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A REVISED OUTPUT PROCESSOR MODULE FOR THE DELFIC FALLOUT PREDICTION SYSTEM

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13. ABSTRACT

The revised Output Processor Module of the DELFIC (Defense Land Fallout Interpretative Code) fallout prediction system is described and instructions are given for its use. Working in close liaison with the Particle Activity Module (DASA-1800-V), the Output Processor converts the output of the Diffusive Transport Module into a variety of displays in a directly contourable printed numerical (map) form. The user may request any number of processing tasks to be carried out. In each request any of sixteen types of processing may be specified leading to the display of maps of any of the following quantities: (1) exposure rate "normalized" to H + 1 hour; (2) exposure rate at time H + T1 hours; (3) integrated exposure, H + T1 to infinity, accounting for time of arrival; (4) integrated exposure, H + T1 to H + T2, accounting for time of arrival; (5) fallout mass per unit area (6) fallout mass per unit area deposited between times H + T1 and H + T2; (7) integrated exposure, H + T1 to H + T2, assuming all particles have arrived by H + T1 hours; (8) same as 7 but integrated to infinity; (9) concentration of an individual mass chain (curies/m^2); (10) time of onset; (11) time of cessation; (12) smallest particle deposited; (13) largest particle deposited; (14) mass per unit area deposited by particles in the size range S1 to S2; (15) H + 1 hour "normalized" exposure rate resulting from particles in the size range S1 to S2; and (16) the number of fallout deposit increment affecting each map grid point. The user is free to specify any limiting coordinates and scale factors for maps.

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PREFACE

The DELFIC (Defense Land Fallout Interpretative Code) Output Processor Module has been updated and revised to process data supplied by the new Diffusive Transport Module (DASA 2669 and its supplement). This document describes the revised Output Processor Module code; it replaces DASA-1800-VI.

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1. INTRODUCTION

This document is intended to fulfill two needs: (1) to provide information to the person who is interested in understanding the Output Processor only in sufficient detail to make use of it, and (2) to provide a detailed explanation of the Output Processor to the researcher or programmer who would make modifications or additions. The sections entitled "Program Description" and "User Information" are intended to fulfill the first need; the sections "Program Details" and "FORTRAN Listings," the second need.

The original DELFIC Output Processor Module, as described in DASA-1800-VI[1], is designed to process grounded fallout parcels that are output by the DELFIC Transport Module[2]. These parcels are nuclear cloud subdivisions in the form of square wafers. In the horizontal plane, they possess discrete boundaries; their particulate content is uniformly distributed between these boundaries. The new Diffusive Transport Module[3] yields radically different descriptions of grounded fallout. Grounded fallout parcels produced by the Diffusive Transport Module are called deposit increments. Each deposit increment is distributed in the ground plane via a bivariate Gaussian function. The processing requirements for the deposit increments are sufficiently different from those for the square wafers that most of the old code is obsolete. Therefore, with the exception of a few important subroutines, the entire code has been rewritten.

This document is prepared in the format of its predecessor, and many parts of both are similar. User requirements and printed output are maintained, where possible, in their original form. The intended applications of the DELFIC code, which are to provide a numerical research tool and to serve as a fallout prediction standard, are unchanged.

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2. PROGRAM DESCRIPTION

2.1 The Purpose and Function of the Output Processor

In simplest terms, it is the task of the Output Processor to accept descriptions of grounded fallout, process the deposit increment data, make requests for particle activities or mass chain concentrations from the Particle Activity Module[6] when required, accumulate the results into a two-dimensional memory array or map image, and then print the resulting array in a form suitable for viewing as a map.

The code provides the following functional capabilities

1. Great flexibility in program use is provided in terms of the variety of computations that are available (see Table 4).
2. The Output Processor is capable of handling a large, essentially unlimited, set of deposit increment data. Since this set can exceed high speed access memory capacity, an open-ended philosophy is adopted for its treatment by use of peripheral storage capacity
3. The area coverage, in terms of location, range, and scale of the map, is under the direct control of the researcher. This gives the user the ability to produce maps for superposition on other preexisting maps, and it enables him to achieve either a microscopic or a macroscopic view of the predicted fallout field.
4. The Output Processor is capable of handling output maps that contain a larger number of map grid points than can be stored in the computer memory at one time. Thus, the code has open-ended capability with regard to map size.
5. In computing radiation exposure rates at arbitrarily specified times, it is deemed of great importance to avoid reliance on a single time decay function (such as $t^{-1.2}$), which is applicable only to a mixture of unfractionated fission products — not in general to isolated samples of fallout such as those that appear locally in fallout fields. Therefore, the Output Processor

Module is built to work in close liaison with the Particle Activity Module[4] so that activities can be computed directly from the primary mass chain data for particles at the particular time or times specified in each output request. Furthermore, and as a consequence of this approach, the user can request computation and display of concentrations of any particular mass chain.

6. With regard to display of the fallout map data produced by the Output Processor we are faced with somewhat conflicting requirements: (1) we desire a numerical display of the data rather than some sort of purely pictorial or graphical display because of the intended research and comparison standard applications of the system, whereas (2) an automated pictorial or graphical display relieves the user of the time consuming and tedious task of coping with numerical tabulations and hand contouring. The display actually provided is a compromise. A numerical display is provided; however, it is in a format that allows strips of the printed computer output to be attached side by side so that the entire fallout prediction area is included on the assembled paper. Thus, the output tabulation consists of the requested output data printed on each of the points of a spatially undistorted grid. The assembled map can be easily contoured directly on the printer output paper. The major disadvantage of this type of display is that sometimes the map assemblies are quite large.

7. The Output Processor is simple to use and is reasonably foolproof and automatic with respect to its internal operations. Since the sizes of input and output data sets can vary widely, the code contains a certain amount of essentially "dimension free" programming.

2.2 Inputs to the Output Processor

The primary input to the Output Processor is the tape of deposit increment descriptions that is prepared by the Diffusive Transport Module (see Table 5). In addition to the deposit increment descriptions, this tape contains Hollerith identifiers for the preceding DELFIC module runs, and a collection of critical data such as explosion yield, ground zero coordinates, height of burst, a fall-out particle size class table, etc. The data set for each deposit increment consists of (see Table 1): impact coordinates of its center of mass, its impact time, its particle diameter (each deposit increment is composed of monodisperse particles), total mass of particles in it, and the parameters needed by the bivariate Gaussian function to distribute it in the ground plane.

In addition to the tape input, the user must communicate to the program via card input his wishes regarding types of output computations and map specifications. He must provide run identifications. And he must supply printer characteristics data that are necessary for production of undistorted maps. The run identifier is an arbitrary 72-character Hollerith statement which the user can set to identify and associate outputs and inputs. The printer characteristics data are the number of characters per inch printed by the off-line printer in the cross-page and down-page directions. Map specifications are the geographical limits of the map, the distances of separations between map points, and choice of format for printing individual map point ordinate values. The data displayed in the map are for one of of the options listed in Table 4 and discussed below.

2.3 Computation and Display Options

The following is a listing and brief discussion of the major options for computation and display. An exhaustive list of all currently available options is provided in the "User Information" chapter. (See Table 4.)

1. Printed descriptions of impacted particles

Under this option the contents of the deposit increment tape (IPOUT) are printed. This option is valuable in checking the execution of experimental transport codes, and it is also useful in providing a hard and readable copy of the stored results of transport production runs.

2. Computation options

The descriptions below apply to each ordinate value of a map.

a. Count of contributing deposit increments. This can be of value to the user in assessing the statistical significance of computed quantities at all points on the map.

b. Exposure rate "normalized" to time H + 1 hour*. This is the option that is most commonly used for comparing fallout patterns. It should be noted that differences may exist between DELFIC H + 1 hour normalizations and those resulting directly, or indirectly, from backward extrapolations of field data. In backward extrapolations a single decay constant is usually used through the map area, whereas DELFIC provides a more rigorous modeling of radioactive decay.

c. Exposure rate at time H + T1. This is the exposure rate at H + T1 taking into account the impact times of all deposit increments.

d. Exposure accumulated from H + T1 to infinity. This is the exposure as integrated from time H + T1 or particle impact time, whichever is later.

---

* A computation of radiation exposure or other quantity that is "normalized" to time T assumes that deposition is complete throughout the map area at time T. Thus if T is small, the normalized values may be larger than actually could be observed at that time.

e. Exposure accumulated from time H + T1 to time H + T2. This is the exposure as integrated from time H + T1 or deposit increment impact time (whichever is later) to time H + T2. A faster alternative treatment of accumulated exposure not accounting for deposit increment impact time is also provided.

f. Total fallout mass per unit area of deposition plane. This is the mass of fallout, both radioactive and inert, deposited on the map grid points during the entire fallout period.

g. Fallout mass per unit area deposited between times T1 and T2. This is the fallout mass, both active and inert, deposited during the specified interval.

h. Activity produced by a user specified mass chain (curies/m^2).

3. Preparation of undistorted maps

The Output Processor produces a numerical presentation of fallout data on a spatially undistorted grid. The user must supply map grid spacing values for both directions, and he must supply the printer characteristics (characters/inch both cross-page and down-page). The program automatically adjusts one of the grid spacings just enough to accommodate the printer characteristics so that spatial distortion is avoided. A map produced by the Output Processor consists of a sequence of numbered "strips" of computer printer paper which can be assembled side-by-side into a single map of the overall area covered. When so assembled the data point with minimum x and minimum y coordinates will be found in the lower left-hand corner of the map (i.e. the lower left-hand corner of strip number one). The coordinates of this point will be (XMIN + DGX, YMIN + DGY). This point need not be either the origin of coordinates or ground zero.

4. Numerical display formats

Two options exist at this time for printing ordinate values at the map grid points. These options, which we designate as the two-line E format and the two-line F 11.3 format, are explained and illustrated as follows for a single map ordinate:

a. The two-line E format,

NNNNNN
± V.VVV,

which is to be interpreted as

± V.VVV x 10^{NNNNNN}

b. The two-line F 11.3 format

NNNNNN
± V.VVV,

which is to be interpreted as

± NNNNNNV.VVV.

2.4 Deposit Increment Processing

The Output Processor prepares all maps with their grid points aligned in the west-east and south-north directions. The map x coordinate direction is positive toward the east, and the y direction is positive toward the north. The z coordinate direction is positive upward. Each deposit increment is defined by the data listed in Table 1.

The standard deviations, $\sigma_{\parallel}$, $\sigma_{\perp}$, and angle, α, are calculated by the Diffusive Transport Module (DTM), they are unique for each fallout parcel(3). $\sigma_{\parallel}^2$ is the variance of the Gaussian distributed deposit increment in the average downwind direction. It is the sum of the initial value input from the Cloud Rise-Transport Interface Module(5) and the downwind component of the turbulent dispersion variance that is computed for the parcel trajectory. $\sigma_{\perp}^2$ is the corresponding crosswind variance. The angle α is the angle between the positive x axis and the average downwind direction axis. The averaging is a space-weighted averaging computed along the trajectory.

TABLE 1

DEPOSIT INCREMENT DESCRIPTION PARAMETERS

Mathematical symbols	FORTRAN Mnemonics	Parameter Definition
x_p, y_p, z_p	X(I), Y(I), ZOUT(I)	space coordinates of the center of mass (meters)*
t_p	T(I)	time of deposit (seconds)
$\sigma_{\parallel}$, $\sigma_{\perp}$	SXOT(I), SYOT(I)	Gaussian distribution standard deviations in the (horizontal) downwind and crosswind directions (meters)*
α	ROUT(I)	angle between the downwind direction axis and the positive x axis (radians)*
D	PS(I)	fallout particle diameter (micrometers)
M	FMAS(I)	mass of fallout (kilograms)

* See text for a more complete definition.

The vertical coordinate of a deposit increment, z_p, usually is the same as that of the deposition plane. However, for fallout parcels that are advected through one of the vertical wind-field boundaries, or that are not impacted when the transport time boundary is reached, the DTM records the z_p at the level of boundary penetration. The output processor code rejects any deposit increment whose z_p is ten meters or greater above the deposition plane.

Consider a deposit increment with total mass or activity content Q. Then at a point x,y, the areal density of mass or activity q(x,y), is

$$q(x,y) = \frac{Q}{2\pi\sigma_{\parallel}\,\sigma_{\perp}} \exp\left[-\frac{\left(X-X_p\right)^2}{2\sigma_{\parallel}^2} - \frac{\left(Y-Y_p\right)^2}{2\sigma_{\perp}^2}\right] \qquad (1)$$

where

$$X = x\cos\alpha + y\sin\alpha \qquad (2)$$

$$Y = y\cos\alpha - x\sin\alpha \qquad (3)$$

and X_p and Y_p are defined similarly. The x,y, and X,Y coordinate axes are related as shown in Figure 1.

An input datum to the code is a parameter QCUT $\equiv q_{min}$ that represents a threshold value for all deposit increments. At any map point, a contribution from any deposit increment that is less than q_{min} is ignored. To provide efficient processing of deposit increments, we need a simple and fast method for determining the boundary that encloses $q(x,y) \geq q_{min}$ for individual deposit increments. The method used is discussed next.

Let q(x,y) equal q_{min} and take logarithms of both sides of Eq. (1). Then we get

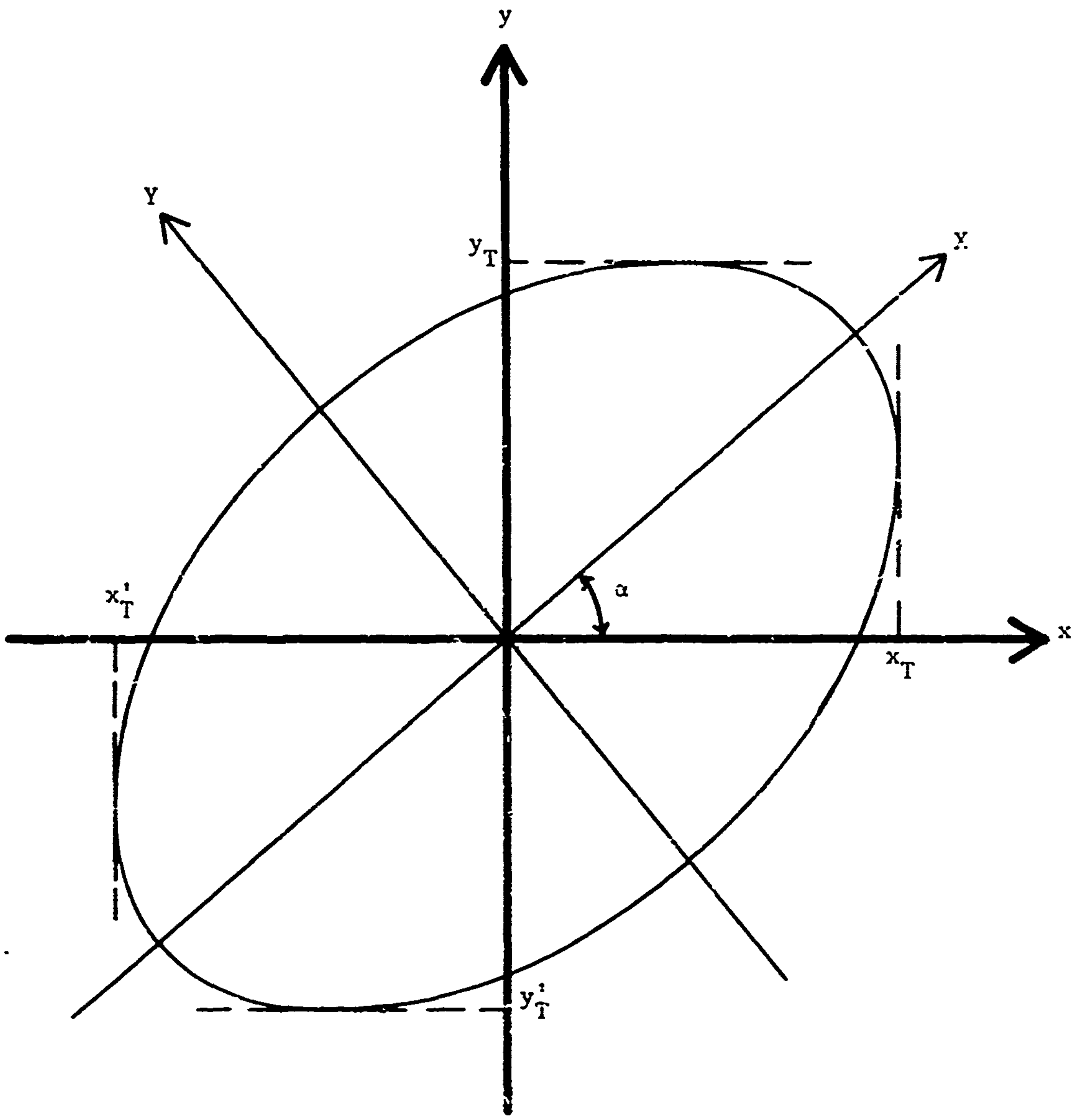

FIGURE 1. A DEPOSIT INCREMENT CONCENTRATION ELLIPSE IN THE MAP x, y PLANE

$$\gamma = \frac{\left(X-X_p\right)^2}{2\sigma_{\parallel}^{2}} + \frac{\left(Y-Y_p\right)^2}{2\sigma_{\perp}^{2}} , \tag{4}$$

where

$$\gamma = \ell n \left(\frac{Q}{2\pi\sigma_{\parallel} \;\; \sigma_{\perp} \, q_{min}} \right). \tag{5}$$

For $\gamma > 0$, Eq. (4) is an equation of an ellipse. This ellipse is drawn in Figure 1. We wish to determine its tangent lines parallel to the y and x axes, which are labeled x_T, x_T' and y_T, y_T' in the figure. From the general properties of an ellipse, it can be shown that these lines are

$$x_T, x_T' = x_p \pm \sqrt{2\gamma \left(\sigma_{\parallel}^2 \;\; \cos^2\alpha + \sigma_{\perp}^2 \sin^2\alpha\right)}, \tag{6}$$

and

$$y_T, y_T' = y_p \pm \sqrt{2\gamma \left(\sigma_{\parallel}^2 \sin^2\alpha + \sigma_{\perp}^2 \cos^2\alpha\right)} \; . \tag{7}$$

In the code, computation of x_T, x_T' and y_T, y_T' is used to establish whether or not a deposit increment contributes to a particular map or map section.

For each deposit increment, map points are considered row-by-row. The bounding rows are determined from the y_T, y_T' values. For a particular row, the bounding x coordinates, x_c, x_c', are given by

$$x_c, x_c' = \frac{\left(y-y_p\right)\left(\frac{1}{\sigma_{\perp}^2} - \frac{1}{\sigma_{\parallel}^2}\right)\sin\alpha \, \cos\alpha \pm \sqrt{-\left(\frac{y-y_p}{\sigma_{\parallel}\sigma_{\perp}}\right)^2 + 2\gamma\left(\frac{\cos^2\alpha}{\sigma_{\parallel}^2} + \frac{\sin^2\alpha}{\sigma_{\perp}^2}\right)}}{\frac{\cos^2\alpha}{\sigma_{\parallel}^2} + \frac{\sin^2\alpha}{\sigma_{\perp}^2}} \; . \tag{8}$$

2.5 Processing for Impact Time and Particle Size

Maps can be prepared for time of fallout onset, time of cessation, smallest particle deposited and largest particle deposited. For these options, the deposit increment processing methods described in the preceding section are applied as follows. At a specified map point, a particular deposit increment is considered or bypassed depending on whether or not the map point lies within the contribution ellipse defined by Eq. (4). In computing γ (Eq. (5)), q_{min} for mass per unit area is used. When the map point falls within the contribution ellipse, the impact time or particle size of the deposit increment may be rejected or it may replace the value already stored for the map point, depending on the outcome of a straightforward logical test.

2.6 Sequences of Processing Requests

The Output Processor accepts in a single input a sequence requests for processing. The user can obtain any number of maps any descriptions in a single run provided that the same deposit increment input tape (IPOUT) is used for them all. The code is completely open-ended in this respect.

The utility of this feature is illustrated by the following example. Suppose the user desires various maps to be prepared for each of two different sets of map specifications. For example, the user may desire large-scale maps of essentially the entire local fallout field for (1) exposure rate normalized to H + 1 hour, (2) total accumulated exposure, and (3) activity from mass chain 95. He may also desire these options, plus some others, for a high resolution map that covers a geographically smaller area close-in to ground zero. To accomplish this he can specify the map limits and grid intervals for the large-scale map and follow it by the needed computation option request cards. These data would be followed in turn by the other map specifications and another series of computation option request cards.

2.7 Output Processing Independent of Other DELFIC Modules

In its primary role the Output Processor acts as the terminal module of the DELFIC system. Nevertheless, it can also operate independently of the other programs of the DELFIC system except for the Particle Activity Module. This feature can be used to advantage if the user saves the magnetic tape results of the transport program's execution. Thus, the user need not specify all desired output at the time of the transport execution but can make subsequent runs of the Output Processor as specific questions arise during the course of his research. The tape and card inputs to the Output Processor are the same, regardless of which way the program is used.

2.8 General Logic of the Output Processor

In this section we present a cursory description of the operations of the Output Processor, including organizational flow charts. More thorough descriptions, which include detailed discussions of the more involved subroutines, are given in the Program Details chapter.

The Output Processor subroutines are listed with brief functional descriptions in Table 2. In addition to these programs, a control program and the utility subroutine ERROR are required. A control program, OPP, which was used for independent operation of the Output Processor Module on the UNIVAC 1108 computer, is included in the FORTRAN listings. The FORTRAN listings of OPP and ERROR are self explanatory.

Output Processor operations are separated into two main parts; these are controlled by subroutines LINK8 and LINK9. LINK8 (Figure 2) is used for run initialization. It also can be used solely to print the contents of a DTM binary output tape, IPOUT. If maps are to be created, LINK8 calls the initialization portion of the Particle Activity Module (PAM) code, PAM1. PAM1 prints out the PAM

TABLE 2

OUTPUT PROCESSOR PROGRAM SYNOPSIS

Program Name	Purpose
LINK8	Initializes and writes printout headings. Prints contents of tape IPOUT if requested. Calls first part of Particle Activity Module (PAM1) to perform request-invarient part of activity calculations.
LINK9	Controls request-dependent portion of the Output Processor computations. Calls the second part of the Particle Activity Module (PAM2).
CALC	Accumulates contributions from individual deposit increments into the map point ordinates.
GOGO	Controls flow of deposit increment description data blocks to and from tape.
MAP	Prints the fallout maps.
PCHECK	Initializes for a map calculation. Computes deposit increment contribution boundaries in the map.
PDMP	Sorts out deposit increments that will contribute to subsequent map core loads (if any) and dumps them onto tape for temporary storage.

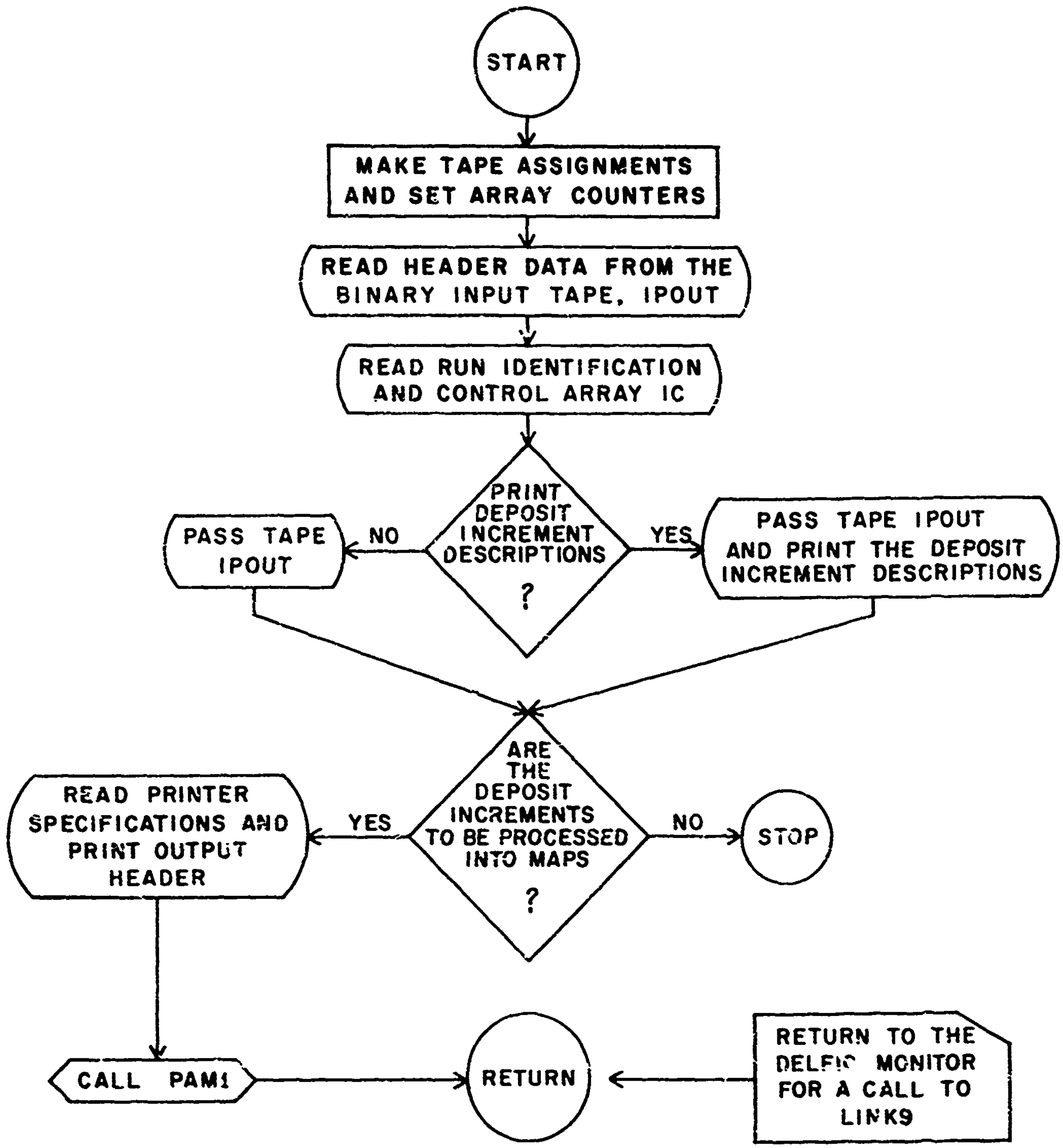

FIGURE 2. ORGANIZATIONAL FLOW CHART OF SUBROUTINE LINK8

header, and performs the shot-specific but map-independent portion of the PAM computations.

LINK9 (Figure 3) accepts map specifications and map requests; it controls the processing of the deposit increment data into maps and the printing of the maps. Deposit increment data are read from the DTM binary output tape, IPOUT. A complete pass of tape IPOUT is made for each map that is created. The map-specific portion of the Particle Activity Module, PAM2, is called for maps that require activity calculations.

A map specification defines map boundaries and grid intervals. An unlimited number of map specifications can be accommodated. For each map specification an unlimited number of map requests can be accommodated. A map request selects one of the sixteen computation options that are available (see Table 4), and provides data that are specific for that request. With reference to Table 3, map specifications are input via cards 4, 5, and 6, and map requests via cards 7.

Core storage of map ordinate data is carried in the singly dimensioned array OMAP (see card 124 in the LINK8 listing). The dimension of OMAP must correspond to the value assigned to the variable NMAP (see card 182 in the LINK8 listing). When the OMAP array is not large enough to accommodate an entire map, the program will still function, provided that two scratch tapes, JPOUT and KPOUT (see cards 178 and 179 of the LINK8 listing) are provided. By use of these scratch tapes, maps with essentially unlimited numbers of points can be prepared.

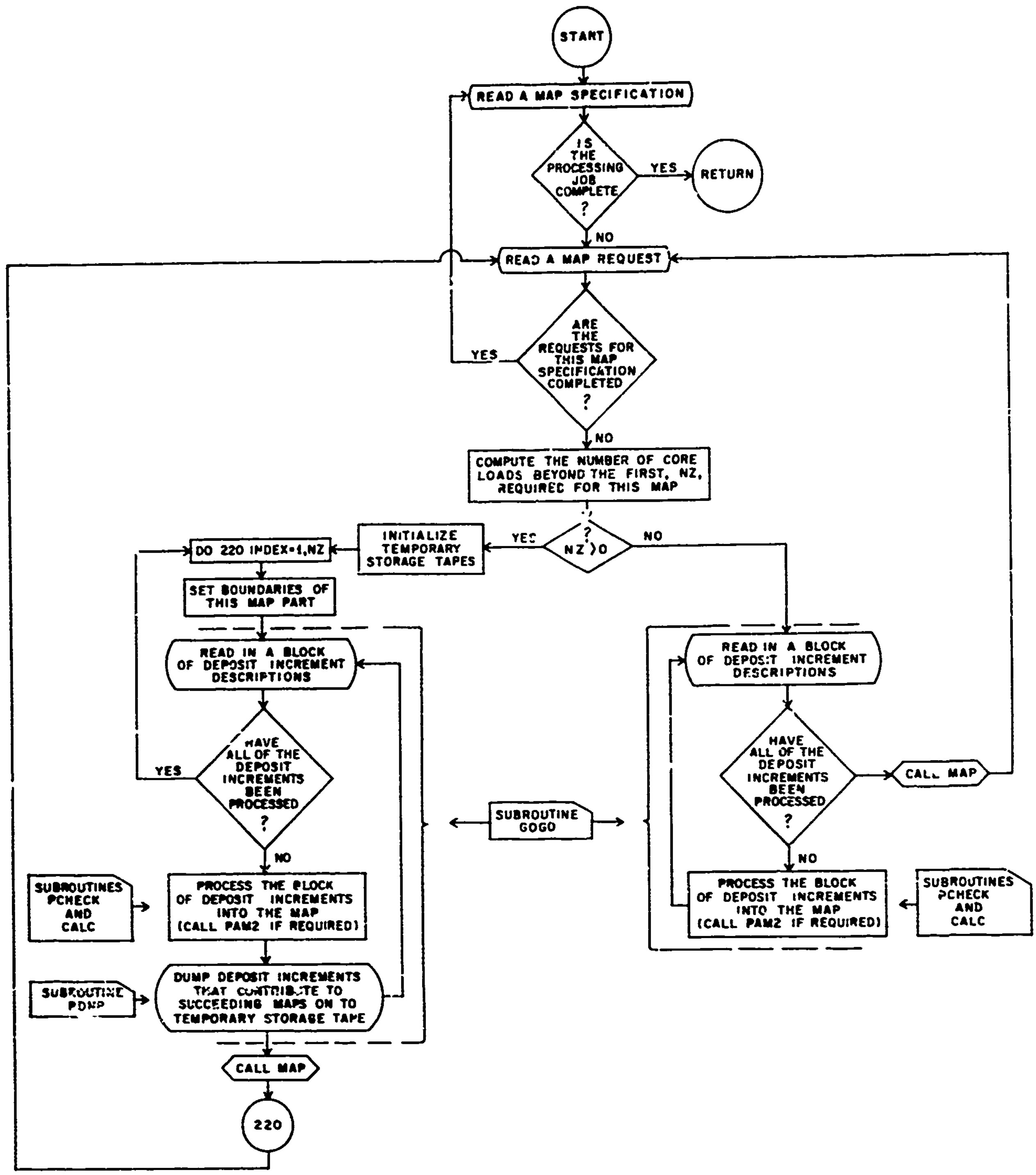

FIGURE 3: ORGANIZATIONAL FLOW CHART OF SUBROUTINE LINK9 AND ASSOCIATED PROGRAMS

3. PROGRAM DETAILS

In this chapter we discuss each of the subroutines listed in Table 2 in some detail. These discussions, in conjunction with the organizational flow charts (Figures 2 and 3), are intended to provide the background needed to easily grasp the complete logical and computational content of the FORTRAN code.

3.1 Subroutine LINK8

This subroutine initializes for an OPM run. One pass through LINK8 is made for each run. LINK8 can be used to initialize for map preparation, or it can be used simply to print the contents of the (binary) deposit increment tape, IPOUT, that has been prepared by the Diffusive Transport Module (DTM). If maps are to be prepared, LINK8 calls subroutine PAM1 of the Particle Activity Module (PAM)[4]. PAM1 performs the portions of the particle activity calculations that are not specific to individual map requests.

The operations of LINK8 are particularly simple. Figure 2 presents an essentially complete outline of them.

3.2 Subroutine LINK9

Subroutine LINK9 initializes for individual map specifications and map requests. It begins by reading in a map specification data card. These data are the map boundary coordinates, the map grid intervals, and a combined ground roughness and instrument response factor for gamma radiation exposure rate. If the sum of absolute values of the grid intervals is found to be zero, the run is terminated. If not, the altitude relative to mean sea level of the fallout deposition plane is read in. Then an integer control array, JC, is read in. This is used to specify the map ordinate numerical display format. Finally, these input data are printed.

A map request card is read and the OMAP array is initialized. If the computation option code parameter NREQ (see Table 4) is zero, the end of map requests for this map specification is signaled; control is transferred to read-in of the next map specification card. If NREQ is greater than zero, the map request data are printed. If an activity map is requested, some additional initialization tasks are performed and PAM2 is called. PAM2 computes the particle activity array FP, which contains the total activity, in suitable units according to the request, associated with each particle size class.

Next, the map grid intervals are adjusted, if necessary, to provide an undistorted printed map. The printer characterization parameters IV and IH are used to make this adjustment. Then, the number of map points in the x and y directions for the complete map are computed. If the whole map cannot be accommodated in core storage, the number of core loads beyond the first, NZ, is computed.

If NZ = 0, subroutine GOGO is called to begin processing the deposit increment data into the map. When all of the deposit increment data have been processed, control is returned to LINK9 and subroutine MAP is called to print the map.

If NZ > 0, the map must be prepared in NZ + 1 parts*. Two scratch tapes, KTAPE and LTAPE, are used for temporary storage of deposit increment description data that contribute to succeeding map parts*. These tapes are treated like the DTM output tape, IPOUT, when they are used as input for successive map part computations.

For NZ > 0, the code begins by initializing the KTAPE and LTAPE assignments. Then it calls GOGO and MAP to prepare and print the first part of the map. Next, it enters a loop indexed from 1 to NZ in which the remaining map parts are prepared and printed.

---

* These map parts should not be confused with the printed map strips that, when assembled, constitute a complete map. What we have called a map part constitutes a portion of a map that can be contained in the computer's rapid access memory. In general, each such map part will yield more than one map strip.

Finally, the sum of all map ordinates, FSUM, is printed, and control is passed to read-in of the next map request card.

3.3 Subroutine GOGO

Subroutine GOGO reads into core storage a block of deposit increment description data from binary input tape KTAPE. Tape KTAPE is either the DTM output tape, IPOUT, or one of the two scratch tapes used for temporary storage when a complete map cannot be contained in core.

Each data block is preceded on the input tape by an integer block count NIJ. When NIJ = 0, this signals that the end of the input tape has been reached. For NIJ > 0, the block of deposit increment data is read into core. Subroutine PCHECK is then called by GOGO to process the block of deposit increment data into the map.

On return of control to GOGO, the values of parameters NZ and ICTR are compared. NZ is the number of map core loads (map parts*) beyond the first required to prepare the map. Both NZ and ICTR are set by subroutine LINK9. If NZ = ICTR, no additional map core loads are required, and another block of data, preceded by its block count, is read in from tape KTAPE. If NZ ≠ ICTR, a succeeding map core load is signaled. In this case, subroutine PDMP is called. PDMP writes on to temporary storage tape those deposit increment descriptions that will contribute to subsequent map parts. Then, the next block of data is read from tape KTAPE.

3.4 Subroutine PDMP

When an entire map cannot be contained in core storage in the OMAP array, the map must be prepared in two or more parts via construction of two or more map core loads*. In this case,

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* See footnote, page 20.

after each block of deposit increment descriptions is processed into the current in-core map part, subroutine PDMP is called by subroutine GOGO to write on to temporary storage tape the data for those deposit increments that will contribute to subsequent map parts.

During the processing of the deposit increments into the in-core map part, subroutine PCHECK labels each deposit increment to indicate whether or not it will contribute to subsequent map parts. This labeling is done in array KTR (see the PCHECK glossary in the FORTRAN listings). PCHECK also tallies the number, NE, or deposit increments currently stored in core that do not contribute to subsequent map parts.

The first operation in PDMP is to compute the number, KP, of deposit increment descriptions that must be saved. Next, the storage block of deposit increment descriptions is rearranged so that all of the data to be saved are stored in a continuous block in the low-core end of the arrays. Finally the block count followed by the block of deposit increment descriptions are copied out onto tape LTAPE.

3.5 Subroutine PCHECK

Subroutine PCHECK is called by subroutine GOGO to initiate the processing of a core-stored block of deposit increment data into the core-stored map or map part.

The subroutine operations are wholly enclosed in a DO loop that passes the complete block of stored deposit increment descriptions. The discussion that follows applies to each deposit increment in the block.

First the altitude of the deposit increment is compared with that of the fallout deposition plane. If the deposit increment is ten meters or more above the deposition plane, it is rejected for further processing. If not, processing continues.

On the basis of the value of NREQ, the computation option code (see Table 4), control is transferred to an appropriate portion of code to initialize for the deposit increment processing. This initialization established the value of F, which is equivalent to Q in Eqs. (1) and (5).

Below statement number 100, the deposit increment contribution ellipse boundaries (see Figure 1), XPRMU, XPRML and YPRMU, YPRML, are computed. These are equivalent to the x_T, x'_T and y_T, y'_T values given by Eqs. (6) and (7). The ellipse boundaries are tested against the map boundaries to determine if the deposit increment contributes to the map. The ellipse boundaries also are checked to determine if the deposit increment will contribute to subsequent map parts, if any. The deposit increment is labeled accordingly via array KTR. If the deposit increment contributes to the currently stored map part, subroutine CALC is called for further processing. If not, further processing is bypassed.

3.6 Subroutine CALC

Subroutine CALC is called by subroutine PCHECK to compute contributions from an individual deposit increment to the map ordinates and add or enter them into the OMAP array.

The first operation is the computation of those factors and terms in Eq. (8) that are independent of individual map point coordinates. Next, the bounding map row indices NOB and NOT, are computed. These are established by YPRMU and YPRML values (y_T and y'_T) that have been computed by subroutine PCHECK. The remainder of the operations are contained in a loop that is indexed between NOB and NOT.

On each map row, as defined by its row index, all points have a common y coordinate. Therefore, in each pass through the row index loop, the limiting x coordinates, x_c, x'_c, in the row are determined by application of Eq. (8). On the basis of the x_c, x'_c, the limiting map colmun indices, NOL and NOR, in the row are computed. Then, the OMAP array index extremes for points in the row, K and L, are computed, and an inner loop indexed between K and L is entered.

Within this inner loop, contributions to the OMAP array elements are computed and added to the elements or replace them depending on the requirements of the computation option.

The OMAP array is singly dimensioned. The map points are represented in the array in the following order. The array element OMAP(1) represents the lower left-hand corner point in the map. The array is then filled by the successive points in the lowermost row. Following the rightmost point in the lowest row in the leftmost point in the next to lowest row, and so on.

3.7 Subroutine MAP

This subroutine writes map print images on the operating system output tape, ISOUT. It writes a map title, a description of the quantity that the map portrays, and an indication of the ordinate format used. It divides the output map into printer strips on the basis of the parameter INC, which is the number of map ordinate columns that can be accommodated by the printer paper. It prints a strip count (MAPRUN) at the top of each strip for identification purposes. A separate call of MAP is necessary for each map part or core load*.

Following the FORTRAN statement listing of subroutine MAP, we see at its beginning a transfer to a first-pass portion of code if MAPRUN equals zero. In this first-pass portion of code, parameter initializations are performed, a map title is written, the display option control parameter, JC(1), is checked for an acceptable value, and then a branch transfer is made to a code that writes the ordinate format identification and makes control transfer assignments for use within the map writing loops.

Between the statement numbers 102 and 170 a two-part title is written that describes the quantity presented in the map. Between statement numbers 170 and 2023 initializations are made for the three nested map writing loops. When 2023 is first reached, M

---

* See footnote page 20.

contains the number of printer strips that are to be produced, and LEFT has the number of columns that should appear on the last printer strip.

At 2023, which is the return point for the outer map writing loop (printer strip loop), MAPRUN, the counter of printer strips, is incremented and the strip title is written. Also, KL, the lower index for retrieval from the one-dimensional map array OMAP, is set at its initial value. Note that in the iteration KL progresses from its largest value to its smallest value to invert the map which is stored numerically inverted in the map array.

At card number 229, the return point for the middle map writing loop (printer line loop), KH, the upper index for retrieval from the map array, is set and KDC, an index for the printer line integer array JMAP, is initialized.

At card number 237, the return point for the last map writing loop (data point loop), KDC is incremented and a transfer is made to the desired presentation format code on the basis of previous assignment. The two printer format codes take their inputs from the map array and place their results back into the map array and into the integer printer line array JMAP. All map-producing codes return to statement number 300.

Below 300 the printer lines are written onto the output tape, certain indexing operations are performed, and return is made to deal with either the next line in the current strip or the first line (and title) on the next strip, or a final return is made to the calling program. Note that if entrance is made to MAP with MAPRUN set positive as a consequence of a previous entrance, the overall titles will not be printed again and strip counting will be resumed where it had been left off.

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4. USER INFORMATION

This chapter is intended to be useful as a user's manual for the Output Processor Module (OPM). However, a reading of this chapter alone is not sufficient preparation for use of the OPM; the user also should at least read sections 2.1 through 2.3.

Inputs to the OPM are of two kinds: (1) a card input that contains the user's specifications for individual fallout maps, and (2) a binary tape input that contains fallout deposit increment descriptions prepared by the Diffusive Transport Module (DTM) as well as other information passed on by the preceding DELFIC modules.

4.1 Card Input

Card inputs are listed in loading sequence in Table 3. Notice that the Particle Activity Module (PAM) card inputs are imbedded in this deck. The user is referred to DASA-1800-V(4) for descriptions of these cards.

As indicated in Table 3, the map requests are segregated into sets. Each map request set is introduced by a map specification card (card 4) that defines the map boundaries and grid intervals. Each map request card (card 7) that follows, specifies a map option (Table 4) for a particular map that is to be computed and printed. Each request set is terminated by a blank card. The run is terminated by a blank map specification card. Thus, the last two cards in the deck must be blank.

CARD 1 - Run Identification

A description of the OPM run is input via this card.

CARD 2 - Run Control Variables

This card allows up to eighteen control variables to be input. Currently, only two of these are used:

TABLE 3

CARD INPUTS FOR IDENTIFICATION
AND CONTROL OF THE OUTPUT PROCESSOR

Data Set	Card No.	Content	FORTRAN Mnemonic and format
	1	Run identification	OPID(J), J=1,12 (12A6)
Initialization	2	Run control variables	IC(J), J=1,18 (18I4)
	3	Printer characteristics: Number of characters per inch in the cross-page and down-page directions	IH,IV (2I4)
Particle Activity Module Card Deck			
First Set of Map Specification Cards	4	Map specification data: maximum and minimum x coordinates, maximum and minimum y coordinates, grid intervals in the x and y directions (all in meters), a combined ground roughness and radiation meter response factor	XMAX, XMIN, YMAX, YMIN, DGX, DGY, GRUFF (7F10.3)
	5	Deposition plane altitude (meters relative to mean sea level)	ZDEP (F10.3)
	6	Map control variables	JC(J), J=1,18 (18I4)

(continued on next page)

Table 3 (continued)

Data	Card No.	Content	FORTRAN Mnemonic and format
First Set of Map Request Cards	7a	Map request: computation option code, NREQ (see Table 4), times of onset and cessation of the computation (hr) or particle diameter range limits (micrometers), mass chain number, deposit increment contribution threshold, map ordinate threshold.	NREQ, T1, T2, MASCHN, QCUT, CUTMAP (I4, 2F10.3, I4, 2F10.3)
	7b	Map request	
	7c	Map request	
	7n	Map request	
	8	Request termination blank card	
Second Set of Map Specification Cards	4'	Map specification data	
	5'	Deposition plane altitude	
	6'	Map control variables	
Second Set of Map Request Cards	7a'	Map request	
	7b'	Map request	
	8'	Request termination blank card	
Additional Sets of Map Specifications and requests		● ● ● ●	
	9	Run termination blank card	

TABLE 4

MAP COMPUTATION OPTIONS

Computation Code NREQ	Computation Option Description
0	Termination of map request set
1	Count of deposit increments contributing to each map ordinate
2	Exposure rate normalized* to time H + 1 hour
3	Exposure rate at time H + T1 hours
4	Integrated exposure, H + T1 to infinity accounting for time of arrival
5	Integrated exposure, H + T1 to H + T2 accounting for time of arrival
6	Total mass per unit area
7	Total mass per unit area deposited from time H + T1 to H + T2
8	Integrated exposure, H + T1 to H + T2 assuming all particles have arrived by H + T1 hours
9	Same as 8 integrated to infinity
10	Activity per unit area from an individual mass chain (curies/m^2)
11	Time of onset of fallout
12	Time of cessation of fallout
13	Smallest particle size deposited
14	Largest particle size deposited
15	Mass per unit area from particles in size range T1 to T2
16	H + 1 hour normalized* exposure rate resulting from particles in size range T1 to T2 microns

* In a calculation normalized to time H + T, it is assumed that all fallout is grounded at time H + T, regardless of whether this actually is the case.

IC(17) Controls the processing of deposit increments. IC(17) > 0 causes the program to stop without entering PAM1 or LINK9. This setting is used if only a printing of the deposit increment tape (IPOUT) is desired, or if the user simply wants to see the run identifiers for the preceding DELFIC modules. IC(17) = 0 causes a normal entrance to the main body of the Output Processor regardless of whether the deposit increment tape has been printed.

IC(18) Controls the option to print the complete contents of the deposit increment tape, IPOUT. IC(18) > 0 causes the deposit increment tape to be printed. IC(18) = 0 bypasses the printing of the deposit increment tape. For either zero or positive value of IC(18), preceding DELFIC module run identifiers and other vital run statistics are printed.

CARD 3 - Printer Characteristics

To prepare and print spatially undistorted maps, the Output Processor needs constants which describe the character spacing of the off-line printer to be used. These constants IH and IV give respectively the cross-page and down-page character spacings of the printer in characters per inch. If IH and IV are found to be zero, the program assigns the standard values of 10 and 6 to them.

CARD 4 - Map Specification Data

Maps must be completely specified by the user. He must specify limiting coordinates and grid intervals (grid point spacing). All maps are rectangular in shape and north-south, east-west in orientation, with north always at the top. The variables XMAX and XMIN indicate respectively the maximum and minimum values of the east-west coordinates of the map. The positive x direction points eastward, which is cross-page to the right on the map. YMAX and YMIN similarly indicate maximum and minimum values of the north-south map coordinates. The positive y axis points northward, which is up-page on the map.

The variables DGX and DGY indicate the map grid-point separations in the east-west and north-south directions, respectively. It should be noted that on the printed map the actual physical spacing of the data points is determined in part by the printer's character and line spacings. Thus, if necessary, the code uses the printer description parameters, IH and IV, to adjust DGX or DGY so that a truly undistorted map is produced. In performing this adjustment the program uses either DGX or DGY as the scale factor basis, depending upon which of these two parameters will yield the largest undistorted map (smallest scale factor).

Gamma ray exposure or exposure rate is computed for a detector placed three feet above an unbounded plane source of fallout. The computed values are corrected for ground roughness absorption and radiation meter response via multiplication by the factor GRUFF. GRUFF is the product of the ground roughness attenuation factor with the radiation meter response factor. A value of 0.5 is satisfactory for most work.

CARD 5 - Deposition Plane Altitude

The value of ZDEP should be the same as ZMIN used in the Diffusive Transport Module calculations.

CARD 6 - Map Control Variables

Currently only one of these variables is used. It is used to specify the printing format of the map ordinate values (see pp. 7 and 8).

JC(1) = 1 results in printing of the map ordinates with a two-line E format, which has the power of ten printed on one line and the associated multiplier printed immediately below.

JC(1) = 2 results in the printing with a two-line F11.3 format, which has the six highest order characters printed on the first line and the five lowest order characters on the second line.

CARD 7 - Map Request

The computation option codes (NREQ values) are given in Table 4 . Except for options 15 and 16, T1 and T2 represent time limits (hours) for the calculations. T1 is the earlier time. The T1 field may be left blank for NREQ = 1, 2, 6, and 10 - 14. The T2 field may be left blank for NREQ = 1 - 4, 6, 9, and 10 - 14.

For options 15 and 16, T1 and T2 (T1 < T2) represent the particle diameter extremes (micrometers) for a range of particle size classes.

If option 10 is selected, a value for MASCHN must be specified. It is the atomic number of the radioactive mass chain for which output is to be displayed.

The quantity QCUT corresponds to q_{min} in Eq. (5). It represents the threshold value of the area density of the quantity to be displayed below which contributions from individual deposit increments are to be neglected.

The quantity CUTMAP is a map ordinate threshold. After all contributions have been accumulated at each map point, a pass is made through the map ordinate array (OMAP) and any ordinate with a value less than CUTMAP is set to zero.

Values for QCUT and CUTMAP that have been found adequate are:

NREQ	QCUT	CUTMAP
2	10^{-4}	10^{-2}
6	10^{-6}	10^{-3}

4.2 Tape Input

The Output Processor requires a binary tape input (unit IPOUT) that is prepared by the Diffusive Transport Module. This tape contains critical run data and run identifiers for each of the preceding DELFIC modules. It also contains deposit increment descriptions, which are the major output of the Diffusive Transport Module. The contents of tape IPOUT are described in Table 5.

4.2 Output

An example of the OPM output is given in the "Sample Printout" chapter. The Particle Activity Module output would appear between pp. 73 and 74 below.

Note on p. 76 the two columns of numbers. These are y axis coordinates that are printed on the same scale as the map. They can be cut from the page and attached along the sides of the map to specify its y axis coordinate values.

Units of quantities displayed in the maps are:

exposure - roentgens

exposure rate - roentgens per hour

mass per unit area - kilograms per square meter

time - seconds

particle diameters - micrometers

activity per unit area - curies per square meter

TABLE 5

BINARY TAPE INPUT TO THE OUTPUT PROCESSOR

Record No.	Content	Variable Names
1	Tape identification word, IPOUT	JPOTJ
2	Fission yield (KT), mass of the cloud soil burden (kg), soil solidification temperature (°K), time at which the cloud reached the soil solidification temperature (sec), geometric standard deviation of the log-normal particle diameter volume-frequency distribution, total yield (KT), altitude of burst above msl (m), x coordinate (E-W) of GZ(m), y coordinate (N-S) of GZ(m), detonation time (sec), spare data word, fallout particle density (kg/m^3), the horizontal cloud subdivision parameter IRAD (see Reference 5, p. 56 ff.), maximum cloud radius (m), altitude of ground zero above msl(m).	FW, SSAM, SLDTMP, TMSD, SIGMA, TW, HBURST, XGZ, YGZ, TGZ, BZ, ROPART, IRAD, RADMAX, ZBRSTZ
3	Cloud Rise-Transport Interface Module run identification	PSEID(I), I=1,12
4	Cloud Rise Module run identification	CRID(I), I=1,12
5	Initial Conditions Module run identification	DETID(I), I=1,12
6	Diffusive Transport Module run identification	WID(I), I=1,12
7	Number of particle size classes	ITAB
8	Particle size class tables: central particle diameter (μm), volume (mass) fraction, particle diameter at the upper boundary of the size class (μm)	PSIZE(I), FMASS(I), PACT(I), I=1, ITAB
9	Number of (altitude) entries in the atmosphere description tables	NAT (=256)
10	Atmosphere tables: Altitude relative to msl(m), viscosity (kg/m-sec), density (kg/m^3)	ALT(I), ATEMP(I), RHO(I), I=1, NAT

Table 5 (continued)

Record No.	Content	Variable Names
11	Deposit increment description block count	NIJ
12	Block of deposit increment descriptions. For each deposit increment: x, y, z, and t coordinates (m and sec), horizontal downwind and crosswind dispersion standard deviations (m), average wind heading from due east (radians), size class central diameter (µm), mass of fallout (kg)	X(I), Y(I), ZOUT(I), T(I), SXOT(I), SYOT(I), ROUT(I), PS(I), FMAS(I), I=1, NIJ
13	Block count	
14	Block of deposit increment descriptions	
.		
.		
.		
15	Zero block count	NIJ=0

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5. FORTRAN STATEMENT LISTINGS

Except for the control program, OPP, which is given first, the subroutines are arranged in alphabetical order according to their names. A listing of the utility program ERROR is given in DASA-2669[3].

```
C     OUTPUT PROCESSOR MAIN   OPP
      COMMON /SET1/
     1CAY        ,DETID(12) ,DIAM(201) ,DMEAN      ,DNS        ,EXPO       ,
     2FMASS(200),IDISTR     ,IEXEC     ,IRISE      ,ISIN       ,ISOUT      ,
     3NDSTR      ,PS(200)   ,SD        ,SSAM       ,TME        ,TMP1       ,
     4TMP2       ,T2M       ,USOIL     ,VPR        ,W          ,HEIGHT     ,
     5ZSCL       ,NHODO     ,ZV(200)   ,VX(200)    ,VY(200)
      DIMENSION NUMTAP(15)
      ISIN=5
      ISOUT=6
      IRISE=10
      DO1 I=1,15
    1 NUMTAP(I)=0
      NUMTAP(2)=13
      NUMTAP(3)=14
      NUMTAP(4)=9
      NUMTAP(9)=10
      NUMTAP(11)=11
      NUMTAP(12)=12
      CALL LINK3(NUMTAP)
      CALL LINK3
      CALL EXIT
      STOP
      END
```

```
      SUBROUTINE CALC
C
C     MARA VERSION   DESIGNED TO OPERATE WITH THE DTM
C     H.G.NORMENT      JUNE 25,1971
C
C     THIS SUBROUTINE COMPUTES MAP CONTRIBUTIONS FOR INDIVIDUAL
C     PARTICLES
C
C
C********************************** GLOSSARY *************************
C
C     NOB             SMALLEST POSSIBLE Y INDEX OF A CONTRIBUTION FROM A
C                     PARTICLE
C     NOL             SMALLEST POSSIBLE X INDEX OF A CONTRIBUTION FROM A
C                     PARTICLE
C     NOR             LARGEST  POSSIBLE X INDEX OF A CONTRIBUTION FROM A
C                     PARTICLE
C     NOT             LARGEST  POSSIBLE Y INDEX OF A CONTRIBUTION FROM A
C                     PARTICLE
C     YREL            Y COORDINATE OF THE MAP POINT ROW CURRENTLY BEING
C                     CONSIDERED RELATIVE TO THE PARTICLE  Y COORDINATE
C     XREL            X COORDINATE OF THE MAP POINT     CURRENTLY BEING
C                     CONSIDERED RELATIVE TO THE PARTICLE  X COORDINATE
C     XL              LEFT BOUNDRY X COORDINATE  OF THE  PARTICLE
C                     CONTRIBUTION ELLIPSE IN THE YREL MAP ROW
C     XR              RIGHT BOUNDRY X COORDINATE  OF THE  PARTICLE
C                     CONTRIBUTION ELLIPSE IN THE YREL MAP ROW
C     NWX             NUMBER OF MAP POINTS SPANNED BY A PARTICLE
C                     CONCENTRATION ELLIPSE IN A ROW
C     VARX2           2.0*GAUSSIAN DISTRN. VARIANCE ALONG A AXIS
C     VARY2           2.0*GAUSSIAN DISTRN. VARIANCE ALONG B AXIS
C     F               MAGNITUDE(I.E. INTEGRATED VALUE) OF A PARTICLE
C                     PROPERTY  TO BE DISTRIBUTED ON THE MAP
C
C     ALSO SEE LINK3 GLOSSARY  AND PCHECK GLOSSARY
C
C ********************************************************************
C
      COMMON /SET1/
     1CAY        ,DETID(12) ,DIAM(201) ,DMEAN     ,DNS       ,EXPO      ,
     2DIFTID(200),IDISTR    ,IEXEC     ,IRISE     ,ISIN      ,ISOUT     ,
     3NDSTR      ,TID(200)  ,SP        ,SSAM      ,TME       ,TMP1      ,
     4TMP2       ,T2M       ,U         ,VPR       ,W         ,HBURST    ,
     5SCLDHP     ,NHODO     ,ZV(200)   ,VX(200)   ,VY(200)
      COMMON /PARDAT/
     1X(500)     ,Y(500)    ,ZCUT(500) ,SXOT(500) ,SYOT(500) ,ROUT(500) ,
     2PS(500)    ,FMAS(500) ,KTP(500)  ,  F       , GAMA     ,  BSQ     ,
     3ASQ        ,SINA      ,COSA      ,WFMAS(200),YPRMU     ,YPRML     ,
     4T(500)
      COMMON /RUNDAT/
     1NTJ        ,NE        ,NPEO      ,NZ        ,ICTP      ,NXMAP     ,
     2T1         ,T2        ,MAPRUN    ,TCZ       ,IP        ,JC(18)    ,
     3IC(18)     ,NYMAP     ,NTASK     ,NORD      ,XGZ       ,YGZ
      COMMON /MAPDAT/
     1OMAP(15000),OCUT      ,CUTMAP    ,DGX       ,DGY       ,DELTAX    ,
     2XMAX       ,XMIN      ,YMAX      ,YMIN      ,FSUM      ,RUFSAM    ,
     3X1         ,X2        ,MBTAPE    ,ZDEP
C
```

```
C ************************************************************************
C
      DATA PROGRM/6HCALC  /
C
C     INITIALIZE FOR THIS PARTICLE
C
      VARX2= ASQ/GAMA
      VARY2= BSQ/GAMA
      A = SINA*COSA*(1.0/VARY2- 1.0/VARX2)*2.0
      B = 4.0/VARX2/VARY2
      C = (COSA**2/VARX2 + SINA**2/VARY2)*2.0
      D = 2.0*GAMA*C
      Q=F/SXOT(IP)/SYOT(IP)/6.28318531
C
C     COMPUTE SMALLEST Y INDEX OF A CONTRIBUTION
C
      NOB = (YPRML - YMIN)/DGY
      NOB=NOB+1
      IF(NOB.LT.1) NOB=1
  100 IF(NOB.LE.NYMAP) GO TO 120
  110 IRROR=-110
      GO TO 400
C
C     COMPUTE LARGEST  Y INDEX OF A CONTRIBUTION
C
  120 NOT = (YPRMU - YMIN)/DGY
      IF(NOT.GT.NYMAP) NOT=NYMAP
      IF(NOT.GT.0 ) GO TO 140
  130 IRROR=-130
      GO TO 400
C
C     ENTER THE MAP ROW LOOP
C
  140 DO 350 J=NOB,NOT
C
C     COMPUTE  THE LIMITING X COORDINATES OF THE PARTICLE CONTRIBUTION
C     ELLIPSE IN THIS ROW
C
      YREL = J
      YREL = YMIN + DGY*YREL - Y(IP)
      RADIC = -B*YREL**2+C
      IF(RADIC.GE.0.0) GO TO 160
  150 IRROR=150
      RADIC=0.0
      CALL ERROR(PROGRM,IRROR,ISOUT)
  160 RADIC=SQRT(RADIC)
      XL = X(IP) + (YREL*A- RADIC)/C
      XR = XL + 2.0*RADIC/C
C
C     COMPUTE SMALLEST X INDEX OF A CONTRIBUTION
C
      NOL = (XL-X1)/DGX
      NOL=NOL+1
      IF(NOL.LT.1) NOL=1
      IF(NOL.GT.NXMAP) GO TO 350
C
C     COMPUTE LARGEST  X INDEX OF A CONTRIBUTION
C
```

```
  160 NOR = (XR-X1)/DGX
      IF(NOR.GT.NXMAP) NOR=NXMAP
      IF(NOR.LT.1) GO TO 350
  200 NWX = NOR - NOL + 1
      IF(NWX.GT.0) GO TO 220
      IF(NWX.EQ.0) GO TO 350
  210 IRROR=-210
      GO TO 400
C
C     COMPUTE OMAP(M) ARRAY INDEX EXTREMES FOR MAP POINTS IN THIS ROW
C
  220 MCRMT=(J-1)*NXMAP
      K = NOL + MCRMT
      L = K+NWX-1
C
C     ADJUST OR ADD CONTRIBUTIONS TO THE MAP POINTS
C
      GO TO (224,224,221,221,222,222),NORD
  221 OMA=T(IP)
      GO TO 224
  222 OMA=PS(IP)
  224 DO 300 M=K,L
      GO TO (225,245,230,240,230,240),NORD
  225 OMAP(M)=OMAP(M)+1.0
      GO TO 300
  230 OMAP(M) = AMIN1(OMA,OMAP(M))
      GO TO 300
  240 OMAP(M) = AMAX1(OMA,OMAP(M))
      GO TO 300
  245 XREL=M   -MCRMT
      XREL = X1   + DGX*XREL - X(IP)
      OMA = Q*EXP( - (XREL*COSA + YREL*SINA)**2/VARX2 - (YREL*COSA
     1 - XREL*SINA)**2/VARY2)
  250 OMAP(M) = OMAP(M) + OMA
  300 CONTINUE
  350 CONTINUE
      RETURN
  400 CALL ERROR(PROGRM,IRROR,ISOUT)
      END
```

```
      SUBROUTINE GOGO
C
C     THIS SUBROUTINE, WHICH IS CALLED BY LINK9, CONTROLS  READ-IN OF
C     PARTICLE DATA AND PCUTS ITS PROCESSING AND ITS LOADING ON TO
C     TEMPORARY STORAGE TAPE.
C
C     H.G.NORMENT     JUNE 28,1971
C
C********************************* GLOSSARY ****************************
C
C     ICTR          A CONTROL PARAMETER - WHEN ICTR.NE.NZ , ANOTHER
C                   MAP CORE LOAD IS SIGNALED TO FOLLOW
C     NIJ           A BLOCK COUNT OF DATA STORED ON TAPE AND/OR IN CORE
C     NZ            NUMBER OF MAP CORE LOADS REQUIRED BEYOND THE FIRST
C
C     ALSO SEE LINK3 GLOSSARY
C
C **********************************************************************
C
      COMMON /SET1/
     1CAY        ,DETID(12) ,DIAM(201) ,DMEAN     ,DNS       ,EXPO      ,
     2DITID(200),IDISTR    ,IEXEC     ,IRISE     ,ISIN      ,ISOUT     ,
     3NDSTR      ,TID(200)  ,SD        ,SSAM      ,TME       ,TMP1      ,
     4TMP2       ,T2M       ,U         ,VPR       ,W         ,HBURST    ,
     5SCLDHB     ,NHODO     ,ZV(200)   ,VX(200)   ,VY(200)
      COMMON /PARDAT/
     1X(500)     ,Y(500)    ,ZOUT(500) ,SXOT(500) ,SYOT(500) ,ROUT(500) ,
     2PS(500)    ,FMAS(500) ,KTR(500)  , F        , GAMA     ,  BSQ     ,
     3ASQ        ,SINA      ,COSA      ,WFMAS(200),YPRMU     ,YPRML     ,
     4T(500)
      COMMON /RUNDAT/
     1NIJ        ,NE        ,NREQ      ,NZ        ,ICTR      ,NXMAP     ,
     2T1         ,T2        ,MAPRUN    ,TGZ       ,IP        ,JC(18)    ,
     3IC(18)     ,NYMAP     ,NTASK     ,NORD      ,XGZ       ,YGZ
      COMMON /CONDAT/
     1IPOUT      ,JPOUT     ,KPOUT     ,KTAPE     ,LTAPE     ,MARRAY    ,
     2NMAP       ,MXREQ     ,IH        ,IV
C
C **********************************************************************
C
      DATA PROGRM/6HGOGO  /
      IEXEC = 1
C     READ A DATA BLOCK COUNT
C
  100 READ(KTAPE)NIJ
      NE=0
C
C     ARE WE FINISHED PROCESSING THE DATA-
C
      IF(NIJ.EQ.0) GO TO 400
      IF(NIJ.LE.MARRAY) GO TO 200
  150 IRROR=-150
  160 CALL ERROR(PROGRM,IRROR,ISOUT)
C
C     READ A BLOCK OF PARTICLE DATA
C
  200 READ(KTAPE)(X(I),Y(I),ZOUT(I),T(I),SXOT(I),SYOT(I),ROUT(I),PS(I),
     1FMAS(I),I=1,NIJ)
```

```
C
C     CALL PCHECK TO BEGIN PROCESSING THE PARTICLE DATA INTO A MAP
C
      CALL PCHECK
      IF(NZ.EQ.ICTR) GO TO 100
C
C     CALL PDUMP TO DUMP PARTICLE DATA ON TO TAPE FOR USE IN SUBSEQUENT
C     MAP CORE LOADS
C
      CALL PDUMP
      GOTO 100
  400 RETURN
      END
```

```
      SUBROUTINE LINK8 (NUMTAP)
C
C     THIS PROGRAM INITIALIZES AND WRITES HEADINGS FOR THE OUTPUT
C     PROCESSOR.  THEN IT CALLS THE FIRST PART OF THE PARTICLE ACTIVITY
C     MODULE (PAM1) TO PRECOMPUTE DATA USED BY THE SECOND PART OF THE
C     PARTICLE ACTIVITY MODULE WHICH WILL BE CALLED DURING THE
C     EXECUTION OF LINK9.
C
C     MAPA VERSION  -  DESIGNED TO OPERATE WITH THE DTM
C     H.G.NORMENT      JUNE 25,1971
C
C********************************* GLOSSARY ***************************
C
C     CUTMAP              CUT-OFF THRESHOLD FOR MAP ORDINATE VALUES
C     DELTAX              MAXIMUM WIDTH OF A CORE-LOAD MAP
C     DGX, DGY            MAP GRID POINT SEPARATION DISTANCES IN THE
C                         X AND Y DIRECTIONS
C     FMASS(I)            FALLOUT MASS FRACTION IN EACH SIZE CLASS
C     FP(I)               TOTAL RADIOACTIVITY IN EACH SIZE CLASS
C     FSUM                SUM OF ALL MAP POINT ORDINATES
C     FW                  FISSION YIELD
C     GRUFF               A COMBINED GROUND ROUGHNESS AND RADIATION METER
C                         RESPONSE FACTOR
C     IC(J)               RUN    CONTROL VARIABLES
C       IC(17).GT.0       NO MAPS ARE TO BE PRODUCED
C       IC(18).GT.0       PRINT CONTENTS OF TAPE IPOUT
C     ICTR                SEE  GOGO GLOSSARY
C     IH                  PRINTER DESCRIPTION-- NUMBER OF CHARCTERS/INCH
C                         ACROSS A PAGE OF PRINTED OUTPUT
C     IV                  PRINTER DESCRIPTION-- NUMBER OF CHARCTERS/INCH
C                         DOWN   A PAGE OF PRINTED OUTPUT
C     INC                 NUMBER OF MAP ORDINATE COLUMNS THAT CAN BE
C                         ACCOMODATED BY THE PRINTER PAPER
C     IPOUT             TAPE ON WHICH PARTICLE PARAMETERS ARE WRITTEN BY
C                         THE DTM (OPM BINARY INPUT)
C     ISOUT               SYSTEM OUTPUT TAPE NUMBER
C     ISIN                SYSTEM INPUT TAPE NUMBER
C     IRROR               ERROR STOP TRACE WORD
C     ITAB                NUMBER OF PARTICLE SIZE CLASSES
C     JC(J)               MAP SPECIFICATION CONTROL VARIABLES
C       JC(1)=1           2 LINE E FORMAT
C       JC(1)=2           2 LINE F11.3 FORMAT
C     KTR(I)              SEE PCHECK GLOSSARY
C     MARRAY              PARTICLE DATA ARRAYS DIMENSION
C     MASCHN              MASS CHAIN NUMBER FOR A NREQ=10 REQUEST
C     MXREQ               MAXIMUM NUMBER OF PROCESSING REQUEST TYPES
C                         ALLOWED FOR IN THE CODE
C     NE                  SEE PCHECK GLOSSARY
C     NIJ                 NUMBER OF PARTICLE DESCRIPTIONS IN THE CURRENT
C                         PARTICLE BLOCK
C     NMAP                MAXIMUM NUMBER OF  MAP POINTS IN A MAP CORE LOAD
C     NOL                 SMALLEST X INDEX OF A MAP POINT TO THE RIGHT OF
C                         THE LEFT  BOUNDARY OF THE CONTRIBUTION ELLIPSE
C                         OF A DEPOSIT INCREMENT
C     NOR                 LARGEST  X INDEX OF A MAP POINT TO THE LEFT  OF
C                         THE RIGHT BOUNDARY OF THE CONTRIBUTION ELLIPSE
C                         OF A DEPOSIT INCREMENT
C     NORD                ROUTING PARAMETER FOR PARTICLE CONTRIBUTIONS
```

```
C                               AT MAP POINTS - -                              LINK8  59
C                                    1 - TIME OF ARRIVAL (NREQ=11)             LINK8  60
C                                        SMALLEST PARTICLE SIZE (NREQ=13)      LINK8  61
C                                    2 - TIME OF CESSATION (NREQ=12)           LINK8  62
C                                        LARGEST PARTICLE SIZE (NREQ=14)       LINK8  63
C                                    3 - STRAIGHTFORWARD ADDITION OF THE       LINK8  64
C                                        GAUSSIAN DISTRIBUTED QUANTITY TO EACH LINK8  65
C                                        MAP POINT (NREQ=2-10, 15-16)          LINK8  66
C                                    4 - COUNT OF DEPOSIT INCREMENTS (NREQ=1)  LINK8  67
C     NOX                       NUMBER OF GRID POINTS ALLOWED IN X DIRECTION   LINK8  68
C                               IN A CORE-LOAD MAP                             LINK8  69
C     NREQ                      COMPUTATION OPTION CODE                        LINK8  70
C     NRQ                       A COUNTER FOR MAP REQUESTS                     LINK8  71
C     NST                       TALLY OF PARTICLE DATA BLOCKS                  LINK8  72
C     NTASK                     A TALLY OF MAP SPECIFICATIONS                  LINK8  73
C     NUMTAP( )                 TAPE NUMBER ARRAY                              LINK8  74
C     NXMAP                     NUMBER OF MAP POINTS ON THE X AXIS IN A MAP CORELINK8  75
C                               LOAD                                           LINK8  76
C     NYMAP                     NUMBER OF MAP POINTS ON THE Y AXIS IN A MAP CORELINK8  77
C                               LOAD                                           LINK8  78
C     NZ                        NUMBER OF MAP CORE LOADS REQUIRED IN ADDITION TOLINK8  79
C                               THE FIRST                                      LINK8  80
C     OMAP(J)                   THE MAP ORDINATE ARRAY                         LINK8  81
C     OPID( )                   OUTPUT PROCESSOR IDENTIFICATION                LINK8  82
C     PACT(I)                   PARTICLE SIZE CLASS UPPER BOUNDARY DIAMETER    LINK8  83
C     PSIZE(I)                  PARTICLE SIZE CLASS CENTRAL DIAMETERS          LINK8  84
C     QCUT                      CUT-OFF THRESHOLD FOR AN INDIVIDUAL DEPOSIT    LINK8  85
C                               INCREMENT CONTRIBUTION                         LINK8  86
C     T1,T2                     REQUEST TIME ARGUMENTS                         LINK8  87
C     TEXIT                     TIME RELATIVE TO SHOT TIME CORRESPONDING TO T2 LINK8  88
C     TIME,TENTER               TIME RELATIVE TO SHOT TIME CORRESPONDING TO T1 LINK8  89
C     X,Y,ZOUT,T,SXOT,          PARTICLE DESCRIPTION PARAMETERS(ALL INDEXED)   LINK8  90
C       SYOT,ROUT,PS,FMAS                 SEE GLOSSARY IN DTM REPORT           LINK8  91
C     XMAX,XMIN                 MAXIMUM AND MINIMUM X COORDINATES OF THE MAP   LINK8  92
C     YMAX,YMIN                 MAXIMUM AND MINIMUM Y COORDINATES OF THE MAP   LINK8  93
C     X1,X2                     X AXIS BOUNDRY COORDINATES OF THE CURRENT MAP  LINK8  94
C                               CORE LOAD                                      LINK8  95
C     WID( )                    DTM IDENTIFICATION                             LINK8  96
C     WFMAS(I)                  TOTAL MASS OF FALLOUT IN EACH PARTICLE SIZE    LINK8  97
C                               CLASS/ GRUFF                                   LINK8  98
C     ZDEP                      ALTITUDE OF THE PARTICLE DEPOSITION PLANE      LINK8  99
C                                                                              LINK8100
C *****************************************************************************LINK8101
C                                                                              LINK8102
C *****************************************************************************LINK8103
C                                                                              LINK8104
C                                                                              LINK8105
C     FOR A GLOSSARY OF COMMON /SET1/ SEE DASA-1800-III(REVISED)               LINK8106
C                                                                              LINK8107
      COMMON /SET1/                                                            LINK8108
     1DAY      ,DETID(12) ,DIAM(201) ,DMEAN     ,DNS       ,EXPO      ,LINK8109
     2DITID(200),IDISTR    ,IEXEC     ,IRISE     ,ISIN      ,ISOUT     ,LINK8110
     3NDSTR    ,TID(200)  ,SD        ,SSAM      ,TME       ,TMP1      ,LINK8111
     4TMP2     ,T2M       ,U         ,VPR       ,W         ,HBURST    ,LINK8112
     5SCLDHB   ,NHODO     ,ZV(200)   ,VX(200)   ,VY(200)              LINK8113
      COMMON /PARDAT/                                                          LINK8114
     1X(500)   ,Y(500)    ,ZOUT(500) ,SXOT(500) ,SYOT(500) ,ROUT(500) ,LINK8115
     2PS(500)  ,FMAS(500) ,KTR(500)  ,  F       , GAMA     ,  BSO     ,LINK8116
```

```
     3ASQ       ,SINA       ,COSA       ,WFMAS(200),YPRMU      ,YPRML      ,LINK8117
     4T(500)                                                               LINK8118
      COMMON /RUNDAT/                                                      LINK8119
     1NIJ       ,NE         ,NPEQ       ,NZ         ,ICTR       ,NXMAP      ,LINK8120
     2T1        ,T2         ,MAPRUN     ,TGZ        ,IP         ,IC(15)     ,LINK8121
     3IC(18)    ,NYMAP      ,NTASK      ,NORD       ,XGZ        ,YGZ         LINK8122
      COMMON /MAPDAT/                                                      LINK8123
     1OMAP(15000),OCUT      ,CUTMAP     ,DGX        ,DGY        ,DELTAX     ,LINK8124
     2XMAX      ,XMIN       ,YMAX       ,YMIN       ,FSUM       ,RUFSAM     ,LINK8125
     3X1        ,X2         ,MFTAPE     ,ZDEP                                LINK8126
      COMMON /CONDAT/                                                      LINK8127
     1IPOUT     ,JPOUT      ,K..JT      ,KTAPE      ,LTAPE      ,MARRAY     ,LINK8128
     2NMAP      ,MXREQ      ,IH         ,IV                                  LINK8129
      COMMON/OUTPUT/                                                       LINK8130
     1    FISNUM      ,FP     (200) ,FW          ,ITAB        ,JGO          LINK8131
     2    ,MASCHN     ,PSIZE  (200) ,FMASS(200)  ,PACT(200)                 LINK8132
C                                                                          LINK8133
C *************************************************************************LINK8134
C                                                                          LINK8135
C     DIMENSIONS PECULIAR TO LINK8                                         LINK8136
      DIMENSION         CRID(12)       ,OPID(12)       ,PSCID(12)          LINK8137
     1,NUMTAP(15),WID(12)                                                  LINK8138
      DIMENSION DD(260)                                                    LINK8139
C                                                                          LINK8140
C *************************************************************************LINK8141
C                                                                          LINK8142
 1    FORMAT(12A6)                                                         LINK8143
 2    FORMAT(15X,18I4)                                                     LINK8144
 10   FORMAT(////29X,63H****  SUMMARY OF PRECEDING DELFIC MODULE RUN IDELINK8145
     1NTIFIERS  **** ///25X43H****  OUTPUT PROCESSOR IDENTIFICATION  ***LINK8146
     2*/25X,12A6///25X,56H****  INITIAL CONDITIONS (FIREBALL) IDENTIFICALINK8147
     3TION  ****/25X,12A6///25X,37H****  CLOUD RISE IDENTIFICATION  ****LINK8148
     4/25X,12A6///25X,57H****  CLOUD RISE-TRANSPORT INTERFACE IDENTIFICALINK8149
     5TION  ****.  /25X,12A6///25X,46H****  DIFFUSIVE TRANSPORT IDENTIFLINK8150
     6ICATION  ****/25X,12A6)                                              LINK8151
 11   FORMAT(//15X24HTRANSPORT IDENTIFICATION//25X,12A6)                   LINK8152
 12   FORMAT(//25X,24H****  OTHER INPUTS  ****)                            LINK8153
 15   FORMAT(18I4)                                                         LINK8154
 16   FORMAT(/15X77H****  THE CONTROL VARIABLE ARRAY, IC(J), HAS GIVEN TLINK8155
     1HE FOLLOWING VALUES  ****)                                           LINK8156
 21   FORMAT(//15X43HPRINTER DESCRIPTION  -  CHARACTERS PER INCH)          LINK8157
 22   FORMAT(15X,10HHORIZONTAL15,10X,10HVERTICAL  I3)                      LINK8158
 26   FORMAT(17X,1HX,11X,1HY, 11X,1HZ, 11X,1HT, 9X,4HSXOT, 8X,4HSYOT,      LINK8159
     1 8X, 4HROUT, 9X,2HPS, 9X,4HFMAS//)                                   LINK8160
 28   FORMAT(1H1///51X19H* * * * * * * * * *//12X101HT H E  D E P A R TLINK8161
     1 M E N T   O F   D E F E N S E   F A L L O U T   P R E D I C T I OLINK8162
     2 N   S Y S T E M,//51X,19H* * * * * * * * * *////48X,23HOUTPUT PROLINK8163
     3CESSOR MODULE///55X,11HPREPARED BY/44X,31HMT. AUBURN RESEARCH ASSOLINK8164
     4C.,INC../54X,13HNEWTON, MASS.)                                       LINK8165
 29   FORMAT(////45X41HLISTING OF DEPOSIT INCREMENT DESCRIPTIONS)          LINK8166
 30   FORMAT(//10X6HBLOCK I4)                                              LINK8167
 36   FORMAT(10X,9E12.4)                                                   LINK8168
 37   FORMAT(10X, 43HNO. OF DEPOSIT INCREMENTS IN THIS BLOCK IS I4)        LINK8169
 39   FORMAT(46H NO MAPS.  THIS RUN FOR TAPE IPOUT PRINT ONLY.)            LINK8170
C                                                                          LINK8171
C************************ BEGINNING OF PROGRAM ****************************LINK8172
C                                                                          LINK8173
      LOGICAL SKIP                                                         LINK8174
```

```
      DATA PROGRM /6H LINK8/
      KOUT=ISOUT
      IPOUT=NUMTAP(9)
      JPOUT=NUMTAP( 2)
      KPOUT=NUMTAP( 3)
      MXPEO=20
      MARRAY =  500
      NMAP=15000
      NTASK=0
C     READ IPOUT HEADER DATA
 102  REWIND IPOUT
      READ (IPOUT)JPOTJ
  101 READ(IPOUT)FW,SSAM,SLDTMP,TMSD,SIGMA,TW,HBURST,XGZ,YGZ,TGZ,BZ,
     1ROPART,IRAD,RADMAX,ZBRSTZ
CONVERT HBURST IN METERS TO HOB IN FEET
      HOB=HBURST/.3048
C
C     READ PREVIOUS IDENTIFIERS FROM GROUNDED PARTICLES TAPE
      READ(IPOUT)(PSEID(J),J=1,12)
      READ(IPOUT)( CRID(J),J=1,12)
      READ(IPOUT)(DETID(J),J=1,12)
      READ(IPOUT)(WID(J),J=1,12)
      READ (IPOUT)ITAB
      READ(IPOUT)(PSIZE(J),FMASS(J),PACT(J),J=1,ITAB)
      READ(IPOUT)NAT
      READ(IPOUT)(OD(J),DD(J),DD(J),J=1,NAT)
C
C     READ IDENTIFIER FOR OUTPUT PROCESSOR RUN
      READ (ISIN,1)(OPID(J),J=1,12)
C
C     READ CONTROL VARIABLE ARRAY
 110  READ (ISIN,15)(IC(J),J=1,18)
C
C     THIS PART OF THE CODE DUMPS TAPE IPOUT IF REQUIRED
C     IC(18) POSITIVE MEANS DUMP TAPE IPOUT BEFORE EXECUTION
      SKIP = .TRUE.
C     IC(18) = 0 MEANS DO NOT DUMP TAPE IPOUT
      IF(IC(18)) 500,5021,502
 500  IRROR=-500
      GO TO 333
 502  SKIP=.FALSE.
      WRITE (ISOUT,28)
      WRITE (ISOUT,11)(WID(J),J=1,12)
      WRITE (ISOUT,29)
 5021 NST = 0
  600 READ (IPOUT)NIJ
      NST=NST+1
      IF(NIJ) 503,501,504
 503  IRROR=-503
      GO TO 333
  504 READ(IPOUT)(X(I),Y(I),ZOUT(I),T(I),SXOT(I),SYOT(I),ROUT(I),PS(I),
     1FMAS(I),I=1,NIJ)
      IF(SKIP) GO TO 600
      WRITE (ISOUT,30)NST
      WRITE (ISOUT,37)NIJ
      WRITE (ISOUT,26)
      WRITE(ISOUT,36)(X(I),Y(I),ZOUT(I),T(I),SXOT(I),SYOT(I),ROUT(I),
     1PS(I),FMAS(I),I=1,NIJ)
```

```
      GO TO 600
 501  CONTINUE
C     IC(17)  POSITIVE MEANS STOP WITHOUT ENTERING OUTPUT PROCESSOR
C     IC(17) = 0 MEANS PROCEED WITH JOB
  505 IF(IC(17)) 506,511,510
 506  IRROR=-506
 333  CALL ERROR (PROGRM,IRROR,ISOUT)
  510 WRITE (ISOUT,39)
      CALL EXIT
C     END OF TAPE IPOUT DUMP
C
 511  CONTINUE
C
C     READ PRINTER DESCRIPTION - CHAR/INCH HORIZONTAL,VERTICAL
 5111 READ (ISIN,15)IH,IV
C     PRINT A HEADING TO IDENTIFY PRINTED OUTPUT
      WRITE (ISOUT,28)
      WRITE (ISOUT,10) (OFID(J),J=1,12),(DETID(J),J=1,12),(CRID(J),J=1,1
     12),(PSEID(J),J=1,12),(WID(J),J=1,12)
      WRITE (ISOUT,12)
      WRITE (ISOUT,16)
      WRITE (ISOUT,2)(IC(J),J=1,18)
      WRITE (ISOUT,21)
      WRITE (ISOUT,22)IH,IV
C
      CALL PAM1
     1    (HCB    ,SLDTMP ,TMSD   ,TW
     2    ,ISIN ,ISOUT ,IPCUT ,NUMTAP ,SIGMA )
  117 RETURN
      END
```

```
      SUBROUTINE LINK9
C
C     MAPA VERSION  -  DESIGNED TO OPERATE WITH THE DTM
C     H.G.NORMENT      JUNE 28,1971
C
C ***********************************************************************
C
C     SECOND HALF OF THE OUTPUT PROCESSOR MAIN CONTROL PROGRAM
C     THIS SUBROUTINE INITIALIZES AND CONTROLS FOR MAP CALCULATIONS
C
C     SUBROUTINES CALLED -
C     GOGO
C     MAP
C
C********************************** GLOSSARY ***************************
C
C     SEE THE LINK8 GLOSSARY
C
C ***********************************************************************
C
      COMMON /SET1/
     1CAY       ,CETID(12) ,DIAM(201) ,DMEAN     ,DNS       ,EXPO      ,
     2DITTID(200),IDISTR    ,IEXEC     ,IRISE     ,ISIN      ,ISOUT     ,
     3NDSTP     ,TID(200)  ,SD        ,SSAM      ,TME       ,TMP1      ,
     4TMP2      ,T2M       ,U         ,VPR       ,W         ,HBURST    ,
     5SCLDHB    ,NHODO     ,ZV(200)   ,VX(200)   ,VY(200)
      COMMON /PARDAT/
     1X(500)    ,Y(500)    ,ZOUT(500) ,SXOT(500) ,SYOT(500) ,ROUT(500) ,
     2PS(500)   ,FMAS(500) ,KTR(500)  ,  F       , GAMA     ,  BSQ     ,
     3ASQ       ,SINA      ,COSA      ,WFMAS(200),YPRMU     ,YPRML
     4T(500)
      COMMON /RUNDAT/
     1NIJ       ,NE        ,NREQ      ,NZ        ,ICTR      ,NXMAP     ,
     2T1        ,T2        ,MAPRUN    ,TGZ       ,IP        ,JC(18)    ,
     3IC(18)    ,NYMAP     ,NTASK     ,NORD      ,XGZ       ,YGZ
      COMMON /MAPDAT/
     1OMAP(15000),QCUT     ,CUTMAP    ,DGX       ,DGY       ,DELTAX    ,
     2XMAX      ,XMIN      ,YMAX      ,YMIN      ,FSUM      ,RUFSAM    ,
     3X1        ,X2        ,MBTAPE    ,ZDEP
      COMMON /CONDAT/
     1IPOUT     ,JPOUT     ,KPOUT     ,KTAPE     ,LTAPE     ,MARRAY    ,
     2NMAP      ,MXREQ     ,IH        ,IV
      COMMON/OUTPUT/
     1    FISNUM       ,FP     (200) ,FH            ,ITAB      ,JGO
     2   ,MASCHN       ,PSIZE  (200) ,FMASS(200)    ,PACT(200)
      COMMON/DECAY/
     1    IGO          ,JD           ,KDOS          ,TENTER
     2   ,TEXIT        ,TIME
C
C ***********************************************************************
C
 1    FORMAT(12A6)
 2    FORMAT (//15X,23HSUM OF MAP ORDINATES = E13.6 )
 3    FORMAT(1H1////54X,11H* * * * * *)
 4    FORMAT (//15X,23HGROUND ROUGHNESS FACTOR F10.3,10X,15HALTITUDE OF
     1GZ F10.3)
    9 FORMAT(7F10.3)
 15   FORMAT(18I4)
```

```
 17   FORMAT(32H OUTPUT PROCESSING IS COMPLETED.)                        LINK9 59
 23   FORMAT(1H1///39X27H****  OUTPUT PROCESSOR TASKI5,6H  ****)         LINK9 60
 24   FORMAT(///15X25HGRID LIMITS AND INTERVALS/18X4HXMIN10X4HXMAX10X4HYLINK9 61
     1MIN10X4HYMAX10X7HDELTA X10X7HDELTA Y/15XF10.0,4XF10.0,4XF10.0,4XF1LINK9 62
     20.0,5XF10.1,5XF10.1)                                               LINK9 63
 25   FORMAT(//15X71HTHE CONTROL VARIABLE ARRAY, JC(J), HAS BEEN GIVEN TLINK9 64
     1HE FOLLOWING VALUES./15X18I4)                                      LINK9 65
 27   FORMAT(/15X32HMAPPED ON GRID INTERVALS  DGX = F10.1,7H   DGY=F10.1LINK9 66
     1)                                                                  LINK9 67
 31   FORMAT(117H0INADEQUATE PRINTER DESCRIPTION. AN UNDISTORTED MAP CANLINK9 68
     1NOT BE GUARANTEED. THIS RUN WAS CONTINUED WITH PRINTER DESCRP./5X,LINK9 69
     214HIH=10 AND IV=6)                                                 LINK9 70
   32 FORMAT(I4,2F10.3,I4,2F10.3)                                        LINK9 71
 33   FORMAT(25H0UNACCEPTABLE REQUEST ...I4)                             LINK9 72
 34   FORMAT(//////15X,15HREQUEST NUMBER I4///15X,5HTYPE I4,10X5HT1 = F1LINK9 73
     10.1,10X,5HT2 = F10.1,10X,9HMASCHN = I4// 15X,6HQCUT= ,E12.5,10X,8HLINK9 74
     2CUTMAP= ,E12.5)                                                    LINK9 75
 35   FORMAT(I5)                                                         LINK9 76
C                                                                        LINK9 77
C ***********************************************************************LINK9 78
C ***********************************************************************LINK9 79
C                                                                        LINK9 80
      DIMENSION DD(260)                                                  LINK9 81
      DATA PROGRM  /6H LINK9/                                            LINK9 82
      LOGICAL JD,KDOS,IGO                                                LINK9 83
C                                                                        LINK9 84
      IGO=.TRUE.                                                         LINK9 85
      NUL=0                                                              LINK9 86
      FSUM=0.0                                                           LINK9 87
  119 IF(FSUM)1601,1191,1601                                             LINK9 88
 1601 WRITE(ISOUT,2) FSUM                                                LINK9 89
      FSUM=0.0                                                           LINK9 90
C                                                                        LINK9 91
C1191 READ LIMITS ON AREA OF INTEREST                                    LINK9 92
 1191 READ(ISIN,9)XMAX,XMIN,YMAX,YMIN,DGX,DGY,GRUFF                      LINK9 93
      IF(GRUFF)1602,1602,1603                                            LINK9 94
 1602 GRUFF=1.0                                                          LINK9 95
 1603 IF(ABS(DGX) + ABS(DGY))120,120,121                                 LINK9 96
 120  WRITE (ISOUT,17)                                                   LINK9 97
      REWIND IPOUT                                                       LINK9 98
      PRINT 17                                                           LINK9 99
      RETURN                                                             LINK9100
C                                                                        LINK9101
C     READ OTHER SPECIFIC INPUT                                          LINK9102
  121 READ(ISIN,9)ZDEP                                                   LINK9103
      READ (ISIN,15) (JC(J),J=1,18)                                      LINK9104
      NTASK=NTASK+1                                                      LINK9105
      NRQ=0                                                              LINK9106
C                                                                        LINK9107
C     CHECK PRINTER DESCRIPTIONS                                         LINK9108
      NI=IH*IV                                                           LINK9109
      IF(NI)601,601,122                                                  LINK9110
  601 IH=10                                                              LINK9111
      IV=6                                                               LINK9112
      WRITE (ISOUT,31)                                                   LINK9113
C                                                                        LINK9114
C 122  WRITE  A LOCAL HEADING                                            LINK9115
 122  WRITE (ISOUT,23)NTASK                                              LINK9116
```

```
 1225 WRITE(ISOUT,24) XMIN,XMAX,YMIN,YMAX,DGX,DGY
      WRITE (ISOUT,4)  GRUFF ,ZDEP
      WRITE (ISOUT,25)(JC(J),J=1,15)
      GO TO 1209
C
 1211 CONTINUE
C
 1209 IF(FSUM)1604,1219,1604
 1604 WRITE (ISOUT,2) FSUM
C 1219 READ A REQUEST FOR PROCESSING
 1219 READ(ISIN,32)NREQ,T1,T2,MASCHN,OCUT,CUTMAP
      IF(MASCHN.EQ.0.AND.NREQ.NE.10)GO TO 1210
      IF(MASCHN.GT.71.AND.MASCHN.LT.162)GO TO 1210
      CALL ERROR(PROGRM,1209,ISOUT)
      MASCHN=95
C
C     CLEAR OUT THE OMAP ARRAY
C
 1210 CLROT=0.0
      IF((NREQ.EQ.11).OR.(NREQ.EQ.13)) CLROT=1.E30
      DO 935 I=1,NMAP
  935 OMAP(I)=CLROT
      MAPRUN=0
      NRQ=NRQ+1
      FSUM = 0.0
C
C     IS NREQ AN ACCEPTABLE REQUEST
C     NO TO 1215
      IF(NREQ)1212,1212,1213
 1213 IF(NREQ-MXREQ)1214,1214,1215
 1215 WRITE (ISOUT,33)NREQ
      GO TO 1209
C
C     MXREQ IS MAXIMUM NUMBER OF CALCULATION CODES ALLOWED FOR IN CALC.
C 1212 NO MORE REQUESTS. PREPARE TO RETURN TO READ LOCAL DATA.
 1212 CONTINUE
      GO TO 119
 1214 REWIND IPOUT
      READ(IPOUT)ITST
      READ(IPOUT)TST,TST,TST,TST,TST,TST,TST,TST,TST,TST,TST,TST,ITST,
     1 TST,TST
      READ(IPOUT)(DETID(J),J=1,12)
      READ(IPOUT)(DETID(J),J=1,12)
      READ(IPOUT)(DETID(J),J=1,12)
      READ(IPOUT)(DETID(J),J=1,12)
      READ(IPOUT)ITAB
      READ(IPOUT)(DD(J),DD(J),DD(J),J=1,ITAB)
      READ(IPOUT)NAT
      READ(IPOUT)(DD(J),DD(J),DD(J),J=1,NAT)
      IF(NRQ-1)1221,1222,1221
 1221 WRITE (ISOUT,3)
 1222 WRITE (ISOUT,34)NRQ,NREQ,T1,T2,MASCHN ,OCUT,CUTMAP
      RUFSAM = SSAM/GRUFF
      JGO=1
      FISNUM=FW*1.45E15
      IF(NREQ.EQ.15.OR.NREQ.EQ.16) GO TO 1223
      T1=TIMSEC(T1,3,0)
      T2=TIMSEC(T2,3,0)
```

```
 1223 TIME=T1-TGZ
      TENTER=TIME
      TEXIT=T2-TGZ
      JD=.TRUE.
      KDOS=.FALSE.
      GO TO (80,81,79,78,82,80,80,82,78,83,80,80,80,80,80,81,80,80,80,80
     1),NPEQ
   81 TIME=3600.0
      GO TO 79
   82 KDOS=.TRUE.
      GO TO 78
   83 JGO=2
      FISNUM=FISNUM*1.E+4
      RUFSAM=SSAM
      GO TO 79
   78 JD=.FALSE.
      FISNUM=FISNUM/3600.
   79 CALL PAM2
   80 CONTINUE
C
C     INITIALIZE FOR PROCESSING
      DO 1705 I=1,ITAB
 1705 WFMAS(I) = FMASS(I)*RUFSAM
  801 IF (NRQ.GT.1) GO TO 1502
C
 1217 CONTINUE
 1302 DISY=IV
      DISX=IH
      RD=2.0*DISY/DISX
      DISX=RD*DGY
      IF(DISX-DGX)1303,1304,1304
 1303 DGX=DISX
 1304 DGY=DGX/RD
C
C     PREPARE TO PROCESS OUTPUT
C*******CALCULATE NUMBER OF MAP CORE LOADS BEYOND FIRST
  140 NYMAP = (YMAX - YMIN)/DGY
      NXMAP=(XMAX-XMIN)/DGX
      NST = NMAP/NYMAP
      IF(NXMAP-NST) 1503,1503,1402
 1402 NXMAP=NST
      XMAP=NXMAP
      ZZ=(XMAX-XMIN)/(XMAP*DGX)
      NZ=ZZ
      TST=NZ
      IF(ZZ-TST) 1500,1501,1401
 1500 IRROR=-1500
      GO TO 333
 1501 NZ=NZ-1
      GO TO 1401
 1503 NZ=0
C
C******** END OF MAP CORE LOADS CALCULATION
 1401 NOX=NXMAP
      IF(NOX)1403,1403,1404
 1403 IRROR=-1403
  333 CALL ERROR (PROGRM,IRROR,ISOUT)
      GO TO 1211
```

```
 1404 OX=NOX                                                            LINK9233
      DELTAX=OX*DGX                                                     LINK9234
C                                                                       LINK9235
 1502 WRITE (ISOUT,27)DGX,DGY                                           LINK9236
C                                                                       LINK9237
      X1=XMIN                                                           LINK9238
      X2=X1+DELTAX                                                      LINK9239
C                                                                       LINK9240
C ***********************************************************************LINK9241
C                                                                       LINK9242
  300 CONTINUE                                                          LINK9243
  301 ICTR=0                                                            LINK9244
      IF(NZ)203,204,207                                                 LINK9245
 203  IERROR=-203                                                       LINK9246
      GO TO 333                                                         LINK9247
C                                                                       LINK9248
C     THIS IS THE BRANCH FOR A SINGLE CORE LOAD MAP                     LINK9249
C                                                                       LINK9250
  204 KTAPE=IPOUT                                                       LINK9251
      CALL GOGO                                                         LINK9252
      REWIND KTAPE                                                      LINK9253
      IF((NREQ.NE.11).AND.(NREQ.NE.13)) GO TO 305                       LINK9254
      DO 302 IMAP=1,NMAP                                                LINK9255
      IF(OMAP(IMAP).GE.1.E30) OMAP(IMAP)=0.0                            LINK9256
  302 CONTINUE                                                          LINK9257
  305 CALL MAP                                                          LINK9258
      GO TO 1211                                                        LINK9259
C                                                                       LINK9260
C     THIS IS THE BRANCH FOR A MULTIPLE CORE LOAD MAP                   LINK9261
C                                                                       LINK9262
  207 KTAPE=IPOUT                                                       LINK9263
      LTAPE=JPOUT                                                       LINK9264
      CALL GOGO                                                         LINK9265
      REWIND KTAPE                                                      LINK9266
      WRITE(LTAPE)NUL                                                   LINK9267
      REWIND LTAPE                                                      LINK9268
      IF((NREQ.NE.11).AND.(NREQ.NE.13)) GO TO 308                       LINK9269
      DO 306 IMAP=1,NMAP                                                LINK9270
      IF(OMAP(IMAP).GE.1.E30) OMAP(IMAP)=0.0                            LINK9271
  306 CONTINUE                                                          LINK9272
  308 CALL MAP                                                          LINK9273
      DO 220 INDEX=1,NZ                                                 LINK9274
C                                                                       LINK9275
C     CLEAR OUT THE OMAP ARRAY                                          LINK9276
C                                                                       LINK9277
      CLROT=0.0                                                         LINK9278
      IF((NREQ.EQ.11).OR.(NREQ.EQ.13)) CLROT=1.E30                      LINK9279
      DO 702 IMAP=1,NMAP                                                LINK9280
  702 OMAP(I)=CLROT                                                     LINK9281
      IF(MOD(INDEX,2).EQ.1) GO TO 208                                   LINK9282
      KTAPE=KPOUT                                                       LINK9283
      LTAPE=JPOUT                                                       LINK9284
      GO TO 209                                                         LINK9285
  208 KTAPE=JPOUT                                                       LINK9286
      LTAPE=KPOUT                                                       LINK9287
  209 ICTR=INDEX                                                        LINK9288
      X1=X2                                                             LINK9289
      X2=X1+DELTAX                                                      LINK9290
```

```
      CALL GOGO                                                         LINK9291
      REWIND KTAPE                                                      LINK9292
      WRITE(LTAPE)NUL                                                   LINK9293
      REWIND LTAPE                                                      LINK9294
      IF((NREQ.NE.11).AND.(NREQ.NE.13)) GO TO 220                       LINK9295
      DO 215 IMAP=1,NMAP                                                LINK9296
      IF(OMAP(IMAP).GE.1.E30) OMAP(IMAP)=0.0                            LINK9297
  215 CONTINUE                                                          LINK9298
  220 CALL MAP                                                          LINK9299
      GO TO 1211                                                        LINK9300
      END                                                               LINK9301
```

```
      SUBROUTINE MAP
C     26  FEB  67
C     T.W.SCHWENKE   TECHNICAL OPERATIONS RESEARCH   SR MAP
C
C     REVISED JUNE 28, 1971    MT. AUBURN RESEARCH ASSOC .
C     FOR USE WITH DTM PRODUCED DEPOSIT INCREMENTS
C     H. G. NORMENT
C
C ********************************************************************
C
      COMMON /SET1/
     1CAY       ,DETID(12) ,DIAM(201) ,DMEAN     ,DNS       ,EXPO      ,
     2DITID(200),IDISTR    ,IEXEC     ,IRISE     ,ISIN      ,ISOUT     ,
     3NDSTR     ,TID(200)  ,SD        ,SSAM      ,TME       ,TMP1      ,
     4TMP2      ,T2M       ,U         ,VPR       ,W         ,HBURST    ,
     5SCLDHR    ,NHODO     ,ZV(200)   ,VX(200)   ,VY(200)
      COMMON /RUNDAT/
     1NIJ       ,NE        ,NREQ      ,NZ        ,ICTR      ,NXMAP     ,
     2T1        ,T2        ,MAPRUN    ,TGZ       ,IP        ,JC(18)    ,
     3IC(18)    ,NYMAP     ,NTASK     ,NORD      ,XGZ       ,YGZ
      COMMON /MAPDAT/
     1OMAP(15000),QCUT     ,CUTMAP    ,DGX       ,DGY       ,DELTAX    ,
     2XMAX      ,XMIN      ,YMAX      ,YMIN      ,FSUM      ,RUFSAM    ,
     3X1        ,X2        ,MRTAPE    ,ZDEP
      COMMON/OUTPUT/
     1    FISNUM      ,FP    (200) ,FW              ,ITAB       ,JGO
     2   ,MASCHN      ,PSIZE (200) ,FMASS(200)  ,PACT(200)
C
C ********************************************************************
C
      DIMENSION JMAP(20)
      INTEGER BLANK
      DIMENSION FMTEXP(21),FMTRUT(21)
      DATA FMTEXP(1),FMTRUT(1),FMTEXP(21),FMTRUT(21),BLANK,FMTA,FMTF,
     1    FMTI/6H(/1X, ,6H(5X,  ,6H)      ,6H)      ,6H       ,6HA6    ,
     2    6HF6.3  ,6HI6     /,DOT/6H  .   /
C
      DATA BITLUM,INC,LREW/ 6HMULTIB,19,0/
C
C ********************************************************************
C
 1    FORMAT(1H1,5HSTRIPI3)
 2    FORMAT(/1X,19I6)
 3    FORMAT(15X21HTWO-LINE E FORMAT MAP)
 4    FORMAT(5X,19F6.3)
 5    FORMAT(15X26HTWO-LINE F11.3 FORMAT MAP.)
 6    FORMAT(16H0DISPLAY METHOD I4,33H IS NOT AVAILABLE. USED METHOD 1.)
 7    FORMAT(//15X,28HTHE OUTPUT PRESENTATION IS A)
 8    FORMAT(//15X,25HTHE QUANTITY PRESENTED IS)
 9    FORMAT(15X,43HA COUNT OF CONTRIBUTING DEPOSIT INCREMENTS.)
 10   FORMAT(15X,42HEXPOSURE RATE NORMALIZED TO TIME H+1 HOUR.)
 11   FORMAT(15X,24HEXPOSURE RATE AT TIME H+F10.1,9H SECONDS.)
 12   FORMAT(15X,36HEXPOSURE ACCUMULATED BETWEEN TIME H+F10.1,22H SECOND
     1S AND INFINITY.)
 13   FORMAT(15X,36HEXPOSURE ACCUMULATED BETWEEN TIME H+F10.1,12H AND TI
     1ME H+F10.1,9H SECONDS.)
 14   FORMAT(15X,60HTOTAL MASS PER UNIT AREA OF CONTRIBUTING DEPOSIT INC
     1REMENTS.)
```

```
 15   FORMAT(15X,43HMASS PER UNIT AREA DEPOSITED BETWEEN TIMES F10.1,5H
     1AND F10.1,9H SECONDS.)
 16   FORMAT(/1X,F7.0,3X,2(10X,5H*****,F12.0,3X),20X,5H*****,/)
 17   FORMAT(15X,41HASSUMES ALL PARTICLES ARE GROUNDED BY T1.)
 18   FORMAT(15X,17HACTIVITY AT TIME F10.1,19H DUE TO MASS CHAIN I4)
 19   FORMAT(15X,26HMULTIFLE BURST BINARY TAPE)
 20   FORMAT(15X,31HGROUND ZERO IS LOCATED AT  X = F10.1,5H   , Y = F10.1
     1)
 21   FORMAT(1H1,41X,36HY-COORDINATE SCALES FOR SIDES OF MAP/1H0)
 22   FORMAT(//1X,F13.0,82X,F13.0)
 23   FORMAT(15X,46HTIME (SECONDS) OF ONSET OF FALLOUT DEPOSITION.)
 24   FORMAT(15X,50HTIME (SECONDS) OF CESSATION OF FALLOUT DEPOSITION.)
 25   FORMAT(15X,50HDIAMETER (MICRONS) OF SMALLEST DEPOSITED PARTICLE.)
 26   FORMAT(15X,49HDIAMETER (MICRONS) OF LARGEST DEPOSITED PARTICLE.)
 27   FORMAT(15X,58HMASS DEPOSITED (KGM/M**2) BY PARTICLES IN THE SIZE R
     1ANGE  ,E12.5,4H TO ,E12.5, 9H MICRONS.)
 28   FORMAT(15X,77HH+1 HOUR NORMALIZED EXPOSURE RATE RESULTING FROM PAR
     1TICLES IN THE SIZE RANGE ,E12.5,4H TO ,E12.5,9H MICRONS.)
 29   FORMAT(15X,28HUNITS ARE ROENTGENS PER HOUR)
 30   FORMAT(15X,19HUNITS ARE ROENTGENS)
 31   FORMAT(15X,18HUNITS ARE KGM/M**2)
 32   FORMAT(15X,21HUNITS ARE CURIES/M**2)
C
C *******************************************************************
C *******************************************************************
C
 99   IF(MAPRUN) 101,100,101
  100 DO 1000 I=2,20
      FMTEXP(I)=BLANK
 1000 FMTRUT(I)=BLANK
      TINC=5.0*DGX
      XCOORD=XMIN+DGX
      VINC=INC
      XCINC=VINC*DGX
      KKL=1
      NX=NXMAP
C     LEFT IS USED HERE AS A TEMPORARY STORAGE
      LEFT=(XMAX-X1)/DGX
C     PRINT MAP TITLE
      WRITE (ISOUT,7)
C     SELECT APPROPRIATE DISPLAY OPTION CODE
      IF(JC(1))147,147,131
 131  IF(JC(1)-6)132,132,147
 130  JC(1)=1
  132 N1=JC(1)
      GO TO (141,142,143,144,145,146),N1
 141  ASSIGN 150 TO N2
      WRITE (ISOUT,3)
      GO TO 102
 142  ASSIGN 151 TO N2
      WRITE (ISOUT,5)
      GO TO 102
 143  WRITE(ISOUT,19)
      ASSIGN 301 TO N2
      IF(LREW.NE.0) GO TO 1431
      LREW=1
      REWIND MBTAPE
 1431 WRITE (MBTAPE)BITLUP
```

```
      WRITE(MBTAPE)XMIN,XMAX,YMIN,YMAX,DGX,DGY
      GO TO 102
C
C*********************** CODE INSERTION POINTS ***********************
 144  CONTINUE
 145  CONTINUE
 146  CONTINUE
C*********************** CODE INSERTION POINTS ***********************
C
 147  WRITE (ISOUT,6)N1
      GO TO 130
 101  KKL=1
      NX=NXMAP
C     LEFT IS USED HERE AS A TEMPORARY STORAGE
      LEFT=(XMAX-X1)/DGX
      GO TO 1702
C 102   PRINT ORDINATE DESCRIPTION
C
 102  WRITE (ISOUT,8)
      GO TO (161,162,163,164,165,166,167,168,169,171,172,173,174,175,176
     1,177,178,179,170,170),NREO
 161  WRITE (ISOUT,9)
      GO TO 170
 162  WRITE (ISOUT,10)
      WRITE (ISOUT,29)
      GO TO 170
 163  WRITE (ISOUT,11)T1
      WRITE (ISOUT,29)
      GO TO 170
 164  WRITE (ISOUT,12)T1
      WRITE (ISOUT,30)
      GO TO 170
 165  WRITE (ISOUT,13)T1,T2
      WRITE (ISOUT,30)
      GO TO 170
 166  WRITE (ISOUT,14)
      WRITE (ISOUT,31)
      GO TO 170
 167  WRITE (ISOUT,15)T1,T2
      WRITE (ISOUT,31)
      GO TO 170
 168  WRITE (ISOUT,13)T1,T2
      WRITE (ISOUT,30)
      WRITE(ISOUT,17)
      GO TO 170
 169  WRITE (ISOUT,12)T1
      WRITE (ISOUT,30)
      WRITE (ISOUT,17)
      GO TO 170
 171  WRITE (ISOUT,18)T1,MASCHN
      WRITE (ISOUT,32)
      WRITE(ISOUT,17)
      GO TO 170
 172  WRITE (ISOUT,23)
      GO TO 170
 173  WRITE (ISOUT,24)
      GO TO 170
 174  WRITE (ISOUT,25)
```

```
      GO TO 170
  175 WRITE (ISOUT,26)
      GO TO 170
  176 WRITE (ISOUT,27) T1,T2
      GO TO 170
  177 WRITE (ISOUT,28) T1,T2
      WRITE (ISOUT,29)
      GO TO 170
C
C************************ CODE INSERTION POINTS ************************
  178 CONTINUE
  179 CONTINUE
C************************ CODE INSERTION POINTS ************************
C
  170 WRITE (ISOUT,20) XGZ,YGZ
  180 IF(JC(1).EQ.3) GO TO 1702
C
C     PRINT A PAIR OF PASTE-ON Y SCALES HERE
      WRITE (ISOUT,21)
      YY=YMIN+DGY*FLOAT(NYMAP)
      DO 1701  J=1,NYMAP
      WRITE (ISOUT,22)YY,YY
 1701 YY=YY-DGY
 1702 IF(LEFT-NX) 1021,1022,1022
 1021 NX=LEFT
 1022 MM=NX/(INC)
      M=MM+1
C     LEFT IS USED HERE AS THE NUMBER OF PRINT COLUMNS IN THE LAST
C     PRINTER STRIP
      LEFT=NX-MM*(INC)
      IF (LEFT.NE.0) GO TO 2023
      M = MM
      LEFT = INC
C     STRIPS
 2023 DO 110 ISTRIP=1,M
      MAPRUN=MAPRUN+1
      IF (JC(1).EQ.3)  GO TO 1023
      XC2=XCOORD+TINC
      XC3=XC2+TINC
      WRITE (ISOUT,1)MAPRUN
      WRITE (ISOUT,16)XCOORD,XC2,XC3
 1023 KL=KKL+(NYMAP-1)*NXMAP
      IF(ISTRIP-M)103,104,103
  104 KINC=LEFT-1
      VLEFT=LEFT
      XCIN=VLEFT*DGX
      GO TO 1031
  103 KINC=INC-1
      XCIN=XCINC
 1031 CONTINUE
      KLINK = KINC+1
      IF(JC(1).EQ.3) WRITE(MBTAPE)NYMAP,KLINK
C
C     ROWS
      DO 200 J=1,NYMAP
      KH=KL+KINC
      KDC=0
      DO 201 K=KL,KH
```

```
      IF(OMAP(K).LT.CUTMAP)OMAP(K)=0.0
 201  FSUM=FSUM+OMAP(K)
C
C     NUMBERS WITHIN ROWS
      DO 300 K=KL,KH
      KDC=KDC+1
C     TRANSFER TO CODE FOR SELECTED PRESENTATION
      GO TO N2,(150,151,301)
C
C 150 CODE FOR POWER OF TEN DISPLAY
 150  IF(OMAP(K))105,106,107
 105  ASSIGN 121 TO N3
      OMAP(K)=-OMAP(K)
      GO TO 109
 107  ASSIGN 300 TO N3
  109 H = ALOG10(OMAP(K))
      H1=AMOD(H,1.0)
      JMAP(KDC)=H-H1
      IF(JMAP(KDC).EQ.0)JMAP(KDC)=0
      FMTEXP(KDC+1) = FMTI
      FMTRUT(KDC+1) = FMTF
      IF (JMAP(KDC).NE.0)GO TO 1090
      JMAP(KDC)=0
      FMTEXP(KDC+1) = FMTA
 1090 OMAP(K) = 10.0**H1
      IF(OMAP(K)-9.999)115,115,1091
 1091 OMAP(K)=OMAP(K)*10.0
      JMAP(KDC)=JMAP(KDC)+1
      FMTEXP(KDC+1) = FMTI
      GO TO 115
  106 JMAP(KDC)=0
      OMAP(K)=0.0
      FMTEXP(KDC+1) = FMTA
      FMTPUT(KDC+1) = FMTA
      GO TO 300
 115  GO TO N3,(300,121)
C 121  RESET SIGN OF MAP COORDINATE
 121  OMAP(K)=-OMAP(K)
      GO TO 300
C
C 151 CODE FOR TWO-LINE F11.3 DISPLAY
 151  JMAP(KDC)=OMAP(K)/10.0
      ZMAP=JMAP(KDC)
      OMAP(K)=OMAP(K)-(ZMAP*10.0)
      FMTEXP(KDC+1)= FMTI
      FMTRUT(KDC+1) = FMTF
      FMTEXP(KDC+1)=FMTA
      FMTRUT(KDC+1)=FMTA
 300  CONTINUE
      WRITE(ISOUT,2      ) (JMAP(K),K=1,KDC)
      WRITE(ISOUT,4      ) (OMAP(K),K=KL,KH)
      GO TO 200
 301  WRITE (MBTAPE) (OMAP(K),K=KL,KH)
 200  KL=KL-NXMAP
      IF (JC(1).EQ.3)  GO TO 110
      WRITE (ISOUT,16)XCOORD,XC2,XC3
      XCOORD=XCOORD+XCIN
 110  KKL=KKL+INC
```

```
111   RETURN
      END
```

```
      SUBROUTINE PCHECK
C
C     THIS SUBROUTINE  DETERMINES THE TYPE OF MAP REQUESTED AND
C     IT INITIALIZES FOR THIS MAP.  FOR EACH PARTICLE IN THE DATA BLOCK
C     IT COMPUTES THE BOUNDARIES  OF ITS CONTRIBUTION ELLIPSE AND
C     IT LABELS IT ACCORDING TO WHETHER IT WILL CONTRIBUTE TO
C     SUBSEQUENT MAP CORE LOADS OR NOT.  IF A PARTICLE CONTRIBUTES TO
C     THE CURRENT MAP CORE LOAD , SUBROUTINE CALC IS CALLED.
C
C     H.G.NORMENT     JUNE 28,1971
C
C******************************** GLOSSARY ******** *****************
C
C     KTR(IP)        INDICATES WHETHER OR NOT THE PARTICLE IS TO BE
C                    CONSIDERED  IN SUBSEQUENT MAP CORE LOADS - -
C                               0 - CONSIDER PARTICLE SUBSEQUENTLY
C                               1 - REJECT PARTICLE FOR FURTHER USE
C     YPRMU          UPPER Y COORDINATE LIMIT FOR PARTICLE CONTRIBUTION
C     XPRMU          UPPER X COORDINATE LIMIT FOR PARTICLE CONTRIBUTION
C     XPRML          LOWER X COORDINATE LIMIT FOR PARTICLE CONTRIBUTION
C     YPRML          LOWER Y COORDINATE LIMIT FOR PARTICLE CONTRIBUTION
C     ASQ            SQUARE OF SEMI-AXIS A OF THE PARTICLE CONTRIBUTION
C                    LIMIT ELLIPSE
C     BSQ            SQUARE OF SEMI-AXIS B OF THE PARTICLE CONTRIBUTION
C                    LIMIT ELLIPSE
C     SINA           SIN    OF THE  ORIENTATION ANGLE OF THE A AXIS OF
C                    THE PARTICLE CONTRIBUTION LIMIT ELLIPSE
C     COSA           COSINE OF THE  ORIENTATION ANGLE OF THE A AXIS OF
C                    THE PARTICLE CONTRIBUTION LIMIT ELLIPSE
C     GAMA           LOG(BASE E) OF THE RATIO OF THE GAUSSIAN PARTICLE
C                    CONTRIBUTION DISTRIBUTION MODE VALUE TO QCUT
C     NE             COUNT OF AVAILABLE PARTICLE STORAGE LOCATIONS IN
C                    CORE.   THIS IS THE NUMBER OF PARTICLES REJECTED
C                    IN PCHECK.
C     NIJ            A BLOCK COUNT OF DATA STORED ON TAPE AND/OR IN CORE
C     F              MAGNITUDE(I.E. INTEGRATED VALUE) OF A PARTICLE
C                    PROPERTY  TO BE DISTRIBUTED ON THE MAP
C
C     ALSO SEE LINK8 GLOSSARY
C
C *******************************************************************
C
      COMMON /SET1/
     1CAY         ,DETID(12) ,DIAM(201) ,DMEAN     ,DNS       ,EXPO      ,
     2DTTID(200),IDISTR    ,IEXEC     ,IRISE     ,ISIN      ,ISOUT     ,
     3NDSTR       ,TID(200)  ,SD        ,SSAM      ,TME       ,TMP1      ,
     4TMP2        ,T2M       ,U         ,VPR       ,W         ,WBURST    ,
     5SCLDHB      ,NHODO     ,ZV(200)   ,VX(200)   ,VY(200)
      COMMON /PARDAT/
     1X(500)      ,Y(500)    ,ZOUT(500) ,SXOT(500) ,SYOT(500) ,ROUT(500) ,
     2PS(500)     ,FMAS(500) ,KTR(500)  ,  F       , GAMA     ,  BSQ     ,
     3ASQ         ,SINA      ,COSA      ,WFMAS(200),YPRMU     ,YPRML     ,
     4T(500)
      COMMON /RUNDAT/
     1NIJ         ,NE        ,NREQ      ,NZ        ,ICTR      ,NXMAP     ,
     2T1          ,T2        ,MAPRUN    ,TGZ       ,IP        ,JC(18)    ,
     3IC(18)      ,NYMAP     ,NTASK     ,NORD      ,XGZ       ,YGZ
      COMMON /MAPDAT/
```

```
     1OMAP(15000),OCUT      ,CUTMAP    ,DGX       ,DGY       ,DELTAX    ,
     2XMAX      ,XMIN       ,YMAX      ,YMIN      ,FSUM      ,RUFSAM    ,
     3X1        ,X2         ,MBTAPE    ,ZDEP
      COMMON/DECAY/
     1    IGO        ,JO          ,KDOS        ,TENTER
     2   ,TEXIT      ,TIME
      COMMON/OUTPUT/
     1    FISNUM     ,FP    (200) ,FW          ,ITAB        ,JGO
     2   ,MASCHN     ,PSIZE (200) ,FMASS(200)  ,PACT(200)
C
C ***********************************************************************
C
 210  FORMAT(8H0FORMULAI6,67H IS UNAVAILABLE. COMPUTATION WAS CONTINUED
     1FOR A REQUEST OF TYPE 6.)
C
C ***********************************************************************
      DATA PROGRM/6HPCHECK/
      NE = 0
      IF(IEXEC.EQ.1) J = 1
      IEXEC = 0
      DO 777 IP=1,NIJ
C
C     DETERMINE IF THE DEPOSIT INCREMENT IS GROUNDED
C
      IF((ZOUT(IP)-ZDEP).LT.10.0) GO TO 75
      KTP(IP)=1
      GO TO 777
   75 GO TO(101,102,103,104,105,106,107,102,102,102,112,113,114,115,116
     1,117,109,110,111,120),NREQ
C
C 101  COUNT OF GROUNDED WAFERS
  101 F=FMAS(IP)
      NORD=1
      GO TO 100
C
C 103  DOSE RATE AT TIME H+T1 SECONDS
 103  IF(T(IP) -T1)102,102,777
C
C 104 DOSE ACCUMULATED FROM TIME H+T1 SECONDS TO INFINITY
 104  IF(T(IP)-T1)1041,1041,1042
 1041 TENTER=T1 -TGZ
      GO TO  130
 1042 TENTER=T(IP) -TGZ
      GO TO 130
C
C 105  DOSE ACCUMULATED FROM TIME H+T1 TO TIME H+T2 SECONDS
 105  IF(T(IP)-T2)1051,777,777
 1051 IF(T(IP)-T1)1053,1053,1052
 1052 TENTER=T(IP)-TGZ
      GO TO  130
 1053 TENTER=T1 -TGZ
      GO TO 130
C
C 106 TOTAL PARTICLE MASS DEPOSITED
 106  F=FMAS(IP)
      NORD=2
      GO TO 100
C
```

```
C 107 TOTAL PARTICLE MASS DEPOSITED BETWEEN TIMES T1 AND T2 SECONDS
  107  IF(T(IP)-T2)1071,777,777
 1071  IF(T(IP)-T1)777,777,106
  130  CALL PAM2
C
C 102 FIND INDEX OF PARTICLE SIZE CLASS
  102 NORD=2
      IF(NZ.NE.0) GO TO 1020
 1022 IF(ABS(PS(IP)-PSIZE(J)) .LT. 1.0E-2) GO TO 132
      J=J+1
      IF(J.LE.ITAB) GO TO 1022
      CALL ERROR(PROGRM ,-102,ISOUT)
 1020 JTAB=ITAB+1
      DO 131 J=1,ITAB
      K=JTAB-J
      IF(PACT(K).GE.PS(IP))GO TO 1023
  131 CONTINUE
      CALL ERROR(PROGRM,131,ISOUT)
      GO TO 777
C
 1023 J=K
  132 IF(NREQ.EQ.4) GO TO 133
      F=FP( J )*FMAS(IP)/FMASS( J )
      GO TO 100
  133 F=FP( J )*FMAS(IP)/FMASS( J )/RUFSAM
      GO TO 100
C
C 112 TIME OF ARRIVAL
  112 F=FMAS(IP)
      NORD=3
      GO TO 100
C
C 113 TIME OF CESSATION
  113 F=FMAS(IP)
      NORD=4
      GO TO 100
C
C 114 SMALLEST PARTICLE SIZE
  114 F=FMAS(IP)
      NORD=5
      GO TO 100
C
C 115 LARGEST PARTICLE SIZE
  115 F=FMAS(IP)
      NORD=6
      GO TO 100
C
C 116 MASS FROM PARTICLES IN THE SIZE RANGE T1 TO T2 MICRONS.
 116  IF(PS(IP).GE.T1.AND.PS(IP).LE.T2)  GO TO 106
      GO TO 777
C
C 117 H+1 HR NORMALIZED DOSE RATE RESULTING FROM PARTICLES IN THE SIZE
C     RANGE T1 TO T2 MICRONS
 117  IF(PS(IP).GE.T1.AND.PS(IP).LE.T2)  GO TO 102
      GO TO 777
C
C
C************************ CODE INSERTION POINTS ************************
```

```
  109 CONTINUE
 110  CONTINUE
 111  CONTINUE
C*********************** CODE INSERTION POINTS ************************
C
 120  CONTINUE
      WRITE (ISOUT,210)NREC
      NREQ=6
      F=FMAS(IP)
C
C ****************************************************************************
C
  100 CONTINUE
C
C     COMPUTE GAMA AND DETERMINE THE LIMITING COORDINATES OF THE
C     PARTICLE CONTRIBUTION ELLIPSE
C
      IF(F.LT.QCUT) GO TO 777
      GAMA = ALOG( F/SXOT(IP)/SYOT(IP)/QCUT/6.28318531)
      IF(GAMA.LT.0.0) GO TO 200
      COSA=COS(ROUT(IP))
      SINA=SIN(ROUT(IP))
      ASQ= 2.0*GAMA*SXOT(IP)**2
      BSQ= 2.0*GAMA*SYOT(IP)**2
      YPRMU=Y(IP) + SQRT(ASQ*SINA**2 + BSQ*COSA**2)
      YPRML = 2.0*Y(IP)-YPRMU
C
C     DOES THE PARTICLE CONTRIBUTE TO THE MAP WITHIN ITS VERTICAL
C     (Y AXIS) LIMITS -
C
      IF(YPRMU.GT.YMIN + DGY.AND.YPRML.LT.YMAX) GO TO 205
  200 KTR(IP)=1
      NE=NE+1
      GO TO 777
  205 XPRMU= X(IP) + SQRT(ASQ*COSA**2 + BSQ*SINA**2)
C
C     DOES THE PARTICLE CONTRIBUTION LIE COMPLETELY BEYOND THE LEFT
C     BOUNDRY OF THIS MAP CORE LOAD -
C
      IF(XPRMU.LT.X1+DGX) GO TO 200
      XPRML = 2.0*X(IP) - XPRMU
C
C     DOES THE PARTICLE CONTRIBUTION LIE COMPLETELY BEYOND THE RIGHT
C     BOUNDRY OF THIS MAP CORE LOAD -
C
      IF(XPRML.LT.X2) GO TO 220
      KTR(IP)=0
      GO TO 777
C
C     WILL THIS CONTRIBUTER ALSO CONTRIBUTE TO SUBSEQUENT MAP CORE LOADS
C
  220 IF(XPRMU.GT.X2) GO TO 230
      KTR(IP)=1
      NE=NE+1
      GO TO 240
  230 KTR(IP)=0
  240 CALL CALC
  777 CONTINUE
```

```
C                                                                       PCHEK233
      RETURN                                                            PCHEK234
C                                                                       PCHEK235
      END                                                               PCHEK236
```

```
      SUBROUTINE PDMP
C
C     THIS SUBROUTINE SORTS OUT THOSE PARTICLES THAT WILL CONTRIBUTE
C     TO SUBSEQUENT MAP CORE LOADS, AND DUMPS THEM ON TO TAPE FOR
C     TEMPORARY STORAGE
C
C     H.G.NORMENT     JUNE 28,1971
C
C********************************** GLOSSARY ***************************
C
C     JL             COUNT OF PARTICLES MOVED FROM UPPER TO LOWER CORE
C                    (JL.LE.KP)
C     JP             COUNT OF AVAILABLE PARTICLE STORAGE LOCATIONS PASSED
C                    IN THE PARTICLE CORE STORAGE BLOCK SORT
C                    (JP.LE.NE.AND.JP.LE.KP)
C     KP             NUMBER OF PARTICLES IN CORE THAT ARE TO BE DUMPED
C                    ONTO TAPE
C                    (KP=NIJ-NE)
C     NE             COUNT OF AVAILABLE PARTICLE STORAGE LOCATIONS IN
C                    CORE.   THIS IS THE NUMBER OF PARTICLES REJECTED
C                    IN PCHECK.
C     NIJ            A BLOCK COUNT OF DATA STORED ON TAPE AND/OR IN CORE
C
C     ALSO SEE LINK8 GLOSSARY
C
C **********************************************************************
C
      COMMON /SET1/
     1CAY       ,DETID(12) ,DIAM(201) ,DMEAN     ,DNS       ,EXPO      ,
     2DITID(200),IDISTR    ,IEXEC     ,IRISE     ,ISIN      ,ISOUT     ,
     3NOSTR     ,TID(200)  ,SC        ,SSAM      ,TME       ,TMP1      ,
     4TMP2      ,T2M       ,U         ,VPR       ,W         ,HBURST    ,
     5SCLDHB    ,NHODO     ,ZV(200)   ,VX(200)   ,VY(200)
      COMMON /PARDAT/
     1X(500)    ,Y(500)    ,ZOUT(500) ,SXOT(500) ,SYOT(500) ,ROUT(500) ,
     2PS(500)   ,FMAS(500) ,KTR(500)  ,  F       , GAMA     ,  RSQ     ,
     3ASQ       ,SINA      ,COSA      ,WFMAS(200),YPRMU     ,YPRML     ,
     4T(500)
      COMMON /RUNDAT/
     1NIJ       ,NE        ,NREQ      ,NZ        ,ICTR      ,NXMAP     ,
     2T1        ,T2        ,MAPPUN    ,TGZ       ,IP        ,JC(18)    ,
     3IC(18)    ,NYMAP     ,NTASK     ,NORD      ,XGZ       ,YGZ
      COMMON /MAPDAT/
     1OMAP(15000),CCUT     ,CUTMAP    ,DGX       ,DGY       ,DELTAX    ,
     2XMAX      ,XMIN      ,YMAX      ,YMIN      ,FSUM      ,RUFSAM    ,
     3X1        ,X2        ,MBTAPE    ,ZDEP
      COMMON /CONDAT/
     1IPOUT     ,JPOUT     ,KPOUT     ,KTAPE     ,LTAPE     ,MARRAY    ,
     2NMAP      ,MXREQ     ,IH        ,IV
C
C **********************************************************************
C
      DATA PROGRM/6HPDMP  /
      KP=NIJ-NE
      IF(NE.EQ.0) GO TO 1000
      JP=0
      M=NIJ+1
      J=1
```

```
      JL=0
C
C     SORT THROUGH THE STORED PARTICLE DATA BLOCK AND MOVE ALL
C     PARTICLE DATA TO BE DUMPED INTO LOWER CORE SO THAT IT IS
C     CONTAINED IN A SOLID DATA BLOCK (I.E. A DATA BLOCK WITH NO
C     REJECTED PARTICLES IN IT)
C
      DO 300 I=1,KP
      IF(KTR(I).EQ.0) GO TO 300
      JP=JP+1
      DO 200 K=J,NE
      L=M-K
      IF(KTR(L).EQ.1)GO TO 100
      JL=JL+1
      KK=K
C
C     MOVE PARTICLE DATA TO AVAILABLE STORAGE IN LOWER CORE
C
      X(I)=X(L)
      Y(I)=Y(L)
      ZOUT(I)=ZOUT(L)
      T(I)=T(L)
      SXOT(I)=SXOT(L)
      SYOT(I)=SYOT(L)
      ROUT(I)=ROUT(L)
      PS(I)=PS(L)
      FMAS(I)=FMAS(L)
      GO TO 260
  100 JP=JP+1
  200 CONTINUE
  250 IRROR=-250
      GO TO 2000
  260 J=KK+1
  300 CONTINUE
      IF(JP.LE.NE) GO TO 400
  310 IRROR=-310
      GO TO 2000
  400 IF(JP.LE.KP) GO TO 500
  410 IRROR=-410
      GO TO 2000
  500 IF(JL.LE.KP)GO TO 1000
  510 IRROR=-510
 2000 CALL ERROR(PROGRM,IRROR,ISOUT)
 1000 WRITE(LTAPE)KP
      WRITE(LTAPE)(X(I),Y(I),ZOUT(I),T(I),SXOT(I),SYOT(I),ROUT(I),PS(I),
     1FMAS(I),I=1,KP)
      RETURN
      END
```

6. SAMPLE PRINTOUT

* * * * * * * * * * *

THE DEPARTMENT OF DEFENSE FALLOUT PREDICTION SYSTEM

* * * * * * * * * * *

OUTPUT PROCESSOR MODULE

PREPARED BY
MT. AUBURN RESEARCH ASSOC., INC.
NEWTON, MASS.

TRANSPORT IDENTIFICATION

SET B DTM IDENT FOR DISPLAY 30 MIN TRANSP., NO VERT. DIFFUSION

LISTING OF DEPOSIT INCREMENT DESCRIPTIONS

BLOCK 1

NO. OF DEPOSIT INCREMENTS IN THIS BLOCK IS 74

X	Y	Z	T	SXOT	SYOT	ROUT	PS	FMAS
7.3056E+01	1.9476E+01	9.3820E+02	5.0302E+01	7.2285E+01	7.2285E+01	0.	1.5174E+03	5.4316E+03
2.4570E+02	6.5742E+01	9.3820E+02	1.0330E+02	1.0437E+02	1.0437E+02	0.	1.5174E+03	5.4316E+03
4.5797E+02	1.2260E+02	9.3820E+02	1.8351E+02	1.5071E+02	1.5071E+02	0.	1.5174E+03	5.4316E+03
1.1361E+02	3.0275E+01	9.3820E+02	7.2626E+01	8.4484E+01	8.4484E+01	0.	1.5174E+03	5.4316E+03
1.4348E+02	9.1639E+01	9.3820E+02	1.3853E+02	1.2937E+02	1.2937E+02	0.	1.5174E+03	5.4316E+03
6.6755E+02	1.8134E+02	9.3820E+02	2.3847E+02	1.9810E+02	1.9810E+02	0.	1.5174E+03	5.4316E+03
2.2198E+02	5.9381E+01	9.3820E+02	9.6551E+01	1.0556E+02	1.0556E+02	0.	1.5174E+03	5.4316E+03
4.2384E+02	1.1346E+02	9.3820E+02	1.7079E+02	1.6186E+02	1.6186E+02	0.	1.5174E+03	5.4316E+03
8.0661E+02	2.4822E+02	9.3820E+02	2.8331E+02	2.4818E+02	2.4818E+02	0.	1.5174E+03	5.4316E+03
2.9059E+02	7.7775E+01	9.3820E+02	1.1667E+02	1.2513E+02	1.2513E+02	0.	1.5174E+03	5.4316E+03
5.2591E+02	1.4083E+02	9.3820E+02	1.9813E+02	1.9380E+02	1.9380E+02	0.	1.5174E+03	5.4316E+03
1.0523E+03	4.0179E+02	9.3820E+02	3.2210E+02	3.0015E+02	3.0015E+02	0.	1.5174E+03	5.4316E+03
4.9295E+02	1.3195E+02	9.3820E+02	1.9412E+02	7.6278E+01	7.6278E+01	0.	7.6194E+02	5.4316E+03
7.8630E+02	2.1051E+02	9.3820E+02	3.1684E+02	1.1903E+02	1.1903E+02	0.	7.6194E+02	5.4316E+03
1.3621E+03	4.3405E+02	9.3820E+02	4.8160E+02	1.8575E+02	1.8575E+02	0.	7.6194E+02	5.4316E+03
7.1648E+02	1.9181E+02	9.3820E+02	2.8766E+02	1.1354E+02	1.1354E+02	0.	7.6194E+02	5.4316E+03
1.1696E+03	3.1398E+02	9.3820E+02	4.0596E+02	1.7440E+02	1.7440E+02	0.	7.6194E+02	5.4316E+03
2.3417E+03	1.0860E+03	9.3820E+02	5.6459E+02	2.6789E+02	2.6789E+02	0.	7.6194E+02	5.4316E+03
9.7110E+02	2.6035E+02	.3820E+02	3.5178E+02	1.5134E+02	1.5134E+02	0.	7.6194E+02	5.4316E+03
1.3202E+03	4.1477E+02	9.3820E+02	4.7000E+02	2.3102E+02	2.3102E+02	0.	7.6194E+02	5.4316E+03
2.7869E+03	1.3467E+03	9.3820E+02	6.2853E+02	3.5264E+02	3.5264E+02	0.	7.6194E+02	5.4316E+03
1.1636E+03	3.1231E+02	9.3820E+02	4.0420E+02	1.8975E+02	1.8975E+02	0.	7.6194E+02	5.4316E+03
1.8955E+03	8.2259E+02	9.3820E+02	5.2391E+02	2.8981E+02	2.8981E+02	0.	7.6194E+02	5.4316E+03
2.6145E+03	1.2471E+03	9.3820E+02	6.8481E+02	4.4264E+02	4.4264E+02	0.	7.6194E+02	5.4316E+03
1.2610E+03	3.3773E+02	9.3820E+02	4.6611E+02	7.2995E+01	7.2995E+01	0.	4.9965E+02	4.0737E+03
1.6475E+03	5.0930E+02	9.3820E+02	5.9205E+02	1.0693E+02	1.0693E+02	0.	4.9965E+02	4.0737E+03

2.6143E+03	1.1447E+03	9.3820E+02	7.1766E+02	1.5663E+02	1.5663E+02	0.	4.9965E+02	4.0737E+03
3.7299E+03	1.7669E+03	9.3810E+02	8.7272E+02	2.6197E+02	2.2945E+02	-1.0445E-01	4.9965E+02	4.0737E+03
1.7755E+03	5.5026E+02	9.3820E+02	6.4399E+02	1.4394E+02	1.4394E+02	0.	4.9965E+02	5.4316E+03
3.2405E+03	1.5062E+03	9.3820E+02	7.7770E+02	2.2246E+02	2.2246E+02	0.	4.9965E+02	5.4316E+03
3.5118E+03	1.6134E+03	9.3810E+02	9.1333E+02	4.6497E+02	3.4383E+02	-1.1553E-01	4.9965E+02	5.4316E+03
2.6232E+03	1.1498E+03	9.3820E+02	7.1928E+02	2.0431E+02	2.0431E+02	0.	4.9965E+02	5.4316E+03
3.3492E+03	1.5470E+03	9.3810E+02	8.7361E+02	3.4435E+02	3.1071E+02	-1.0538E-01	4.9965E+02	5.4316E+03
3.7085E+03	1.6832E+03	9.3810E+02	9.7816E+02	6.7414E+02	4.7254E+02	-1.3415E-01	4.9965E+02	5.4316E+03
3.2637E+03	1.5196E+03	9.3820E+02	7.8103E+02	2.6675E+02	2.6675E+02	0.	4.9965E+02	5.4316E+03
3.4753E+03	1.6027E+03	9.3810E+02	9.0702E+02	5.0167E+02	4.0199E+02	-1.1303E-01	4.9965E+02	5.4316E+03
3.9055E+03	1.7344E+03	9.3810E+02	1.0423E+03	8.4577E+02	6.0584E+02	-1.5333E-01	4.9965E+02	5.4316E+03
2.1081E+03	6.3203E+02	9.3820E+02	7.6679E+02	7.1104E+01	7.1104E+01	0.	3.6824E+02	3.2589E+03
3.0408E+03	1.2566E+03	9.3810E+02	8.7837E+02	1.3776E+02	1.0018E+02	-9.9397E-02	3.6824E+02	3.2589E+03
3.9579E+03	1.7369E+03	9.3810E+02	9.7154E+02	2.5629E+02	1.4117E+02	-1.1953E-01	3.6824E+02	3.2589E+03
4.1406E+03	1.7408E+03	9.3810E+02	1.0851E+03	3.9115E+02	1.9903E+02	-1.4883E-01	3.6824E+02	3.2589E+03
4.5553E+03	1.7988E+03	9.3810E+02	1.1974E+03	4.7055E+02	2.8066E+02	-1.5091E-01	3.6824E+02	3.2589E+03
4.1923E+03	1.8479E+03	9.3810E+02	9.9744E+02	3.5435E+02	1.7634E+02	-1.2236E-01	3.6824E+02	5.4316E+03
4.3289E+03	1.7633E+03	9.3810E+02	1.1407E+03	5.1845E+02	2.7685E+02	-1.6243E-01	3.6824E+02	5.4316E+03
4.8313E+03	1.8981E+03	9.3810E+02	1.2817E+03	6.6004E+02	4.3451E+02	5.0390E-02	3.6824E+02	5.4316E+03
4.1695E+03	1.7301E+03	9.3810E+02	1.1036E+03	4.9307E+02	2.6351E+02	-1.5724E-01	3.6824E+02	5.4316E+03
4.6889E+03	1.8402E+03	9.3810E+02	1.2377E+03	6.2422E+02	4.0227E+02	-8.0929E-02	3.6824E+02	5.4316E+03
5.1999E+03	2.0318E+03	9.3810E+02	1.3698E+03	8.6613E+02	6.1352E+02	3.1411E-01	3.6824E+02	5.4316E+03
4.9400E+03	1.8007E+03	9.3810E+02	1.1927E+03	5.7667E+02	3.5507E+02	-1.5326E-01	3.6824E+02	5.4316E+03
4.9910E+03	1.9504E+03	9.3810E+02	1.3221E+03	7.4296E+02	5.2987E+02	2.2554E-01	3.6824E+02	5.4316E+03
5.4502E+03	2.0874E+03	9.3810E+02	1.4497E+03	1.1543E+03	7.9030E+02	2.9629E-01	3.6824E+02	5.4316E+03
4.2685E+03	1.6300E+03	9.3810E+02	1.1497E+03	2.3708E+02	7.0472E+01	-1.4150E-01	2.8647E+02	2.7158E+03
5.0925E+03	1.9566E+03	9.3810E+02	1.2469E+03	2.6183E+02	9.7214E+01	-1.7306E-01	2.8647E+02	2.7158E+03
5.7262E+03	2.1102E+03	9.3810E+02	1.3434E+03	2.8602E+02	1.3471E+02	-1.6718E-01	2.8647E+02	2.7158E+03
5.4722E+03	1.9388E+03	9.3810E+02	1.4391E+03	3.3509E+02	1.8378E+02	9.8038E-02	2.8647E+02	2.7158E+03
5.8377E+03	2.0654E+03	9.3810E+02	1.5341E+03	4.1559E+02	2.5087E+02	1.3516E-01	2.8647E+02	2.7158E+03
6.1471E+03	2.1266E+03	9.3810E+02	1.6284E+03	6.1271E+02	3.4239E+02	2.1702E-01	2.8647E+02	2.7158E+03
5.4560E+03	1.9372E+03	9.3810E+02	1.4349E+03	3.6697E+02	2.0113E+02	7.9291E-02	2.8647E+02	4.0737E+03
5.8596E+03	2.0698E+03	9.3810E+02	1.5385E+03	4.6820E+02	2.8409E+02	1.4830E-01	2.8647E+02	4.0737E+03
6.1877E+03	2.1352E+03	9.3810E+02	1.6412E+03	7.0281E+02	4.0009E+02	2.1876E-01	2.8647E+02	4.0737E+03
6.5049E+03	2.2423E+03	9.3810E+02	1.7430E+03	8.9834E+02	5.6671E+02	3.2854E-01	2.8647E+02	4.0737E+03
6.0175E+03	2.1039E+03	9.3810E+02	1.5775E+03	6.3651E+02	3.3692E+02	1.9715E-01	2.8647E+02	5.4316E+03
6.3844E+03	2.2035E+03	9.3810E+02	1.7064E+03	9.1986E+02	5.1273E+02	2.8217E-01	2.8647E+02	5.4316E+03
6.6896E+03	2.3938E+03	1.0405E+03	1.7876E+03	1.1574E+03	7.8133E+02	6.1336E-01	2.8647E+02	5.4316E+03
6.3353E+03	2.1754E+03	9.3810E+02	1.6857E+03	8.4754E+02	4.6297E+02	2.4206E-01	2.8647E+02	5.4316E+03
6.6650E+03	2.3569E+03	9.6435E+02	1.7984E+03	1.0967E+03	6.9047E+02	5.0166E-01	2.8647E+02	5.4316E+03
6.9955E+03	2.5895E+03	1.1430E+03	1.8412E+03	1.3596E+03	1.0259E+03	9.6235E-01	2.8647E+02	5.4316E+03
6.8161E+03	2.0960E+03	9.3810E+02	1.6295E+03	1.8814E+02	7.8934E+01	-1.7100E-01	2.2989E+02	2.0368E+03
6.5488E+03	2.0387E+03	9.3810E+02	1.7051E+03	2.1441E+02	1.0325E+02	1.4167E-01	2.2989E+02	2.0368E+03
6.8306E+03	2.0806E+03	9.3810E+02	1.7805E+03	2.8562E+02	1.2794E+02	4.0641E-02	2.2989E+02	2.0368E+03
7.0011E+03	2.1493E+03	9.6435E+02	1.8401E+03	3.2672E+02	1.6604E+02	4.0518E-01	2.2989E+02	2.0368E+03
7.1940E+03	2.3150E+03	1.0668E+03	1.8550E+03	4.6104E+02	2.0333E+02	1.0068E+00	2.2989E+02	2.0368E+03
7.2911E+03	2.5358E+03	1.2192E+03	1.8406E+03	5.4660E+02	2.5924E+02	9.3020E-01	2.2989E+02	2.0368E+03
7.2495E+03	2.4219E+03	1.1430E+03	1.8503E+03	6.2377E+02	2.5400E+02	1.0423E+00	2.2989E+02	4.0737E+03

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THE DEPARTMENT OF DEFENSE FALLOUT PREDICTION SYSTEM
* * * * * * * * * * *

OUTPUT PROCESSOR MODULE

PREPARED BY
MT. AUBURN RESEARCH ASSOC.,INC.
NEWTON, MASS.

**** SUMMARY OF PRECEDING DELFIC MODULE RUN IDENTIFIERS ****

**** OUTPUT PROCESSOR IDENTIFICATION ****
SET B OPM   IDENT  FOR DISPLAY        02/02/72

**** INITIAL CONDITIONS (FIREBALL) IDENTIFICATION ****
SET B ICM  IDENT   FOR DISPLAY

**** CLOUD RISE IDENTIFICATION ****
SET B CRM  IDENT   FOR DISPLAY  NDSTR=20, KDI=4

**** CLOUD RISE-TRANSPORT INTERFACE IDENTIFICATION ****
SET B CRTIM IDENT  FOR DISPLAY  NDSTR=20, KDI=4

**** DIFFUSIVE TRANSPORT IDENTIFICATION ****
SET B DTM   IDENT  FOR DISPLAY  30 MIN TRANSP., NO VERT. DIFFUSION

**** OTHER INPUTS ****

**** THE CONTROL VARIABLE ARRAY, IC(J), WAS GIVEN THE FOLLOWING VALUES ****
 -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0   1

PRINTER DESCRIPTION  -  CHARACTERS PER INCH
   HORIZONTAL   10          VERTICAL    6
```

```
**** OUTPUT PROCESSOR TASK    1 ****

GRID LIMITS AND INTERVALS
   XMIN        XMAX        YMIN        YMAX        DELTA X      DELTA Y
   -4000       11000       -2000       7000        600.0        500.0

GROUND ROUGHNESS FACTOR     .500        ALTITUDE OF GZ    930.100

THE CONTROL VARIABLE ARRAY, JC(J), HAS BEEN GIVEN THE FOLLOWING VALUES.
   1  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0  -0

REQUEST NUMBER     1

TYPE    2          T1 =        1.0          T2 =        -0.0          MASCHN =   -0

QCUT=  1.00000E-06          CUTMAP=  1.00000E-04
```

TOTAL PAM OUTPUT

PSIZE	FP
15.1741E+02	31.6434E+07
76.1945E+01	33.4902E+07
49.9646E+01	34.9699E+07
36.8237E+01	36.2605E+07
28.6472E+01	37.4940E+07
22.9889E+01	38.7266E+07
18.8116E+01	39.9939E+07
15.5893E+01	41.3250E+07
13.0230E+01	42.7486E+07
10.9287E+01	44.2965E+07
91.8509E+00	46.0093E+07
77.0802E+00	47.9420E+07
64.3912E+00	50.1694E+07
53.3614E+00	52.8006E+07
43.6652E+00	56.0069E+07
35.0406E+00	60.0805E+07
27.2600E+00	65.579[illegible]+07
20.0905E+00	73.770[illegible]+07
13.1744E+00	88.6768E+07
66.1533E-01	12.6455E+08

MAPPED ON GRID INTERVALS DGX = 600.0 DGY= 500.0

THE OUTPUT PRESENTATION IS A
TWO-LINE E FORMAT MAP

THE QUANTITY PRESENTED IS
EXPOSURE RATE NORMALIZED TO TIME H+1 HOUR.
UNITS ARE ROENTGENS PER HOUR
GROUND ZERO IS LOCATED AT X = -0.0 , Y = -0.0

Y-COORDINATE SCALES FOR SIDES OF MAP

7000	7000
6500	6500
6000	6000
5500	5500
5000	5000
4500	4500
4000	4000
3500	3500
3000	3000
2500	2500
2000	2000
1500	1500
1000	1000
500	500
-0	-0
-500	-500
-1000	-1000
-1500	-1500

STRIP 1

-3400 ***** -400 ***** 2600 *****

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3	-3	-3	-3	-3
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.229	.404	.525	.510	.367
0	0	0	0	0	0	0	0	0	0	0	-3	-3	-2	-2	-2	-2	-2	-2
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.109	.425	.126	.277	.453	.550	.500	.341
0	0	0	0	0	0	0	0	0	0	-3	-2	-2	-1	-1	-1	-1	-1	-1
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.307	.123	.420	.115	.237	.365	.419	.368	.252
0	0	0	0	0	0	0	0	-3	-2	-2	-1	-1	-1	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.188	.106	.403	.121	.328	.802	.157	.230	.260	.240	.178
0	0	0	0	0	0	0	-3	-2	-1	-1	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	.226	.208	.118	.426	.107	.230	.487	.889	1.270	1.511	1.517	1.142
0	0	0	0	0	0	0	-2	-1	-1	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	.128	.129	.827	.325	.813	1.568	2.863	4.593	6.449	8.222	7.912	4.988
0	0	0	0	0	0	-3	-2	-1	0	0	0	1	1	1	1	1	1	1
0.000	0.000	0.000	0.000	0.000	0.000	.220	.388	.485	.424	2.098	6.054	1.132	1.667	2.151	3.300	3.821	2.565	1.109
0	0	0	0	0	0	-3	-2	0	0	1	1	2	2	2	2	1	1	1
0.000	0.000	0.000	0.000	0.000	0.000	.318	.655	.142	2.118	1.295	5.034	1.073	1.013	1.247	1.333	8.711	9.693	1.192
0	0	0	0	0	0	-3	-1	0	1	1	2	2	2	1	1	1	0	0
0.000	0.000	0.000	0.000	0.000	0.000	.770	.286	.728	1.167	5.934	1.458	1.006	1.041	5.562	3.384	1.836	7.866	2.513
0	0	0	0	0	0	-1	0	0	1	2	1	1	1	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	.757	2.780	9.327	3.918	1.301	3.448	1.689	1.227	9.951	6.001	3.003	1.266	.402
0	0	0	0	0	-3	0	1	2	1	0	0	0	0	0	0	[illegible]	0	-1
0.000	0.000	0.000	0.000	0.000	.464	8.346	9.202	1.653	6.449	6.772	2.750	1.824	1.765	1.437	.905	.451	.181	.563
0	0	0	0	0	-3	2	2	1	0	0	0	0	0	0	0	-1	-1	-2
0.000	0.000	0.000	0.000	0.000	.918	7.381	1.613	3.189	.745	.287	.194	.193	.234	.204	.132	.666	.265	.820
0	0	0	0	0	0	0	0	0	[illegible]	-2	-1	-1	-1	-1	-1	-2	-2	-2
0.000	0.000	0.000	0.000	0.000	0.000	.121	.751	.171	.568	.903	.133	.212	.272	.250	.168	.863	.339	.102
0	0	0	0	0	0	0	-3	-3	-3	-3	-2	[illegible]	-2	-2	-2	-3	-3	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	.417	.246	.188	.579	[illegible]	[illegible]	.276	.251	.169	.850	.320	0.000
0	0	0	0	0	0	0	0	0	0	0	-3	-3	-3	-3	-3	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.12[illegible]	.192	.224	.193	.124	0.000	0.000	0.000

-3400 ***** -400 ***** 2600 *****

STRIP 2

8000 ***** 11000 ***** 14000 *****

0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000
-3	0	0	0	0	0
.198	0.000	0.000	0.000	0.000	0.000
-2	-3	-3	0	0	0
.176	.676	.191	0.000	0.000	0.000
-1	-2	-2	-3	0	0
.132	.506	.136	.250	0.000	0.000
-1	-1	-2	-2	-3	0
.969	.358	.861	.134	.139	0.000
0	0	-1	-2	-3	0
.577	.185	.372	.473	.395	0.000
0	0	-1	-2	-3	0
2.012	.518	.841	.868	.594	0.000
0	0	-1	-2	-3	0
3.271	.659	.868	.736	.444	0.000
0	0	-1	-2	-3	0
2.108	.354	.400	.309	.182	0.000
0	-1	-2	-3	0	0
.570	.487	.958	.780	0.000	0.000
-1	-1	-2	-3	0	0
.903	.145	.174	.166	0.000	0.000
-1	-2	-3	0	0	0
.131	.229	.307	0.000	0.000	0.000
-2	-3	0	0	0	0
.193	.341	0.000	0.000	0.000	0.000
-3	0	0	0	0	0
.228	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000
0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000

SUM OF RAY ORDINATES = 3.0363322+03

OUTPUT PROCESSING IS COMPLETED.

OUTPUT PROCESSING IS COMPLETED.

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