,21),CTWSD
     1              ,NWSCT(6)
      IF(NDH(KH1)-360)5,6,6
    5 NDR1=NDH(KH1)
      GO TO 9
    6 NDR1=NDH(KH1)-360
    9 IF(NDH(KH2)-360)7,8,8
    7 NDR2=NDH(KH2)
      GO TO 10
    8 NDR2=NDH(KH2)-360
   10 KD1=NDR1/45+1
      KD2=NDR2/45+1
      IF((KD1.GT.8).OR.(KD2.GT.8)) RETURN 1
      M1(KD1)=M1(KD1)+1
      M2(KD2)=M2(KD2)+1
      DO 4 J=1,6
      IF(NSPD(J).GT.0) GO TO 4
      IF((NS(J).GT.900).OR.(NS(J).LT.6)) NS(J)=0
      WS=NS(J)
      WSM(J)=WS*.044703
      NS(J)=WS*0.447027
      IF(NS(J)-199)1,1,2
    1 K=NS(J)/10+1
      GO TO 3
    2 K=21
    3 NSP(K,J)=NSP(K,J)+1
      NWSCT(J)=NWSCT(J)+1
    4 CONTINUE
      IF(NS(KH1)-199)21,21,22
   21 MK=NS(KH1)/10+1
      GO TO 23
   22 MK=21
   23 MSP1(KD1,MK)=MSP1(KD1,MK)+1
      IF(NS(KH2)-199)24,24,25
   24 MK=NS(KH2)/10+1
      GO TO 26
   25 MK=21
   26 MSP2(KD2,MK)=MSP2(KD2,MK)+1
      CTWSD=CTWSD+1.
   30 RETURN 2
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE TDAT
      COMMON /DUS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /STAB1/ LUN1(4,6),LUN2(4,6),LUNIV1(6),LUNIV2(6),LSTA1(6),
     2             LSTA2(6),NF1,NF2,NCT1,NCT2,CTTEM,LFUM1,LFUM2,
     3             PFUM1,PFUM2
      COMMON /SPD1/ NS(6),NDH(6),KD1,KD2,KH1,KH2,KS1,KS2,KS3,NDRP,WSM(6)
      COMMON /TEM2/ NCON1,NCON2,UBAR1,UBAR2,S100,U100,DT(5),LT(5)
      COMMON /TEM1/ TEMP(6),DH(6),TEL(11),NT(6)
      COMMON /DUS2/ DSTX(4),DUSTX(4),TDIST(4),STKH1,STKH2,NDST,HSQ1,HSQ2
     1             ,HHSQ1,HHSQ2,FSTK1,FSTK2
      COMMON /DUS4/ UN850(8,41),ST850(8,41),UN200(8,41),ST200(8,41),
     1             PU850(8,41),PS850(8,41),PU200(8,41),PS200(8,41)
      COMMON /SIG/ SIGY(4),SIGZ(4),SIGA1,SIGE1,SIGA2,SIGE2
      CTTEM=CTTEM+1.
      DO 1 I=1,5
      IF(DH(I).EQ.0.) DH(I)=1.
      DT(I)=(TEMP(I)-TEMP(I+1))/DH(I)
    1 LT(I)=DT(I)
      IF(DT(1).LE.0.) CALL CAT1(&5)
      NCON1=1
      SIGA1=2.
      NST1=NST1+1
      NF1=1
      LS1=LT(1)/10+1
      IF(LS1.GT.6) LS1=6
      LSTA1(LS1)=LSTA1(LS1)+1
      UBAR1=WSM(KS1)*(FSTK1/EL(KS1))**.5
      NCT1=NCT1+1
    5 IF(DT(4).LE.0.) CALL CAT2(&2)
      NCON2=1
      SIGA2=2.
      NST2=NST2+1
      NF2=1
      LS2=LT(4)/10+1
      IF(LS2.GT.6) LS2=6
      LSTA2(LS2)=LSTA2(LS2)+1
      UBAR2=WSM(KS2)*(FSTK2/EL(KS2))**.5
      NCT2=NCT2+1
    2 NBAR1=UBAR1/.5+1.
      NBAR2=UBAR2/.5+1.
      IF(NBAR1.GT.41)NBAR1=41
      IF(NBAR2.GT.41)NBAR2=41
      IF(NCON1)17,17,18
   17 UN850(KD1,NBAR1)=UN850(KD1,NBAR1)+1.
      GO TO 19
   18 ST850(KD1,NBAR1)=ST850(KD1,NBAR1)+1.
   19 IF(NCON2) 20,20,21
   20 UN200(KD2,NBAR2)=UN200(KD2,NBAR2)+1.
      GO TO 22
   21 ST200(KD2,NBAR2)=ST200(KD2,NBAR2)+1.
   22 CONTINUE
   16 RETURN
      END
```

```
COMPILER OPTIONS - NAME=  MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

      SUBROUTINE CAT1(*)
      COMMON /DUS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /STAB1/ LUN1(4,6),LUN2(4,6),LUNIV1(6),LUNIV2(6),LSTA1(6),
     2              LSTA2(6),NF1,NF2,NCT1,NCT2,CTTEM,LFUM1,LFUM2,
     3              PFUM1,PFUM2
      COMMON /SPD1/ NS(6),NDH(6),KD1,KD2,KH1,KH2,KS1,KS2,KS3,NDRP,WSM(6)
      COMMON /SPD2/ NSP(21,6),M1(8),M2(8),MSP1(8,21),MSP2(8,21),CTWSD
      COMMON /TEM2/ NCON1,NCON2,UBAR1,UBAR2,S100,U100,DT(5),LT(5)
      COMMON /DUS2/ DSTX(4),DUSTX(4),TDIST(4),STKH1,STKH2,NDST,HSQ1,HSQ2
     1              ,HHSQ1,HHSQ2,FSTK1,FSTK2
      COMMON /SIG/ SIGY(4),SIGZ(4),SIGA1,SIGE1,SIGA2,SIGE2
      NCON1=0
      U100=WSM(KS3)*(328./EL(KS3))**.25
      UBAR1=WSM(KS1)*(FSTK1/EL(KS1))**.25
      IF((UBAR1.EQ.0.).OR.(U100.EQ.0.)) RETURN 1
      NCT1=NCT1+1
      S100=23./U100+4.75
      SIGA1=(S100*U100)/UBAR1
      DEG=SIGA1/15.
      ND=DEG+1.
      IF(ND.GT.4) ND=4
      LM=IABS(LT(1))/10+1
      IF(LM.GT.6) LM=6
      LUN1(ND,LM)=LUN1(ND,LM)+1
      LM=0
      DO 1 I=2,5
      IF(LT(I).GT.0) LM=MAX0(LM,LT(I))
    1 CONTINUE
      KF=0
      IF((NF1.EQ.1).AND.(IABS(LT(1)).GE.10)) KF=1
      IF(KF.EQ.0) GO TO 2
      LFUM1=LFUM1+1
      NF1=0
    2 IF(LM.EQ.0) RETURN 1
      LM=LM/10+1
      IF(LM.GT.6) LM=6
      LUNIV1(LM)=LUNIV1(LM)+1
      RETURN 1
      END
```

```
COMPILER OPTIONS - NAME=  MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

      SUBROUTINE CAT2(*)
      COMMON /DUS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /STAB1/ LUN1(4,6),LUN2(4,6),LUNIV1(6),LUNIV2(6),LSTA1(6),
     2              LSTA2(6),NF1,NF2,NCT1,NCT2,CTTEM,LFUM1,LFUM2,
     3              PFUM1,PFUM2
      COMMON /SPD1/ NS(6),NDH(6),KD1,KD2,KH1,KH2,KS1,KS2,KS3,NDRP,WSM(6)
      COMMON /SPD2/ NSP(21,6),M1(8),M2(8),MSP1(8,21),MSP2(8,21),CTWSD
      COMMON /TEM2/ NCON1,NCON2,UBAR1,UBAR2,S100,U100,DT(5),LT(5)
      COMMON /DUS2/ DSTX(4),DUSTX(4),TDIST(4),STKH1,STKH2,NDST,HSQ1,HSQ2
     1              ,HHSQ1,HHSQ2,FSTK1,FSTK2
      COMMON /SIG/ SIGY(4),SIGZ(4),SIGA1,SIGE1,SIGA2,SIGE2
      NCON2=0
      U100=WSM(KS3)*(328./EL(KS3))**.25
      UBAR2=WSM(KS2)*(FSTK2/EL(KS2))**.25
      IF((UBAR2.EQ.0.).OR.(U100.EQ.0.)) RETURN 1
      NCT2=NCT2+1
      S100=23./U100+4.75
      SIGA2=(S100*U100)/UBAR2
      DEG=SIGA2/15.
      ND=DEG+1.
      IF(ND.GT.4) ND=4
      LM=IABS(LT(4))/10+1
      IF(LM.GT.6) LM=6
      LUN2(ND,LM)=LUN2(ND,LM)+1
      LM=0
      IF(LT(5).GT.0) LM=LT(5)/10+1
      KF=0
      IF((NF2.EQ.1).AND.(IABS(LT(4)).GE.10)) KF=1
      IF(KF.EQ.0) GO TO 1
      LFUM2=LFUM2+1
      NF2=0
    1 IF(LM.EQ.0) RETURN 1
      IF(LM.GT.6) LM=6
      LUNIV2(LM)=LUNIV2(LM)+1
      RETURN 1
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE DOSE
      COMMON Z1(50,50),Z2(50,50),XIN1,XIN2,YIN1,YIN2,HX1,HX2,HY1,HY2,
     1       NIXM,NIYM,MIXM,MIYM,NREC
      COMMON /DOS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /DOS2/ DSTX(4),DUSTX(4),TDIST(4),STKH1,STKH2,NDST,HSQ1,HSQ2
     1             ,HHSQ1,HHSQ2,FSTK1,FSTK2,FACT(4,4)
      COMMON /DOS3/ RDS1(4,8,21),TDS1(4,8,21),RDS2(4,8,41),TDS2(4,8,41),
     1             CTWBD1,CTWBD2,CTTYD1,CTTYD2,TMX1(4),TMX2(4),RMX1(4),
     1             RMX2(4),MGAM1(4),MGAM2(4),MTHY1(4),MTHY2(4)
      COMMON /SPD1/ NS(6),NDH(6),KD1,KD2,KH1,KH2,KS1,KS2,KS3,NDRP,WSM(6)
      COMMON /SPD2/ NSP(21,6),M1(8),M2(8),MSP1(8,21),MSP2(8,21),CTWSD
      COMMON /TEM2/ NCON1,NCON2,UBAR1,UBAR2,S100,U100,DT(5),LT(5)
      COMMON /SIG/ SIGY(4),SIGZ(4),SIGA1,SIGE1,SIGA2,SIGE2
      IF(NOP(5).EQ.0) GO TO 9
      IF((U100.EQ.0.).AND.(NCON2.EQ.0)) UBAR2=0.
      IF((U100.GT.0.).AND.(UBAR2.GT.0.)) CALL SIGMA(3,4,NOP(6),NCON2,
     1 UBAR2)
    1 IF(NOP(5).LT.2) GO TO 4
      DO 2 N=1,NDST
      CALL THY(TDOS,UBAR2,SIGY(N),SIGZ(N),TDIST(N),HSQ2,HHSQ2)
      IF(NOP(10).GT.0) CALL DAVE(&2,&20,4,TDOS,DBAR,N)
   19 DBAR=TDOS
   20 KTY=DBAR/(2.5*FACT(4,N))+1.000001
      IF(DBAR.GT.TMX2(N)) MTHY2(N)=NREC
      IF(KTY.GT.41) KTY=41
      TMX2(N)=AMAX1(TMX2(N),DBAR)
      TDS2(N,KD2,KTY)=TDS2(N,KD2,KTY)+1.
    2 CONTINUE
      CTTYD2=CTTYD2+1.
    3 IF(NOP(5).GT.2) GO TO 9
    4 IF(NOP(9).GT.0) GO TO 7
    7 DO 8 N=1,NDST
      CALL RAD(RDOS,UBAR2,SIGY(N),SIGZ(N),TDIST(N),STKH2,Z2,XIN2,YIN2,
     1        HX2,HY2,MIXM,MIYM,N)
      IF(NOP(10).GT.0) CALL DAVE(&8,&22,3,RDOS,DBAR,N)
   21 DBAR=RDOS
   22 KRAD=DBAR/(2.5*FACT(3,N))+1.000001
      IF(DBAR.GT.RMX2(N)) MGAM2(N)=NREC
      IF(KRAD.GT.41) KRAD=41
      RMX2(N)=AMAX1(RMX2(N),DBAR)
      RDS2(N,KD2,KRAD)=RDS2(N,KD2,KRAD)+1.
    8 CONTINUE
      CTWBD2=CTWBD2+1.
    9 IF(NOP(3).EQ.0) GO TO 18
      IF((U100.EQ.0.).AND.(NCON1.EQ.0)) UBAR1=0.
      IF((UBAR1.GT.0.).AND.(U100.GT.0.)) CALL SIGMA(1,2,NOP(4),NCON1,
     1 UBAR1)
   10 IF(NOP(3).LT.2) GO TO 13
      DO 11 N=1,NDST
      CALL THY(TDOS,UBAR1,SIGY(N),SIGZ(N),TDIST(N),HSQ1,HHSQ1)
      IF(NOP(10).GT.0) CALL DAVE(&11,&24,2,TDOS,DBAR,N)
   23 DBAR=TDOS
   24 KTY=DBAR/(5.*FACT(2,N))+1.000001
      IF(DBAR.GT.TMX1(N)) MTHY1(N)=NREC
      IF(KTY.GT.21) KTY=21
      TMX1(N)=AMAX1(TMX1(N),DBAR)
      TDS1(N,KD1,KTY)=TDS1(N,KD1,KTY)+1.
   11 CONTINUE
      CTTYD1=CTTYD1+1.
   12 IF(NOP(3).GT.2) GO TO 18
   13 IF(NOP(9).GT.0) GO TO 16
   16 DO 17 N=1,NDST
      CALL RAD(RDOS,UBAR1,SIGY(N),SIGZ(N),TDIST(N),STKH1,Z1,XIN1,YIN1,
     1        HX1,HY1,NIXM,NIYM,N)
      IF(NOP(10).GT.0) CALL DAVE(&17,&26,1,RDOS,DBAR,N)
   25 DBAR=RDOS
   26 KRAD=DBAR/(5.*FACT(1,N))+1.000001
      IF(DBAR.GT.RMX1(N)) MGAM1(N)=NREC
      IF(KRAD.GT.21) KRAD=21
      RMX1(N)=AMAX1(RMX1(N),DBAR)
      RDS1(N,KD1,KRAD)=RDS1(N,KD1,KRAD)+1.
   17 CONTINUE
      CTWBD1=CTWBD1+1.
   18 RETURN
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE SIGMA(N1,N2,N3,N4,UBAR)
      COMMON /SIG/ SIGY(4),SIGZ(4)
      COMMON /TEM2/ NCON1,NCON2,UBAR1,UBAR2,S100,U100,DT(5),LT(5)
      COMMON /DOS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /DOS2/ DSTX(4),DUSTX(4),TDIST(4),STKH1,STKH2,NDST,HSQ1,HSQ2
     1            ,HHSQ1,HHSQ2
      IF(N3.EQ.0) GO TO 1
      SIGA=NSIGMA(N1)
      SIGA=SIGA/40.
      IF(SIGA.LT.2.) SIGA=2.
      SIGE=NSIGMA(N2)
      SIGE=SIGE/40.
      IF(SIGE.LT.0.4) SIGE=0.4
      IF(N4) 3,3,5
    1 IF(N4.EQ.0) GO TO 2
      SIGA=2.
      SIGE=.4
      GO TO 5
    2 SIGA=(S100*U100)/UBAR
      SIGE=0.7*SIGA
    3 DO 4 N=1,NDST
      SIGY(N)=SIGA*DUSTX(N)
    4 SIGZ(N)=SIGE*DUSTX(N)
      RETURN
    5 DO 6 N=1,NDST
      SIGY(N)=SIGA*DSTX(N)
    6 SIGZ(N)=SIGE*DSTX(N)
      RETURN
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE THY(TDOS,UBAR,SIGY,SIGZ,DST,HSQ,HHSQ)
C     SUBROUTINE TO CALCULATE THYROID INHALATION DOSE
      COMMON /THYD/ COMSOR(5),BIEN(5),EGMM(5),AMDA(5),ISO
      IF(UBAR.GT.0.) GO TO 1
      TDOS=0.
      RETURN
    1 PIMU=3.141593*UBAR
      TIME=DST/UBAR
      Q2=1./(PIMU*SIGY*SIGZ)
      SIGZ2=SIGZ*SIGZ
      TDOS=0.
      CHI=Q2*EXP(-HHSQ/SIGZ2)
      DO 10 I=1,ISO
      CHISV=CHI*COMSOR(I)*EXP(-AMDA(I)*TIME)
      ATAU=CHISV*EGMM(I)
      TH=.9213E-13*ATAU*BIEN(I)
   10 TDOS=TDOS+TH
      RETURN
      END
```

```
COMPILER OPTIONS - NAME=  MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

      SUBROUTINE RAD(RDOS,UBAR,SIGY,SIGZ,DST,STKHT,Z,XIN,YIN,HX,HY,
     1               IXM,IYM,M)
C     SUBROUTINE TO CALCULATE WHOLE BODY GAMMA DOSE FOR A RELEASE OF
C     RADIOACTIVE MATERIAL TO THE ATMOSPHERE
C
      COMMON /DOS1/  NOP(20),EL(6),NSIGMA(4)
      COMMON /GAMM/  NGAM,GNU,GAM(20),DEC(20),ENG(20),DGAM(20),DDEC(20),
     1               DENG(20)
      COMMON/SOURCE/Y(63,4)
      DIMENSION Z(50,50)
      IF(UBAR.GT.0.) GO TO 3
    1 RDOS=0.
      RETURN
    3 SO=0.
      IF(NOP(9).EQ.0) GO TO 4
      DO 2 I=1,NGAM
      TIME=DST/UBAR
      PLT=EXP(-DEC(I)*TIME)
      DLT=EXP(-DDEC(I)*TIME)
      SG=GAM(I)*PLT+DGAM(I)*DLT+GAM(I)*DENG(I)*DEC(I)/(ENG(I)*(DDEC(I)-
     1   DEC(I)))*(PLT-DLT)
    2 SO=SO+SG
      GO TO 5
C     PROGRAM TO PROVIDE THIRD DEGREE INTERPOLATION OF A FUNCTION OF ONE
C     VARIABLE
    4 IF (UBAR.GT.32.0) GO TO 6
      N=UBAR*10.
      IF(UBAR.GT.2.5) N=UBAR+28.5
      XO=N
      IF(UBAR.LE.2.5) XO=XO/10.
      IF(UBAR.GT.2.5) XO=XO-28.5
      YO=Y(N,M)
      DEL11=Y(N+1,M)-Y(N,M)
      DEL12=Y(N+2,M)-Y(N+1,M)
      DEL13=Y(N+3,M)-Y(N+2,M)
      DEL21=DEL12-DEL11
      DEL22=DEL13-DEL12
      DEL31=DEL22-DEL21
      U=UBAR-XO
      IF(UBAR.LE.2.5) U=U/.1
      SO=YO+U*DEL11+(U*(U-1.)/2.)*DEL21+((U*(U-1.)*(U-2.))/6.)*DEL31
      GO TO 5
    6 SO=.39E19
    5 CALL DBTERP(SIGY,SIGZ,DINT,NGO,Z,XIN,YIN,HX,HY,IXM,IYM)
      IF(NGO.EQ.0)GO TO 1
      RDOS=     SO/(4.*UBAR*STKHT)*DINT*GNU
      RETURN
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE DBTERP(SIGY,SIGZ,SDM,NGO,Z,XIN,YIN,HX,HY,IXM,IYM)
C     PROGRAM TO PROVIDE FOURTH DEGREE DOUBLE INTERPOLATION OF A
C     FUNCTION OF TWO VARIABLES
      REAL*8                          XST,YST,U,V,Z11,Z21,Z12,DEL10,DEL01,
     1 SUM,U1,V1,Z31,Z22,Z13,DEL20,DEL11,DEL02,U2,V2,Z41,Z32,Z23,Z14,
     2 DEL30,DEL21,DEL12,DEL03,U3,V3,Z51,Z42,Z33,Z24,Z15,DEL40,DEL31,
     3 DEL22,DEL13,DEL04
      DIMENSION Z(50,50)
      X=SIGY
      Y=SIGZ/SIGY
      NGO=1
C
C     DETERMINE IF X WILL FIT ON TABLE
C
   11 XMAX=(XIN-1.)*HX
      IF(XMAX-X)101,101,12
C
C     DETERMINE IF Y WILL FIT ON TABLE
C
   12 YMAX=(YIN-1.)*HY
      IF(YMAX-Y)101,101,14
C
C     DETERMINE STARTING VALUES
C
   14 IX=X/HX
      IY=Y/HY
      IXM=XIN
      IYM=YIN
      XST=FLOAT(IX)*HX
      YST=FLOAT(IY)*HY
      U=(X-XST)/HX
      V=(Y-YST)/HY
      SUM=0.
      IX=IX+1
      IY=IY+1
      Z11=Z(IX,IY)
      Z21=Z(IX+1,IY)
      Z12=Z(IX,IY+1)
      DEL10=Z21-Z11
      DEL01=Z12-Z11
      SUM=SUM+Z11+U*DEL10+V*DEL01
      SDM=SUM
      IXMAX=IXM-2
      IYMAX=IYM-2
      IF(IXMAX-IX)104,105,105
  105 IF(IYMAX-IY)104,106,106
  106 U1=U-1
      V1=V-1
      Z31=Z(IX+2,IY)
      Z22=Z(IX+1,IY+1)
      Z13=Z(IX,IY+2)
      DEL20=Z31-2.*Z21+Z11
      DEL11=Z22-Z21-DEL01
      DEL02=Z13-2.*Z12+Z11
      SUM=SUM+0.5*(U*U1*DEL20+2.*U*V*DEL11+V*V1*DEL02)
      SDM=SUM
      IXMAX=IXM-3
      IYMAX=IYM-3
      IF(IXMAX-IX)104,107,107
  107 IF(IYMAX-IY)104,108,108
  108 U2=U-2.
      V2=V-2.
      Z41=Z(IX+3,IY)
      Z32=Z(IX+2,IY+1)
      Z23=Z(IX+1,IY+2)
      Z14=Z(IX,IY+3)
      DEL30=Z41-3.*Z31+3.*Z21-Z11
      DEL21=Z32-2.*Z22+Z12-DEL20
      DEL12=Z23-2.*Z22+Z21-DEL02
      DEL03=Z14-3.*Z13+3.*Z12-Z11
      SUM=SUM+(U*U1*U2*DEL30+3.*U*U1*V*DEL21+3.*U*V*V1*DEL12+V*V1*V2
     1    *DEL03)/6.
      SDM=SUM
  104 GO TO 113
  101 NGO=0
  113 RETURN
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE DAVE(*,*,N,DOST,DBAR,K)
      COMMON /DAV/ LZO(4,4),NAV,SAV
      DIMENSION DOS(4,61,4)
      LZO(N,K)=LZO(N,K)+1
      M=LZO(N,K)-(LZO(N,K)/NAV)*NAV
      IF(M.EQ.0) M=NAV
      DOS(N,M,K)=DOST
      IF(LZO(N,K).LT.NAV) RETURN 1
      DBAR=0.
    3 DO 4 I=1,NAV
    4 DBAR=DBAR+DOS(N,I,K)
      DBAR=DBAR/SAV
      RETURN 2
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE REED(NLP)
      COMMON /DGP2/ NSR(21,6),M3(8),M4(8),MSP3(8,21),MSP4(8,21),LUN3(4,6
     1             ),LUN4(4,6),LUNIV3(6),LUNIV4(6),LSTA3(6),LSTA4(6),
     2          LFUM3,LFUM4,NCT3,NCT4,TEMCT,WBD1CT,WBD2CT,TDY1CT,TDY2CT
     3         ,UNUP(8,41),STUP(8,41),UNLO(8,41),STLO(8,41),RDS3(4,8,21),
     4          TDS3(4,8,21),RDS4(4,8,41),TDS4(4,8,41),WSDCT,NCTWS(6)
      COMMON /STAB1/ LUN1(4,6),LUN2(4,6),LUNIV1(6),LUNIV2(6),LSTA1(6),
     2              LSTA2(6),NF1,NF2,NCT1,NCT2,CTTEM,LFUM1,LFUM2,
     3              PFUM1,PFUM2
      COMMON /DOS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /DOS2/ DSTX(4),DUSTX(4),TDIST(4),STKH1,STKH2,NDST,HSQ1,HSQ2
     1              ,HHSQ1,HHSQ2,FSTK1,FSTK2,FACT(4,4)
      COMMON /DOS3/ RDS1(4,8,21),TDS1(4,8,21),RDS2(4,8,41),TDS2(4,8,41),
     1              CTWBD1,CTWBD2,CTTYD1,CTTYD2,TMX1(4),TMX2(4),RMX1(4),
     1              RMX2(4),MGAM1(4),MGAM2(4),MTHY1(4),MTHY2(4)
      COMMON /SPD2/ NSP(21,6),M1(8),M2(8),MSP1(8,21),MSP2(8,21),CTWSD
     1              ,NWSCT(6)
      COMMON /DOS4/ UN850(8,41),ST850(8,41),UN200(8,41),ST200(8,41),
     1              PU850(8,41),PS850(8,41),PU200(8,41),PS200(8,41)
      COMMON /TTLE/ WORDS(20)
      DIMENSION ALPHA(40)
      GO TO (1,7,7),NLP
    1 IF(NOP(7).EQ.0) GO TO 14
      IF(NOP(1).EQ.0) GO TO 2
      READ (5,101) (ALPHA(I),I=1,20)
      READ (5,100) NSR,M3,M4,MSP3,MSP4,NCTWS
      READ (5,102) WSDCT
    2 IF(NOP(2).EQ.0) GO TO 3
      READ (5,101) (ALPHA(I),I=1,20)
      READ (5,100) LUN3,LUN4,LUNIV3,LUNIV4,LSTA3,LSTA4,LFUM3,LFUM4,NCT3,
     1     NCT4
      READ (5,102) TEMCT,UNUP,STUP,UNLO,STLO
    3 IF((NOP(3).EQ.0).OR.(NOP(3).GT.2)) GO TO 4
      DO 20 N=1,NDST
      READ (5,101) ALPHA
      READ (5,102) ((RDS3(N,I,J),I=1,8),J=1,21),WBD1CT
    4 IF (NOP(3).LT.2) GO TO 5
      READ (5,101) ALPHA
      READ (5,102) ((TDS3(N,I,J),I=1,8),J=1,21),TDY1CT
    5 IF((NOP(5).EQ.0).OR.(NOP(5).GT.2)) GO TO 6
      READ (5,101) ALPHA
      READ (5,102) ((RDS4(N,I,J),I=1,8),J=1,41),WBD2CT
    6 IF(NOP(3).LT.2) GO TO 14
      READ (5,101) ALPHA
      READ (5,102) ((TDS4(N,I,J),I=1,8),J=1,41),TDY2CT
   20 CONTINUE
      RETURN
    7 IF(NOP(8).EQ.0) GO TO 14
    8 IF(NOP(1).EQ.0) GO TO 9
      WRITE (7,101) WORDS
      WRITE (7,100) NSP,M1,M2,MSP1,MSP2,NWSCT
      WRITE (7,102) CTWSD
    9 IF(NOP(2).EQ.0) GO TO 10
      WRITE (7,101) WORDS
      WRITE(7,100) LUN1,LUN2,LUNIV1,LUNIV2,LSTA1,LSTA2,LFUM1,LFUM2,NCT1,
     1     NCT2
      WRITE (7,102) CTTEM,UN850,ST850,UN200,ST200
   10 DO 30 N=1,NDST
      IF((NOP(3).EQ.0).OR.(NOP(3).GT.2)) GO TO 11
      WRITE (7,101) WORDS
      WRITE(7,103) TDIST(N),STKH1
      WRITE(7,102) ((RDS1(N,I,J),I=1,8),J=1,21),CTWBD1
   11 IF(NOP(3).LT.2) GO TO 12
      WRITE (7,101) WORDS
      WRITE(7,103) TDIST(N),STKH1
      WRITE(7,102) ((TDS1(N,I,J),I=1,8),J=1,21),CTTYD1
   12 IF((NOP(5).EQ.C).OR.(NOP(5).GT.2)) GO TO 13
      WRITE (7,101) WORDS
      WRITE(7,103) TDIST(N),STKH2
      WRITE(7,102) ((RDS2(N,I,J),I=1,8),J=1,41),CTWBD2
   13 IF(NOP(5).LT.2) GO TO 30
      WRITE (7,101) WORDS
      WRITE(7,103) TDIST(N),STKH2
      WRITE(7,102) ((TDS2(N,I,J),I=1,8),J=1,41),CTTYD2
   30 CONTINUE
   14 RETURN
  100 FORMAT (10I8)
  101 FORMAT (20A4)
  102 FORMAT (10F8.0)
  103 FORMAT ('DOWNWIND DISTANCE =',1PE11.4,' METERS, RELEASE HEIGHT =',
     1 0PF6.0,' METERS')
      END
```

```
COMPILER OPTIONS - NAME=  MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

      SUBROUTINE DATGP(NGP)
      COMMON /STAB1/ LUN1(4,6),LUN2(4,6),LUNIV1(6),LUNIV2(6),LSTA1(6),
     2            LSTA2(6),NF1,NF2,NCT1,NCT2,CTTEM,LFUM1,LFUM2,
     3             PFUM1,PFUM2
      COMMON /STAB2/ LUT1(4),LUT2(4),PSTA1(6),PSTA2(6),PCU1(4,6),PCU2(4,
     1               6),PUT1(4),PUT2(4),PSI1(6),PSI2(6)
      COMMON /DDS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /DDS2/ DSTX(4),DUSTX(4),TDIST(4),STKH1,STKH2,NDST,HSQ1,HSQ2
     1              ,HHSQ1,HHSQ2,FSTK1,FSTK2
      COMMON /DDS3/ RDS1(4,8,21),TDS1(4,8,21),RDS2(4,8,41),TDS2(4,8,41),
     1              CTWBD1,CTWBD2,CTTYD1,CTTYD2,TMX1(4),TMX2(4),RMX1(4),
     1              RMX2(4),MGAM1(4),MGAM2(4),MTHY1(4),MTHY2(4)
      COMMON /DDS4/ UN850(8,41),ST850(8,41),UN200(8,41),ST200(8,41),
     1              PU850(8,41),PS850(8,41),PU200(8,41),PS200(8,41)
      COMMON /SPD1/ NS(6),NDH(6),KD1,KD2,KH1,KH2,KS1,KS2,KS3,NDRP,WSM(6)
      COMMON /SPD2/ NSP(21,6),M1(8),M2(8),MSP1(8,21),MSP2(8,21),CTWSD
     1              ,NWSCT(6)
      COMMON /DGP1/ PCT1(8),PCT2(8),XPC1(8,21),XPC2(8,21),NRD1(4,21),
     1              XRD1(4,21),PRD1(8),PR1(4,8,21),NTY1(4,21),XTY1(4,21)
     2             ,PTD1(8),PT1(4,8,21),NRD2(4,41),XRD2(4,41),PRD2(8),
     3             PR2(4,8,41),NTY2(4,41),XTY2(4,41),PTD2(8),PT2(4,8,41)
      COMMON /DGP2/ NSR(21,6),M3(8),M4(8),MSP3(8,21),MSP4(8,21),LUN3(4,6
     1              ),LUN4(4,6),LUNIV3(6),LUNIV4(6),LSTA3(6),LSTA4(6),
     2          LFUM3,LFUM4,NCT3,NCT4,TEMCT,WBD1CT,WBD2CT,TDY1CT,TDY2CT
     3         ,UNUP(8,41),STUP(8,41),UNLO(8,41),STLO(8,41),RDS3(4,8,21),
     4          TDS3(4,8,21),RDS4(4,8,41),TDS4(4,8,41),WSDCT,NCTWS(6)
      COMMON /DGP4/ LOT1,POT1,LOT2,POT2,LIV1,LIV2,PIV1,PIV2
C     CONSOLIDATION OF PRESENT DATA AND DATA FROM PREVIOUS DATA
C     REDUCTION RUNS
      GO TO (100,38),NGP
  100 IF(NOP(1).EQ.0) GO TO 3
    1 DO 52 I=1,8
      X1=M1(I)
      X2=M2(I)
      PCT1(I)=(X1/CTWSD)*100.
      PCT2(I)=(X2/CTWSD)*100.
      DO 52 J=1,21
      XPC1(I,J)=0.
      XPC2(I,J)=0.
      XP1=MSP1(I,J)
      IF(X1.EQ.0) GO TO 2
      XPC1(I,J)=(XP1/X1)*100.
    2 XP2=MSP2(I,J)
      IF(X2.EQ.0) GO TO 52
      XPC2(I,J)=(XP2/X2)*100.
   52 CONTINUE
    3 DCT1=NCT1
      DCT2=NCT2
      DO 55 I=1,8
      DO 55 J=1,41
      PU850(I,J)=UN850(I,J)/CTWBD1*100.
      PS850(I,J)=ST850(I,J)/CTWBD1*100.
      PU200(I,J)=UN200(I,J)/CTWBD2*100.
   55 PS200(I,J)=ST200(I,J)/CTWBD2*100.
      DO 10 I=1,6
      P1=LUNIV1(I)
      P2=LUNIV2(I)
      PZ1=LSTA1(I)
      PZ2=LSTA2(I)
      PSI1(I)=P1/DCT1*100.
      PSI2(I)=P2/DCT2*100.
      PSTA1(I)=PZ1/DCT1*100.
      PSTA2(I)=PZ2/DCT2*100.
      DO 10 J=1,4
      P1=LUN1(J,I)
      P2=LUN2(J,I)
      PCU1(J,I)=P1/DCT1*100.
   10 PCU2(J,I)=P2/DCT2*100.
      FM1=LFUM1
      FM2=LFUM2
      PFUM1=FM1/DCT1*100.
      PFUM2=FM2/DCT2*100.
      LOT1  = LSTA1(1)
      POT1  = PSTA1(1)
      LOT2  = LSTA2(1)
      POT2  = PSTA2(1)
      LIV1  = LUNIV1(1)
      LIV2  = LUNIV2(1)
      PIV1  = PSI1 (1)
      PIV2  = PSI2 (1)
      DO 109 J=1,4
      LUT1(J) = LUN1(J,1)
```

```
      PUT1(J) = PCU1(J,1)
      LUT2(J) = LUN2(J,1)
  109 PUT2(J) = PCU2(J,1)
      DO 110 I=2,6
      LOT1  = LSTA1(I)+LOT1
      POT1  = PSTA1(I)+POT1
      LOT2  = LSTA2(I)+LOT2
      POT2  = PSTA2(I)+POT2
      LIV1  = LUNIV1(I)+LIV1
      LIV2  = LUNIV2(I)+LIV2
      PIV1  = PSI1 (I)+PIV1
      PIV2  = PSI2 (I)+PIV2
      DO 110 J=1,4
      LUT1(J) = LUN1(J,I)+LUT1(J)
      PUT1(J) = PCU1(J,I)+PUT1(J)
      LUT2(J) = LUN2(J,I)+LUT2(J)
  110 PUT2(J) = PCU2(J,I)+PUT2(J)
   20 IF((NOP(3)+NOP(5)).EQ.0) GO TO 50
      DO 37 N=1,NOST
      IF(NOP(3).EQ.0) GO TO 29
      IF(NOP(3).GT.2) GO TO 25
      DO 22 J=1,21
      NRD1(N,J)=0
      RAD1=0.
      DO 21 I=1,8
   21 RAD1=RAD1+RDS1(N,I,J)
      NRD1(N,J)=RAD1+.1
   22 XRD1(N,J)=RAD1/CTWBD1*100.
      DO 23 I=1,8
      X1=M1(I)
      PRD1(I)=(X1/CTWBD1)*100.
      DO 23 J=1,21
      PR1(N,I,J)=0.
      XD1=RDS1(N,I,J)
      IF(X1.EQ.0) GO TO 23
      PR1(N,I,J)=XD1/X1*100.
   23 CONTINUE
   24 IF(NOP(3).LT.2) GO TO 29
   25 DO 27 J=1,21
      NTY1(N,J)=0
      TY1=0.
      DO 26 I=1,8
   26 TY1=TY1+TDS1(N,I,J)
      NTY1(N,J)=TY1+.1
   27 XTY1(N,J)=TY1/CTTYD1*100.
      DO 28 I=1,8
      X1=M1(I)
      PTD1(I)=(X1/CTTYD1)*100.
      DO 28 J=1,21
      PT1(N,I,J)=0.
      XD1=TDS1(N,I,J)
      IF(X1.EQ.0) GO TO 28
      PT1(N,I,J)=XD1/X1*100.
   28 CONTINUE
   29 IF(NOP(5).EQ.0) GO TO 37
      IF(NOP(5).GT.2) GO TO 34
      DO 31 J=1,41
      NRD2(N,J)=0
      RAD2=0.
      DO 30 I=1,8
   30 RAD2=RAD2+RDS2(N,I,J)
      NRD2(N,J)=RAD2+.1
   31 XRD2(N,J)=RAD2/CTWBD2*100.
      DO 32 I=1,8
      X1=M2(I)
      PRD2(I)=(X1/CTWBD2)*100.
      DO 32 J=1,41
      PR2(N,I,J)=0.
      XD1=RDS2(N,I,J)
      IF(X1.EQ.0) GO TO 32
      PR2(N,I,J)=XD1/X1*100.
   32 CONTINUE
   33 IF(NOP(5).LT.2) GO TO 37
   34 DO 36 J=1,41
      NTY2(N,J)=0
      TY2=0.
      DO 35 I=1,8
   35 TY2=TY2+TDS2(N,I,J)
      NTY2(N,J)=TY2+.1
   36 XTY2(N,J)=TY2/CTTYD2*100.
      DO 37 I=1,8
      X1=M2(I)
      PTD2(I)=(X1/CTTYD2)*100.
      DO 37 J=1,41
```

```
      PT2(N,I,J)=0.
      XD1=TDS2(N,I,J)
      IF(X1.EQ.0) GO TO 37
      PT2(N,I,J)=XD1/X1*100.
   37 CONTINUE
   50 RETURN
   38 CTWSD=CTWSD+WSDCT
      CTTEM=CTTEM+TEMCT
      CTWBD1=CTWBD1+WBD1CT
      CTWBD2=CTWBD2+WBD2CT
      CTTYD1=CTTYD1+TDY1CT
      CTTYD2=CTTYD2+TDY2CT
      DO 39 I=1,8
      M1(I)=M1(I)+M3(I)
      M2(I)=M2(I)+M4(I)
      DO 39 J=1,21
      MSP1(I,J)=MSP1(I,J)+MSP3(I,J)
   39 MSP2(I,J)=MSP2(I,J)+MSP4(I,J)
      DO 41 N=1,NDST
      DO 41 I=1,8
      DO 40 J=1,21
      TDS1(N,I,J)=TDS1(N,I,J)+TDS3(N,I,J)
   40 RDS1(N,I,J)=RDS1(N,I,J)+RDS3(N,I,J)
      DO 41 J=1,41
      TDS2(N,I,J)=TDS2(N,I,J)+TDS4(N,I,J)
   41 RDS2(N,I,J)=RDS2(N,I,J)+RDS4(N,I,J)
      DO 49 I=1,6
      NWSCT(I)=NWSCT(I)+NCTWS(I)
      DO 49 J=1,21
   49 NSP(J,I)=NSP(J,I)+NSR(J,I)
      DO 42 I=1,8
      DO 42 J=1,41
      UN850(I,J)=UN850(I,J)+UNUP(I,J)
      ST850(I,J)=ST850(I,J)+STUP(I,J)
      UN200(I,J)=UN200(I,J)+UNLO(I,J)
   42 ST200(I,J)=ST200(I,J)+STLO(I,J)
      DO 300 I=1,6
      LUNIV1(I)=LUNIV1(I)+LUNIV3(I)
      LUNIV2(I)=LUNIV2(I)+LUNIV4(I)
      LSTA1(I)=LSTA1(I)+LSTA3(I)
      LSTA2(I)=LSTA2(I)+LSTA4(I)
      DO 300 J=1,4
      LUN1(J,I)=LUN1(J,I)+LUN3(J,I)
  300 LUN2(J,I)=LUN2(J,I)+LUN4(J,I)
      NCT1=NCT1+NCT3
      NCT2=NCT2+NCT4
      LFUM1=LFUM1+LFUM3
      LFUM2=LFUM2+LFUM4
      GO TO 100
      END
```

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

```
      SUBROUTINE OUT(KO)
C
C     SUBROUTINE TO CONTROL ALL OUTPUT DATA
      COMMON /STAB1/ LUN1(4,6),LUN2(4,6),LUNIV1(6),LUNIV2(6),LSTA1(6),
     2              LSTA2(6),NF1,NF2,NCT1,NCT2,CTTEM,LFUM1,LFUM2,
     3               PFUM1,PFUM2
      COMMON /STAB2/ LUT1(4),LUT2(4),PSTA1(6),PSTA2(6),PCU1(4,6),PCU2(4,
     1               6),PUT1(4),PUT2(4),PSI1(6),PSI2(6)
      COMMON /SPD1/ NS(6),NDH(6),KD1,KD2,KH1,KH2,KS1,KS2,KS3,NDRP,WSM(6)
      COMMON /SPD2/ NSP(21,6),M1(8),M2(8),MSP1(8,21),MSP2(8,21),CTWSD
     1               ,NWSCT(6)
      COMMON /DOS1/ NOP(20),EL(6),NSIGMA(4)
      COMMON /DOS2/ CSTX(4),DUSTX(4),TDIST(4),STKH3,STKH4,NDST,HSQ1,HSQ2
     1               ,HHSQ1,HHSQ2,FSTK1,FSTK2,FACT(4,4)
      COMMON /DOS3/ RDS1(4,8,21),TDS1(4,8,21),RDS2(4,8,41),TDS2(4,8,41),
     1              CTWBD1,CTWBD2,CTTYD1,CTTYD2,TMX1(4),TMX2(4),RMX1(4),
     1              RMX2(4),MGAM1(4),MGAM2(4),MTHY1(4),MTHY2(4)
      COMMON /DOS4/ UN850(8,41),ST850(8,41),UN200(8,41),ST200(8,41),
     1              PU850(8,41),PS850(8,41),PU200(8,41),PS200(8,41)
      COMMON /DINC/ NINC(21),NONC(41),NTIN(41)
      COMMON /DGP1/ PCT1(8),PCT2(8),XPC1(8,21),XPC2(8,21),NRD1(4,21),
     1              XRD1(4,21),PRD1(8),PR1(4,8,21),NTY1(4,21),XTY1(4,21)
     2             ,PTD1(8),PT1(4,8,21),NRD2(4,41),XRD2(4,41),PRD2(8),
     3              PR2(4,8,41),NTY2(4,41),XTY2(4,41),PTD2(8),PT2(4,8,41)
      COMMON /DGP4/ LOT1,PUT1,LOT2,POT2,LIV1,LIV2,PIV1,PIV2
      COMMON /TTLE/ WORDS(20)
      REAL*4 NONC
      DIMENSION MCT(8)
      DIMENSION P(21,12),WSCT(6)
   31 FORMAT ('0 NUMBER OF RECORDS IN THIS SURVEY =',F9.0)
      STKH1=FSTK1
      STKH2=FSTK2
      NHT1=STKH3
      NHT2=STKH4
      KX=0
      NN=1
      IF(NOP(1).EQ.0) GO TO 20
      CALL TITLE(KO,WORDS,TDIST(NN),KX)
      WRITE (6,3)
    3 FORMAT (    34X,'FREQUENCY OF WIND SPEED IN METERS PER SEC BY ELEVA
     1TION IN FEET')
      WRITE (6,2)
    2 FORMAT ('0'23X,'ELEVATION',23X,'FRACTION AT EACH SPEED BY ELEVATIO
     1N',4X,'ACCUM FRACTION BY SPEED BY ELEVATION')
      WRITE (6,4)
    4 FORMAT ('0  SPEED     1000      800      600      450      300      120
     1  1000     800     600     450     300     120    1000     800     600     450     300
     2   120')
      DO 1 I=1,6
    1 WSCT(I)=NWSCT(I)
      DO 10 K=1,21
      DO 6 L=1,6
      M=L+6
      P(K,L)=NSP(K,L)
      P(K,L)=P(K,L)/WSCT(L)
      KK=K-1
      IF(KK.NE.0) GO TO 5
      P(K,M)=P(K,L)
      GO TO 6
    5 P(K,M)=P(KK,M)+P(K,L)
    6 CONTINUE
      IF((K-21).EQ.0) GO TO 8
    7 WRITE (6,11) KK,K,(NSP(K,I),I=1,6),(P(K,N),N=1,12)
      GO TO 10
    8 WRITE (6,12) (NSP(K,I),I=1,6),(P(K,N),N=1,12)
   10 CONTINUE
   11 FORMAT ('0',I2,' TO',I3,6I8,12F6.2)
   12 FORMAT ('0 OVER 20',6I8,12F6.2)
      WRITE (6,222)(NWSCT(I),I=1,6)
  222 FORMAT('  TOTALS ',6I8)
      WRITE (6,13) CTWSD
   13 FORMAT ('0 NUMBER OF RECORDS IN THIS SURVEY ='F9.0)
      CALL TITLE(KO,WORDS,TDIST(NN),KX)
      WRITE (6,14) STKH1
   14 FORMAT (' WIND DIRECTION DATA AT ',F4.0,' FEET')
      WRITE (6,15) (I,PCT1(I),I=1,8)
   15 FORMAT ('0'4X,8('  SECTOR ',I1,F6.2))
      WRITE (6,16)
   16 FORMAT ('OSPEED  EVENTS  PERCT',7('    EVENTS  PERCT'))
      WRITE (6,17) (J,MSP1(1,J),XPC1(1,J),MSP1(2,J),XPC1(2,J),MSP1(3,J),
     1 XPC1(3,J),MSP1(4,J),XPC1(4,J),MSP1(5,J),XPC1(5,J),MSP1(6,J),
     2 XPC1(6,J),MSP1(7,J),XPC1(7,J),MSP1(8,J),XPC1(8,J),J=1,21)
```

```
 17 FORMAT (I4,I9,F8.2,I8,F8.2,I8,F8.2,I8,F8.2,
   1          I8,F8.2,I8,F8.2,I8,F8.2,I8,F8.2)
    WRITE (6,18)
 18 FORMAT (/)
    WRITE (6,14) STKH2
    WRITE (6,15) (I,PCT2(I),I=1,8)
    WRITE (6,16)
    WRITE (6,17) (J,MSP2(1,J),XPC2(1,J),MSP2(2,J),XPC2(2,J),MSP2(3,J),
   1 XPC2(3,J),MSP2(4,J),XPC2(4,J),MSP2(5,J),XPC2(5,J),MSP2(6,J),
   2 XPC2(6,J),MSP2(7,J),XPC2(7,J),MSP2(8,J),XPC2(8,J),J=1,21)
 20 IF(NUP(2).EQ.0) GO TO 32
    CALL TITLE(KO,WORDS,TDIST(NN),KX)
    WRITE (6,113) NHT1
    WRITE (6,105)
105 FORMAT(' LAPSE RATE   STABLE  PERCENT',4(5X,'UNSTABLE   PERCENT'),
   1/' DEG F/100''',22X,'SIGA < 15',14X,'SIGA < 30',14X,'SIGA < 45',
   2  14X,'SIGA > 45')
    DO 106 I=1,5
    N1=I-1
106 WRITE (6,107) N1,I ,LSTA1(I),PSTA1(I),(LUN1(J,I),PCU1(J,I),J=1,4)
107 FORMAT('0',I3,' TO',I2,I11,F8.2,4(I13,F10.2))
    WRITE (6,108)    LSTA1(6),PSTA1(6),(LUN1(J,6),PCU1(J,6),J=1,4)
108 FORMAT ('0  OVER 5',I11,F8.2,4(I13,F10.2))
    WRITE (6,111) LOT1,POT1,(LUT1(J),PUT1(J),J=1,4)
111 FORMAT ('0  TOTAL',I12,F8.2,4(I13,F10.2))
112 FORMAT (//)
    WRITE (6,113) NHT2
113 FORMAT('0',50X,I3,' METER ANALYSIS',/)
    WRITE (6,105)
    DO 114 I=1,5
    N1=I-1
114 WRITE(6,107) N1,I ,LSTA2(I),PSTA2(I),(LUN2(J,I),PCU2(J,I),J=1,4)
    WRITE(6,108) LSTA2(6),PSTA2(6),(LUN2(J,6),PCU2(J,6),J=1,4)
    WRITE(6,111) LOT2,POT2,(LUT2(J),PUT2(J),J=1,4)
    WRITE (6,112)
    WRITE (6,115) NHT1,NHT2
115 FORMAT(' UNSTABLE AT',I4,', INVERSION BELOW',16X,'UNSTABLE AT',I4,
   1'INVERSION BELOW',/,'    LAPSE',43X,'LAPSE',/,' MAGNITUDE     EVENTS
   2  PERCENT',20X,'MAGNITUDE     EVENTS  PERCENT',/,' DEG F/100''',38X
   3,'DEG F/100''',/)
    DO 116 I=1,5
    N1=I-1
116 WRITE (6,117) N1,I ,LUNIV1(I),PSI1(I),N1, I,LUNIV2(I),PSI2(I)
117 FORMAT (I4,' TO',I2,I11,F8.2,19X,I4,' TO',I2,I11,F8.2)
    WRITE (6,118) LUNIV1(6),PSI1(6),LUNIV2(6),PSI2(6)
118 FORMAT ('    OVER 5',I11,F8.2,22X,'OVER 5',I11,F8.2,/)
    WRITE (6,119) LIV1,PIV1,LIV2,PIV2
119 FORMAT ('    TOTALS',I11,F8.2,22X,'TOTALS',I11,F8.2,//)
    WRITE (6,120) NHT1,LFUM1,PFUM1,NCT1
    WRITE (6,120) NHT2,LFUM2,PFUM2,NCT2
120 FORMAT(' NUMBER OF POTENTIAL  FUMIGATION EVENTS AT',I4,' METERS ='
   1,I5,' OR',F6.2,' PERCENT OF',I7,' SAMPLES',/)
100 FORMAT (6I6,5F6.1)
101 FORMAT (4I3,17I4)
160 FORMAT (8I10)
    CALL TITLE(KO,WORDS,TDIST(NN),KX)
    WRITE (6,66) STKH1
 66 FORMAT ('0 WIND SPEED DISTRIBUTION BY STABILITY CLASSIFICATION AT'
   1 ,F6.0,' FEET',/)
    WRITE (6,67)
 67 FORMAT (30X,'SPEED AND DIRECTION DATA FOR UNSTABLE CONDITIONS',/)
    DIMENSION SPIN(41)
    DO 68 I=1,41
    SPIN(I)=I
    SPIN(I)=SPIN(I)/2.+.0001
    IF(I.EQ.41) SPIN(I)=SPIN(I-1)
 68 CONTINUE
    WRITE (6,15) (I,PCT1(I),I=1,8)
    WRITE (6,16)
    DO 69 J=1,41
 69 WRITE (6,70)   SPIN(J),(UN850(K,J),PU850(K,J),K=1,8)
    WRITE (6,65)
 70 FORMAT (F6.1,F7.0,F7.2,1X,F7.0,F7.2,6(2X,F7.0,F7.2))
    CALL TITLE(KO,WORDS,TDIST(NN),KX)
    WRITE (6,66) STKH1
    WRITE (6,71)
 71 FORMAT (30X,'SPEED AND DIRECTION DATA FOR STABLE CONDITIONS',/)
    WRITE (6,15) (I,PCT1(I),I=1,8)
    WRITE (6,16)
    DO 72 J=1,41
 72 WRITE (6,70)   SPIN(J),(ST850(K,J),PS850(K,J),K=1,8)
    WRITE (6,65)
    CALL TITLE(KO,WORDS,TDIST(NN),KX)
```

```
      WRITE (6,66) STKH2
      WRITE (6,67)
      WRITE (6,15) (I,PCT2(I),I=1,8)
      WRITE (6,16)
      DO 73 J=1,41
   73 WRITE (6,70) SPIN(J),(UN200(K,J),PU200(K,J),K=1,8)
      WRITE (6,65)
      CALL TITLE(KO,WORDS,TDIST(NN),KX)
      WRITE (6,66) STKH2
      WRITE (6,71)
      WRITE (6,15) (I,PCT2(I),I=1,8)
      WRITE (6,16)
      DO 74 J=1,41
   74 WRITE (6,70) SPIN(J),(ST200(K,J),PS200(K,J),K=1,8)
      WRITE (6,65)
   32 IF (NOP(3)+NOP(5).EQ.0) GO TO 50
      KX=1
      DO 62 N=1,NDST
      IF(NOP(3).EQ.0) GO TO 39
      IF(NOP(3).GT.2) GO TO 37
      CALL TITLE(KO,WORDS,TDIST(N),KX)
      WRITE (6,33) STKH1
   33 FORMAT (' CALCULATED WHOLE BODY DOSE FOR A RELEASE HEIGHT OF',
     1   F5.0,' FEET')
      WRITE (6,15) (I,PRD1(I),I=1,8)
      WRITE (6,34)
   34 FORMAT ('ODOSE ',7(' EVENTS  PERCT  '),' EVENTS  PERCT')
      DO 35 I=1,21
      DOSIN=FACT(1,N)*NINC(I)
      DO 350 M=1,8
  350 MCT(M)=RDS1(N,M,I)+0.1
   35 WRITE (6,36) DOSIN,(MCT(J),PR1(N,J,I),J=1,8)
      WRITE (6,65)
   65 FORMAT ('+>')
      WRITE (6,81) RMX1(N),MGAM1(N)
   81 FORMAT (' HIGHEST CALCULATED DOSE OF',1PE11.4,' R OCCURRED FROM RE
     1CORD NUMBER',I7)
   36 FORMAT(F7.1,I6,F7.2,7(2X,I7,F7.2))
      WRITE (6,31) CTWBD1
      WRITE (6,26) FACT(1,N)
   37 IF(NOP(3).LT.2) GO TO 39
      WRITE (6,18)
      WRITE (6,43) STKH1
   43 FORMAT ('OCALCULATED THYROID INHALATION DOSE FOR A RELEASE HEIGHT
     1OF'F5.0,' FEET')
      WRITE (6,15) (I,PTD1(I),I=1,8)
      WRITE (6,34)
      DO 56 I=1,21
      DOSIN=FACT(2,N)*NINC(I)
      DO 560 M=1,8
  560 MCT(M)=TDS1(N,M,I)+0.1
   56 WRITE (6,36) DOSIN,(MCT(J),PT1(N,J,I),J=1,8)
      WRITE (6,65)
      WRITE (6,81) TMX1(N),MTHY1(N)
      WRITE (6,31) CTTYD1
      WRITE (6,26) FACT(2,N)
   39 IF(NOP(5).EQ.0) GO TO 44
      IF(NOP(5).GT.2) GO TO 42
      CALL TITLE(KO,WORDS,TDIST(N),KX)
      WRITE (6,18)
      WRITE (6,33) STKH2
      WRITE (6,15) (I,PRD2(I),I=1,8)
      WRITE (6,34)
      DO 41 I=1,41
      DOSIN=FACT(3,N)*NONC(I)
      DO 410 M=1,8
  410 MCT(M)=RDS2(N,M,I)+0.1
   41 WRITE (6,36) DOSIN,(MCT(J),PR2(N,J,I),J=1,8)
      WRITE (6,65)
   49 FORMAT (F6.1,7(F7.0,F7.2,2X),F7.0,F7.2)
      WRITE (6,81) RMX2(N),MGAM2(N)
      WRITE (6,18)
      WRITE (6,31) CTWBD2
      WRITE (6,26) FACT(3,N)
   42 IF(NOP(5).LT.2) GO TO 44
      CALL TITLE(KO,WORDS,TDIST(N),KX)
      WRITE (6,43) STKH2
      WRITE (6,15) (I,PTD2(I),I=1,8)
      WRITE (6,34)
      DO 57 I=1,41
      DOSIN=FACT(4,N)*NONC(I)
      DO 570 M=1,8
  570 MCT(M)=TDS2(N,M,I)+.1
   57 WRITE (6,36) DOSIN,(MCT(J), PT2(N,J,I),J=1,8)
```

```
      WRITE (6,65)
      WRITE (6,81) TMX2(N),MTHY2(N)
      WRITE (6,18)
      WRITE (6,31) CTTYD2
      WRITE (6,26) FACT(4,N)
   26 FORMAT('+',46X,', NORMALIZATION FACTOR =',1PE10.3)
   44 IF(NOP(3).EQ.0) GO TO 48
      CALL TITLE(KO,WORDS,TDIST(N),KX)
      WRITE (6,45) STKH1
   45 FORMAT (' CALCULATED WHOLE BODY AND THYROID INHALATION DOSE FOR AL
     1L SECTORS,',F5.0,' FOOT RELEASE HEIGHT')
      WRITE (6,46)
   46 FORMAT('0',14X,'WHOLE BODY DOSE',31X,'THYROID INHALATION DOSE')
      WRITE (6,47)
   47 FORMAT ('0',5X,'DOSE',8X,'EVENTS',3X,'PERCENT',4X,'ACC. PCT',8X,
     1       'DOSE',8X,'EVENTS',3X,'PERCENT',4X,'ACC. PCT')
      PG=0.
      PT=0.
      DO 59 I=1,21
      DOSIN=FACT(1,N)*NINC(I)
      DOSIM=FACT(2,N)*NINC(I)
      PG=PG+XRD1(N,I)
      PT=PT+XTY1(N,I)
   59 WRITE (6,55) DOSIN,NRD1(N,I),XRD1(N,I),PG,DOSIM,NTY1(N,I),XTY1
     1       (N,I),PT
      WRITE (6,60)
   60 FORMAT('+',3X,'>',47X,'>')
      WRITE (6,18)
      WRITE (6,31) CTWBD1
      WRITE (6,27) FACT(1,N),FACT(2,N)
   48 IF(NOP(5).EQ.0) GO TO 62
      CALL TITLE(KO,WORDS,TDIST(N),KX)
      WRITE (6,45) STKH2
      WRITE (6,80)
   80 FORMAT ('0',14X,'WHOLE BODY DOSE',31X,'THYROID INHALATION DOSE')
      WRITE (6,47)
      PG=0.
      PT=0.
      DO 61 I=1,41
      DOSIN=FACT(3,N)*NONC(I)
      DOSIM=FACT(4,N)*NONC(I)
      PG=PG+XRD2(N,I)
      PT=PT+XTY2(N,I)
   61 WRITE (6,55) DOSIN,NRD2(N,I),XRD2(N,I),PG,DOSIM,NTY2(N,I),XTY2
     1       (N,I),PT
   25 FORMAT(2(F11.1,I13,F10.2,F10.2))
      WRITE (6,60)
      WRITE (6,18)
      WRITE (6,31) CTWBD2
      WRITE (6,27) FACT(3,N),FACT(4,N)
   27 FORMAT('+',46X,', NORMALIZATION FACTOR (WBD) =',F5.2,' ,(THY) =',
     1 F5.2)
   62 CONTINUE
   50 IF(NOP(7).NE.0) GO TO 52
   53 WRITE (6,18)
      WRITE (6,51)
   51 FORMAT ('0 END OF OUTPUT DATA')
   55 FORMAT(2(F11.2,I13,F10.2,F11.2,3X))
      RETURN
   52 IF(KU.EQ.2) GO TO 53
   38 FORMAT ('+',73X,' DOSE X 10')
      RETURN
      END
```

```
LER OPTIONS - NAME=  MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

      SUBROUTINE TITLE(KC,WORDS,DIST,KX)
      DIMENSION  WORDS(20)
      TDIST=DIST/1000.
      IF(KO.EQ.2) GO TO 4
      IF(KX.GT.0) GO TO 3
      WRITE (6,1)  (WORDS(I),I=1,20)
      GO TO 5
    3 WRITE (6,6) TDIST,(WORDS(I),I=1,20)
      GO TO 5
    4 IF(KX.GT.0) GO TO 7
      WRITE (6,2) (WORDS(I),I=1,20)
      GO TO 5
    7 WRITE (6,8) TDIST,(WORDS(I),I=1,20)
    1 FORMAT ('1',20A4,5X,'PROCESSED RESULTS FROM NEW DATA ONLY',/)
    2 FORMAT ('1',20A4,5X,'CONSOLIDATED DATA FROM NEW AND PREVIOUS RUN',
     1 /)
    6 FORMAT('1',F5.2,' KM, ',20A4,3X,'PROCESSED RESULTS FROM NEW DATA',
     1       /)
    8 FORMAT('1',F5.2,' KM, ',20A4,3X,'CONSOLIDATION OF OLD AND NEW DATA
     1       ',/)
    5 RETURN
      END
```

```
COMPILER OPTIONS - NAME=  MAIN,OPT=00,LINECNT=50,SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,ID

      BLOCK DATA                                                        01
      COMMON/SOURCE/A,B,C,D
      REAL A(63)/             .114716E19,.192930E19,.235217E19,.261375E19,
     1.279328E19,.292557E19,.302795E19,.311003E19,.317757E19,.323428E19,
     2.328268E19,.332452E19,.336108E19,.339334E19,.342203E19,.344771E19,
     3.347085E19,.349181E19,.351089E19,.352834E19,.354435E19,.355910E19,
     4.357273E19,.358538E19,.359713E19,.360808E19,.361832E19,.362791E19,
     5.363691E19,.364537E19,.359713E19,.368111E19,.373054E19,.376312E19,
     6.378623E19,.380347E19,.381682E19,.382747E19,.383616E19,.384339E19,
     7.384950E19,.385473E19,.385925E19,.386321E19,.386669E19,.386979E19,
     8.387256E19,.387505E19,.387730E19,.387935E19,.388121E19,.388292E19,
     9.388450E19,.388595E19,.388729E19,.388854E19,.388970E19,.389078E19,
     1.389180E19,.389275E19,.389364E19,.389448E19,.389527E19/
      REAL B(63)/             .260428E18,.540370E18,.857644E18,.114716E19,
     1.139475E19,.160340E19,.177954E19,.192930E19,.205780E19,.216911E19,
     2.226640E19,.235217E19,.242838E19,.249659E19,.255805E19,.261375E19,
     3.266451E19,.271100E19,.275377E19,.279328E19,.282991E19,.286399E19,
     4.289580E19,.292557E19,.295350E19,.297978E19,.300455E19,.302795E19,
     5.305010E19,.307111E19,.295350E19,.316182E19,.329369E19,.338564E19,
     6.345372E19,.350629E19,.354815E19,.358230E19,.361071E19,.363471E19,
     7.365527E19,.367307E19,.368864E19,.370238E19,.371458E19,.372550E19,
     8.373533E19,.374421E19,.375229E19,.375967E19,.376643E19,.377266E19,
     9.377840E19,.378371E19,.378865E19,.379325E19,.379754E19,.380155E19,
     1.380532E19,.38C885E19,.381218E19,.381532E19,.381828E19/
      REAL C(63)/             .175421E18,.304752E18,.471265E18,.658560E18,
     1.846194E18,.102350E19,.118650E19,.133454E19,.146833E19,.158915E19,
     2.169838E19,.179737E19,.188735E19,.196939E19,.204444E19,.211333E19,
     3.217676E19,.223536E19,.228965E19,.234011E19,.238712E19,.243104E19,
     4.247217E19,.251079E19,.254713E19,.258138E19,.261375E19,.264438E19,
     5.267342E19,.270101E19,.254713E19,.282067E19,.299645E19,.312084E19,
     6.321436E19,.328762E19,.334675E19,.339558E19,.343664E19,.347167E19,
     7.350193E19,.352834E19,.355160E19,.357225E19,.359070E19,.360730E19,
     8.362230E19,.363594E19,.364838E19,.365978E19,.367027E19,.367995E19,
     9.368891E19,.369723E19,.370498E19,.371221E19,.371897E19,.372531E19,
     1.373126E19,.373687E19,.374215E19,.374714E19,.375186E19/
      REAL D(63)/             .969666E17,.139960E18,.176839E18,.216812E18,
     1.260428E18,.308473E18,.361163E18,.417997E18,.478068E18,.540370E18,
     2.603966E18,.668060E18,.732013E18,.795331E18,.857644E18,.918681E18,
     3.978254E18,.103624E19,.109255E19,.114716E19,.120005E19,.125122E19,
     4.130071E19,.134854E19,.139475E19,.143940E19,.148254E19,.152422E19,
     5.156449E19,.160340E19,.139475E19,.177954E19,.205780E19,.226640E19,
     6.242838E19,.255805E19,.266451E19,.275377E19,.282991E19,.289580E19,
     7.295350E19,.300455E19,.305010E19,.309105E19,.312811E19,.316182E19,
     8.319265E19,.322097E19,.324708E19,.327125E19,.329369E19,.331459E19,
     9.333411E19,.335238E19,.336952E19,.338564E19,.340082E19,.341516E19,
     1.342871E19,.344155E19,.345372E19,.346528E19,.347628E19/           24
      END
```

APPENDIX F

MARE - A COMPUTER PROGRAM TO ESTIMATE SECTOR-AVERAGED WHOLE BODY GAMMA MAN-REM EXPOSURE

CODE DESCRIPTION

MARE is a FORTRAN IV code that estimates the product of population and whole body gamma dose (man-rem) assuming the released radioactivity is confined within a specified dispersion angle or sector. Distribution of the radioactive material within this confined angle is assumed to be homogeneous in the horizontal direction and Gaussian in the vertical direction with the center of the Gaussian distribution at the material release height. Each sector is subdivided into areas of constant radial width, and the calculated dose at the center of this area is assumed to apply over the entire area. The population within this area is then used to compute the man-rem product for each area. This product is also accumulated for each radial increment to estimate the cumulative man-rem exposure as a function of distance from the release point.

All calculations are based on an instantaneous release model which yields total dose; or if a release rate is used as input, dose per unit time is calculated.

ANALYTICAL DESCRIPTION

The mathematical model employed was developed by L. M. Arnett and is analogous to the derivations reported in Reference 7 and employed in RADOS.[8] Integrations are performed in three parts. Referring to Figure F-1, the first integration, I_1, is over the circle of radius ρ, where ρ is one-half the sector width for a given downwind distance. The second integration, I_2, includes the contribution above $z = 0$ and between the circle of radius ρ and the upper limit of integration. The third integration, I_3, is the same for the area below $z = 0$ and accounts for ground-level reflection. The upper limits of integration are computed within the code to account for all significant portions of the radioactive cloud.

Define the dimensionless parameters α, β, and γ such that:

$$\alpha = \frac{h}{\sigma_z}, \quad \beta = \frac{\rho}{h}, \text{ and } \gamma = \frac{a}{\rho}$$

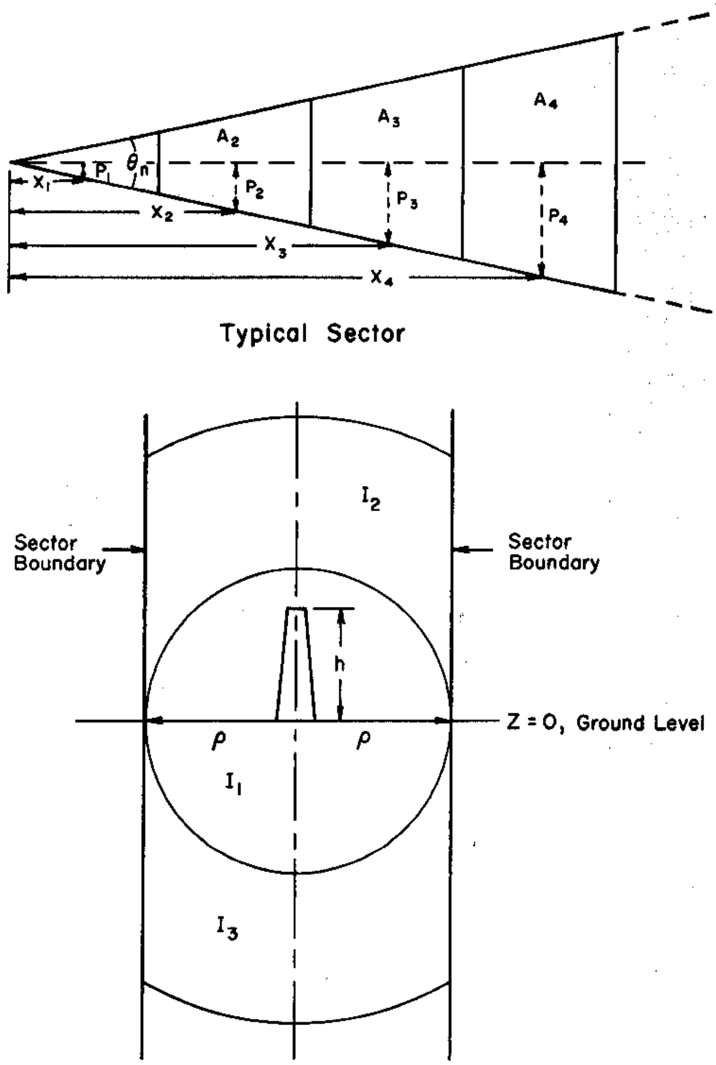

FIG. F-1 GEOMETRY FOR SECTOR AVERAGING PROCEDURE where h = release height, cm

σ_z = vertical dispersion coefficient, cm

a = distance from receptor to the volume element making a dose contribution, cm

$$I_1 = \int_0^1 \int_0^{\pi} G(\gamma)F(\theta)d\gamma d\theta$$

$$I_2 = \int_1^{\infty} \int_0^{\csc^{-1}\gamma} G(\gamma)F(\theta)d\gamma d\theta$$

$$I_3 = \int_1^{\infty} \int_{\pi-\csc^{-1}\gamma}^{\pi} G(\gamma)F(\theta)d\gamma d\theta$$

$$G(\gamma) = \frac{2}{\pi} \left\{ K_{i1}(\mu\rho\gamma) + \mu\rho\gamma K_0(\mu\rho\gamma) + \frac{(\mu\rho\gamma)^2}{7E^{2.4}} K_1(\mu\rho\gamma) \right\}$$

$$F(\theta) = \frac{\alpha\beta}{\sqrt{2\pi}} \exp \left\{ -\frac{1}{2} \alpha^2 (\gamma\beta\cos\theta - 1)^2 \right\}$$

where μ = linear attenuation coefficient of gamma, cm^{-1}

E = gamma energy, Mev

K = Bessel functions

$$\text{Dose} = \frac{\alpha\beta\nu}{(2\pi)^{3/2}\ \overline{U}\rho} (I_1 + I_2 + I_3) \sum_{i=1}^{n} S_i \exp\left(\frac{-\lambda_i X}{\overline{U}}\right)$$

where $\overline{U}$ = wind speed, cm

X = downwind distance, cm

S = source for isotope i, Mev/sec

λ = decay constant for isotope i, sec^{-1}

ν = dose conversion factor, $\frac{r}{sec} \Big/ \frac{Mev}{(cm^2)(sec)}$

For large values of ρ the second and third integrations will become insignificant compared to the first and are therefore not computed for $\rho > 1$ km.

$G(\gamma)$ is derived from an analytical fit for buildup factors in air and is valid only for $0.5 \leqslant E \leqslant 2$.

INPUT PREPARATION

Computer input requirements are arranged to allow parametric surveys with minimum preparation if the isotopic inventory and population input are held constant. Input is prepared as follows:

Card Type 1 (20A4)

Alphanumeric problem identification

Card Type 2 (3E12.6)

a) Number of gamma energy groups, $1 \leqslant G \leqslant 4$

b) Number of isotopes, $1 \leqslant I \leqslant 20$

c) Number of downwind distances, $1 \leqslant D \leqslant 30$

Card Type 3 (I3)

Number of sectors for which population numbers are provided $1 \leqslant S \leqslant 24$

Card Type 4 (13F6.0)

Population by sector for each area within the sector, beginning at the release point. 30 entries per sect maximum.

Card Type 5 (6E12.6)

Constants for gamma energy groups

a) ν_1, dose conversion factor, group 1

b) μ_1, linear attenuation coefficient of air for group 1, cm^{-1}

c) E_1, gamma energy in Mev

There may be up to four groups, two sets of constants per card.

Card Type 6 (6E12.6)

Isotope parameters, one set per card, up to 20 cards

a) S_p, parent source, Mev/sec

b) λ_p, parent decay constant, sec^{-1}

c) E_p, parent gamma energy, Mev

d) S_d, daughter source, Mev/sec

e) λ_d, daughter decay constant, sec^{-1}

f) E_d, daughter gamma energy, Mev

Card Type 7 (6E12.6)

Downwind distances at which doses are estimated. These entries must correspond in sequence to the entries on Card Type 4.

Card Type 8 (20A4)

Alphanumeric information to correspond to each set of parameters entered on Card Type 9. This will be used as output data to describe each set of output.

Card Type 9

Parametric entries, one set per card

a) h, activity release height, cm

b) C, stability classification. Enter zero for unstable and 1 for stable. Unstable is defined as a negative or zero dt/dz and stable as positive dt/dz.

c) σ_e, vertical atmospheric dispersion angle, degrees

d) $\overline{u}$, wind speed, cm/sec

e) A, sector angle, degrees

Card Types 8 and 9 may be repeated as many times as desired to perform parametric surveys of variables on Card Type 9.

Consecutive problems may be processed by separating each problem deck with a blank card.

OUTPUT

Input data are printed out for checking and identification purposes. A complete output for all sectors is printed for each set of parametric entries on Card Types 8 and 9. All output data are suitably identified and should be self-explanatory.

The FORTRAN listing of the main program is included, and the required Bessel function subroutines are listed in Reference 8.

```
C      PROGRAM MARE
C
C   A PROGRAM TO COMPUTE DOSE INTEGRALS ASSUMING HOMOGENEOUS HORIZONTAL
C   DISPERSION WITHIN A GIVEN DISPERSION ANGLE AND GAUSSIAN DISPERSION IN
C   THE VERTICAL DIRECTION
C
      DIMENSION SUM1(4),SUM2(4),SUM3(4),GCD1(6),G(6),GAB1(6),GAB2(6),
     1DIST(30),WORDS(20),GNU(4),GMU(4),EN(4),P(20),PL(20),DEP(20),D(20),
     2DL(20),DED(20),H(6),ANG(6),DN1(6),SUMGP(4),SP(20,30),SD(20,30)
      DIMENSION BQ(6),DOSE(30),PUPR(24,30),ACR(24,30)
      DIMENSION DISM(30),TITLE(20)
      REAL*4 PUP(24,30)/720*0.0/
C
      FTHETA(GAM,BETA,THET,ALPH2)=(EXP(-.5*ALPH2*(GAM*BETA* COS(THET)-1.
     1          )**2))
      FGAMMA(B,BSQ,EN)=(2.*BEK13(B)/(BSQ+1.)+(B-B/(BSQ+1.))*BK0(B)+((BSQ
     1       )/(BSQ+1.)+BSQ/(7.*EN**2.4))*BK1(B))
      NK=1
      PI=3.141593
      G(1)=.3376524E-1
      G(2)=.1693953
      G(3)=.3806904
      G(4)=.6193096
      G(5)=.8306047
      G(6)=.9662348
      H(1)=.8566225E-1
      H(2)=.1803808
      H(3)=.233957
      H(4)=H(3)
      H(5)=H(2)
      H(6)=H(1)
      CALL EFTM(64)
      CALL SETBTF
C
      A1=0.
      C1=0.
      D1=PI
      A2=1.
C  LOWER INNER LIMIT, SECOND SET
      C2=0.
      D3=PI
C
C  COMPUTED GAUSSIAN INCREMENTS FOR OUTER INTEGRALS AND FIRST SET INNER
C
      DO 20 I=1,6
   20 GCD1(I)=G(I)*PI
    1 READ (5,210) (WORDS(I),I=1,20)
      READ (5,220) GP,SI,DISS
      NG=GP+0.1
      IS=SI+0.1
      NDIST=DISS+0.1
      READ (5,400) NSEC
      MSEC=NSEC/3
      MSEC=3*MSEC
      IF(MSEC.LT.NSEC) MSEC=MSEC+3
      DO 410 I=1,NSEC
  410 READ (5,420) (PUP(I,K),K=1,NDIST)
      READ (5,220) (GNU(I),GMU(I),EN(I),I=1,NG)
      READ (5,220) (P(I),PL(I),DEP(I),D(I),DL(I),DED(I),I=1,IS)
      READ (5,220) (DIST(I),I=1,NDIST)
      WRITE (6,230) (WORDS(I),I=1,20)
      WRITE (6,240)
      WRITE (6,260)
      DO 2 I=1,IS
```

```
    2 WRITE (6,250) I,P(I),PL(I),DEP(I),D(I),DL(I),DED(I)
      WRITE (6,240)
      WRITE (6,270)
      DO 3 I=1,NG
    3 WRITE (6,280) I,GNU(I),GMU(I),EN(I)
      WRITE (6,240)
    4 READ (5,210) (TITLE(I),I=1,20)
      READ (5,220) STKHT,STAB,SIGE,UBAR,DANG
      IF(STKHT.EQ.0) GO TO 1
      DO 5 K=1,NDIST
      DISM(K)=DIST(K)/100.
    8 TIME=DIST(K)/UBAR
      DO 5 I=1,IS
      NDP=DEP(I)+0.1
      NDD=DED(I)+0.1
      PLT=EXP(-PL(I)*TIME)
      DLT=EXP(-DL(I)*TIME)
      SP(I,K)=P(I)*PLT
    5 SD(I,K)=D(I)*DLT+(P(I)*(EN(NDD)*DL(I)/(EN(NDP)*(DL(I)-PL(I))))
     1       *(PLT-DLT))
C
      DEG=PI*DANG/360.
C CONVERSION, DEGREES TO RADIANS FOR INPUT DISPERSION ANGLE, DANG
C
      DO 120 K=1,NDIST
      IF(STAB.EQ.0) GO TO 7
      SIGZ=(SIGE*0.15*(DIST(K)/100.)**0.71)*20.
      VERT=.2*SIGE
      GO TO 9
    7 SIGZ=(SIGE*.045*(DIST(K)/100.)**0.86)*10.
      VERT=.7*SIGE
    9 ALPH=STKHT/SIGZ
      ALPH2=ALPH*ALPH
      CONS=SQRT(2.)*ALPH/PI**1.5
      XO=2.*DIST(K)*SIN(DEG)/COS(DEG)
      BETA=XO/(2.*STKHT)
      CON=CONS*BETA
      CONV=1./(2.*UBAR*XO)
      UPLIM=2.E5/XO
      B1=1.
      IF(UPLIM.LE.1.) B1=UPLIM
      DO 100 N=1,NG
      SUM1(N)=0.
      SUM2(N)=0.
      SUM3(N)=0.
      DO 40 I=1,6
      SUM=0.
      GAB1(I)=G(I)*B1
      GAM=GAB1(I)
      BARG=GMU(N)*GAM*XO/2.
      BASQ=BARG*BARG
      IF(BARG.GT.174.) GO TO 40
      DINT1=FGAMMA(BARG,BASQ,EN(N))
      DO 30 J=1,6
      THET=GCD1(J)
      DINT2=FTHETA(GAM,BETA,   THET,ALPH2)
   30 SUM=SUM+DINT2*H(J)
      SUM1(N)=SUM1(N)+SUM*DINT1*H(I)
   40 CONTINUE
      SUM1(N)=SUM1(N)*PI*CON*B1
C     INTEGRAL FOR FIRST SET OF EQUATIONS HAS BEEN COMPUTED
C
      IF(UPLIM.LE.1.) GO TO 100
      DO 10 I=1,6
   10 GAB2(I)=G(I)*(UPLIM-1.)+1.
      DO 60 I=1,6
      SUM=0.
      GAM=GAB2(I)
      ANG(I)=1./(SQRT(GAM**2.-1.))
      ANG(I)=ATAN(ANG(I))
      BARG=GMU(N)*GAM*XO/2.
      BASQ=BARG*BARG
      BQ(I)=BARG
      IF(BARG.GT.174.) GO TO 60
      DN1(I)=FGAMMA(BARG,BASQ,EN(N))*H(I)
      DO 50 J=1,6
      THET=G(J)*ANG(I)
      DN2=FTHETA(GAM,BETA,   THET,ALPH2)*H(J)
   50 SUM=SUM+DN2
      SUM2(N)=SUM2(N)+SUM*DN1(I)*ANG(I)
   60 CONTINUE
      SUM2(N)=SUM2(N)*(UPLIM-1.)*CON
```

```
C       INTEGRAL FOR SECOND SET OF EQUATIONS HAS BEEN COMPUTED
C
        DO 80 I=1,6
        SUM=0.
        IF(BQ(I).GT.174.) GO TO 80
        GAM=GAB2(I)
        DO 70 J=1,6
        THET=G(J)*ANG(I)+PI
        DN2=FTHETA(GAM,BETA,    THET,ALPH2)*H(J)
   70   SUM=SUM+DN2
        SUM3(N)=SUM3(N)+SUM*DN1(I)*ANG(I)
   80   CONTINUE
        SUM3(N)=SUM3(N)*(UPLIM-1.)*CON
C       ALL INTEGRALS HAVE BEEN COMPUTED
  100   SUMGP(N)=SUM1(N)+SUM2(N)+SUM3(N)
        DOSE(K)=0
        DO 110 I=1,IS
        NDP=DEP(I)+0.1
        NDD=DED(I)+0.1
        DOSP=SP(I,K)*GNU(NDP)*SUMGP(NDP)
        DOSD=SD(I,K)*GNU(NDD)*SUMGP(NDD)
  110   DOSE(K)=DOSE(K)+DOSP+DOSD
        DOSE(K)=DOSE(K)*CONV
        IF(K.EQ.1) WRITE (6,290)(TITLE(I),I=1,20)
        WRITE(6,310) NK,VERT,STKHT,UBAR,XO,SIGZ,SUM1(1),SUM2(1),SUM3(1
     1          ),SUMGP(1),DIST(K),DOSE(K)
        IF(NG.EQ.1) GO TO 120
        WRITE (6,320) (N,SUM1(N),SUM2(N),SUM3(N),SUMGP(N),N=2,NG)
  120   CONTINUE
        DO 500 I=1,MSEC
        DO 500 K=1,NDIST
        POPR(I,K)=0.
  500   ACR(I,K)=0.
        DO 510 I=1,NSEC
        L=1
        DO 510 K=1,NDIST
        POPR(I,K)=POP(I,K)*DOSE(K)
        IF(K.GT.1) L=K-1
  510   ACR(I,K)=ACR(I,L)+POPR(I,K)
        NS=1
  520   NE=NS+2
        K2=NS+1
        WRITE(6,230) (WORDS(I),I=1,20)
        WRITE (6,240)
        WRITE(6,600) NS,K2,NE
        DO 530 K=1,NDIST
  530   WRITE(6,610) K,DISM(K),DOSE(K),POP(NS,K),POPR(NS,K),ACR(NS,K),POP(
     1  K2,K),POPR(K2,K),ACR(K2,K),POP(NE,K),POPR(NE,K),ACR(NE,K)
        NS=NE+1
        IF(NS.LE.NSEC) GO TO 520
        GO TO 4
  210   FORMAT (20A4)
  220   FORMAT (6E12.6)
  230   FORMAT ('1',20A4)
  240   FORMAT (//)
  250   FORMAT (12X,I3,3X,6(1PE14.6,2X))
  260   FORMAT (1X,'RELEASE INVENTORY',2X,'PARENT,MEV/S',3X,'DECAY CONST,/
     1S',3X,'ENERGY GROUP',3X,'DAUGHTER,MEV/S',2X,'DECAY CONST,/S',3X,
     2'ENERGY GROUP',/)
  270   FORMAT (1X,'ENERGY GROUP CONSTANTS',3X,'DOSE CONV',6X,'ATTEN COEFF
     1',6X,'ENERGY,MEV/S',/)
  280   FORMAT (18X,I3,3X,3(1PE14.6))
  290   FORMAT ('1',20A4,/,
     1 6X,'VERT',7X,'STACK',8X,'WIND',31X,'FIRST',6X,'SECOND',7X,
     1'THIRD',6X,'INTEGRAL      DISTANCE          DOSE',/,
     2' GRP  DEG        HEIGHT          SPEED          WIDTH       SIGMA Z',4X,
     3'INTEGRAL     INTEGRAL      INTEGRAL         SUM')
  310   FORMAT (/,I3,F8.2,1X,10(1PE12.3))
  320   FORMAT    (I3,57X,1PE12.3,E12.3,E12.3,E12.3)
  400   FORMAT (20I3)
  420   FORMAT (13F6.0)
  600   FORMAT (35X,'SECTOR',I3,23X,'SECTOR',I3,23X,'SECTOR',I3,/,
     1   6X,'DISTANCE',5X,'POINT',/,7X,'METERS',6X,'DOSE,R',
     2 3(3X,'POPULATION  MAN-REM     ACCUM.'),/)
  610   FORMAT (I4,2(1PE11.3),3(2X,E10.3,E10.3,E10.3))
        END
```