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User's Guide to GASPAR Code

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ABSTRACT

The document is a user's guide for the GASPAR code, a computer program written for the evaluation of radiological impacts due to the release of radioactive material to the atmosphere during normal operation of light water reactors. The GASPAR code implements the radiological impact models of NRC Regulatory Guide 1.109, Revision 1, for atmospheric releases. The code is currently used by NRC in reactor licensing evaluations to estimate (1) the collective or population dose to the population within a 50-mile radius of a facility, (2) the total collective dose to the U.S. population, and (3) the maximum individual doses at selected locations in the vicinity of the plant.

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BACKGROUND

GASPAR was originally written in 1975 and was subsequently released to the user community. The code has been updated several times in the intervening period. These updates have largely been of an input/output nature in an attempt to better serve the user's needs. The contribution of the user community to the identification of these needs is gratefully acknowledged.

Chapter 1

Introduction to GASPAR* Code

1.1 Introduction

This document is intended to serve as a user's guide for the GASPAR code, a computer program written for the evaluation of radiological impacts due to the release of radioactive material to the atmosphere during normal operation of light water reactors. In particular, the code implements the radiological impact models of Regulatory Guide 1.109, Rev. 1, for atmospheric releases. The code is currently used by the NRC in reactor licensing evaluations to estimate (1) the collective or population dose (person-rem) to the population within a 50-mile radius of a facility (refered to as the ALARA dose); (2) the total collective dose to the U.S. population (the NEPA dose); and (3) the maximum individual doses at selected locations in the vicinity of the plant. Models for the code are documented in Appendix A and in Regulatory Guide 1.109, Rev. 1.

GASPAR is independent of the atmospheric model which evaluates and describes the concentration and dispersion of materials released to the atmosphere. Multiple release points with their associated source terms and atmospheric dispersion factors are treated by the code. Detailed output of the estimated radiological impacts can be printed as a function of release point, population age group, exposure pathway, body organ, and nuclide. Summary output tables can be obtained which include a tabulation of contributions from each release point by nuclide for the population dose, and a tabulation useful for doing the cost/benefit analysis of the radwaste system.

Input is made entirely by punched cards. The input deck, which is described in Chapter 2, is comprised of title cards, job control cards, site data cards, meteorological data, source terms (nuclides and quantities from each release point) and special location cards (meteorological data at selected locations

*The earlier GASPAR version (5/11/77) contains some errors in the dose factors in BLOCK DATA. Code versions marked "revised 8/19/77" have been corrected. Appendix C includes directions for updating the dose factor library and a printout of the current values which have been updated recently by NRC.

for individual impact estimates). The code provides options for changing parameter values assigned in storage blocks. The site data includes four subdecks: population distribution data, milk, meat and vegetable production data. The meteorological input data consists of average annual relative effluent concentration X/Q, X/Q decayed, X/Q decayed and depleted and ground deposition D/Q.

GASPAR provides options for estimating population dose, individual dose, or both individual and population dose. The program generates four distinguishable types of output described in Chapter 3. They are as follows: (1) a printback of input in a slightly altered form which is recognizable by the lack of bordering, (2) population dose values, (3) individual dose values, and (4) cost-benefit tables (doses from each source term individually). All doses are printed in tables, discussed in Chapter 3 with examples.

The appendicies of this document provide further information for using this code. Appendix A describes the mathematical models contained in GASPAR.* Appendix B details the procedure for overriding and changing stored variable values that would be necessary with site specific data. Appendix C illustrates the procedure by which the dose factor library can be modified. A diagram of the GASPAR code is provided in Appendix D and a listing of an example input deck for a combined run is provided in Appendix E.

*A copy of the GASPAR code may be obtained from the ADP Support Group, Office of the Administration, U.S. Nuclear Regualtory Commission, Washington, D.C. 20555.

Chapter 2

Instructions for Completing GASPAR Input Deck

2.1 Introduction

The GASPAR computer code implements calculations for the air release dose models developed in Regulatory Guide 1.109 (see Appendix A). The program computes population doses (ALARA limit to the 50-mile region and NEPA total U.S. population) and individual doses at selected locations in the vicinity of a plant. The code can be used to determine both population and individual doses or population and individual doses separately. These instructions describe the methods for selecting each of these options in preparing a control deck.

2.2 Input Card Preparation - Combined Run

This section discusses the control cards and the subdecks for computing both population and individual doses. There are four types of subdecks which are arranged in the following order and contain the following types of information: (1) site-specific population and food production data; (2) meteorological data; (3) data for source terms or nuclide quantities at specific release points; and (4) selected location data for computation of individual doses. The GASPAR input deck preparation, Table I (page 2-2), provides detailed instructions for preparing a GASPAR combined run and should be consulted when reading the following general descriptions.

A deck for a combined population and individual dose run has the following structure (note for a combined run JC(1) = 0):

Cards/Subdecks Needed	Title
1	Plant Title Card
2	Job Control
3	Site Specific Information
4...(subdeck)	Population Data
5...(subdeck)	Milk Production Data
6...(subdeck)	Meat Production Data
7...(subdeck)	Vegetation Data
8...(subdeck)	Release Point/Source Terms (Up to 99)

Table I: GASPAR Input Deck Preparation Table - Combined Run

Card No.	Format	Variable	Columns	Description/Purpose/Units
1.0	2X,78A1	ITITLE	3-80	Plant title card: Plant name, license status, meteorological data date, docket No., investigator. Card is read and printed.
2.0	10I2			Job Control card
	I2	JC(1)	1,2	Input deck type: o or blank if population doses only are to be computed. Non zero if individual doses only. For combined run, JC(1)=0. For a combined run or individual doses only run special location cards 13.n are included.
	I2	JC(2)	3,4	Number of source terms or release points (≤ 99).
	I2	JC(3)	5,6	0, causes cumulating doses to be printed for successive source term. 1, causes total dose to be printed only. (See Chapter 3).
	I2	JC(4)	7,8	Ignored if 0 or blank. If nonzero, subroutine BLKDAT is called so that site specific changes can be made in stored data blocks. (See Appendix B for instructions for changing BLOCK DATA, and variables list for PHYS, TRANFR and USAGE.)
	I2	JC(5)	9,10	Usually set to 0 and ignored. (See Appendix C) JC(5)=1, Standard Dose Factor Library is printed from BLOCK DATA JC(5)=2, Changes to DFL (subdeck 2.2...) are read, printed back and the run will use this new factor library.

Card No.	Format	Variable	Columns	Description/Purpose/Units
				JC(5)=3, Changes to DFL (subdeck 2.2...) are read, printed back, used for the run and in addition will be punched in a form that can be used to permanently update GASPAR (See Appendix C).
		Subdeck 2.1...		Required if stored data in PHYS, TRANFR or USAGE are to be changed. Only if JC(4)=0
	Options for Changing Stored Data (See Appendices B&C)	Blank Card, or Subdeck 2.2...		Required if stored data in Dose Factor Library are to be changed. Only if JC(5)=2 or 3.
		Blank Card		
3.0	7E8.0, 4F6.0			Site Specific Information. When possible the following variables should be determined locally by measurement. See also Figure 1 for NRC determined regional values for growing and pasture seasons.
	E8.0	PDEN	1-8	The distance from the facility to the NE corner of the US (MAINE) in miles. Lack of an entry here is fatal to the run. Following are the variables of Columns 9-80, along with their default values. (For individual dose run only a dummy value may be supplied.)
	Note - Blank or 0 on remaining variables will result in use of default values			
	E8.0)	FV	9-16	Fraction of year leafy vegetables are grown. (Default value = 1.0)
	E8.0	FP	17-24	Fraction of year cows are on pasture (default value = 1.0) [See Reg. Guide 1.109-8]
	E8.0	FG	25-32	Fraction of crop from garden (default value = 0.76 from USDA) [See Reg. Guide 1.109-7]
	E8.0	FPF	33-40	Fraction of daily intake of cows derived from pasture while on pasture (default value = 1.0). [See Reg. Guide 1.109-28]

Card No.	Format	Variable	Columns	Description/Purpose/Units
	E8.0	H	41-48	Absolute humidity over growing season, relative (%) value if T is supplied. When H and T are blanks a default value of 8.0 g/m^3 is used.
	E8.0	T	49-56	Average Temperature over growing season (deg.F).
	F6.0	FGT	57-62	Fraction of year goats are on pasture (default value = 1.0)
	F6.0	FPG	63-68	Fraction of daily intake of goat from pasture while on pasture. (default value = 1.0)
	F6.0	FB	69-74	Fraction of year beef cattle are on pasture default value = 1.0).
	F6.0	FBF	75-80	Fraction of daily intake of beef cattle derived from pasture while on pasture (default value = 1.0).
Individual dose option	For an Individual Dose Only run, Card 2, variable JC(1) ≠0 and the following subdecks 4..., 5..., 6... and 7... are deleted (see Section 2.4)			
4.0	2X,78A1	LS	3-80	Population Title Card. Total population within 50 mile, plant name and year of projected population.
4.1	3I5			Population Data Control Card
	I5	IDAT	1-5	Compass sector for starting data: 0 for north, 1 for south (defaults to north). The 50-mile region is divided into 160 subregions formed by sectors centered on the 16 compass points (N,NNE, NE, etc.) and annuli at distances of 1,2,3,4,5,10,20,30,40 and 50 miles from the center of the facility. Each sector will require 10 population data entries.
	I5	KC	6-10	No. of annular population entries on first sector card. $2 \leq KC \leq 7$. Each of the 16 pairs of sector cards will require a continuation card with (10-KC) population data entries (default to 7).

Card No.	Format	Variable	Columns	Description/Purpose/Units
	I5	KT	11-15	Total No. of annular population values to be read for each sector: 0, or 10. If kT=0 the 50 mile total will be uniformly distributed over all sectors and annuli and card 4.2 will follow (see below). Otherwise KT=10 and 16 pairs of sector population data cards must follow.
4.1.1a	3A1,7X,7E10.0			Sector population data cards (16 pairs required, each with KC values)
	3A1		1-3	Compass sector for start of sector population data. (N or S).
	E10.0		11-20	Population, subregion 0-1 mile
	E10.0, E10.0, etc.		21-30, 31-40, etc.	Population, 2nd subregion 1-2 mile. There will be KC entries on this card.
4.1.1b	8E10.0		1-10, 11-20 .....etc.	Continuation card, (10-KC) entries.
	(Complete Population subdeck 4 for all 16 sectors (clockwise) thru cards 4.1.16 a&b)			
4.2	8E10.0			Population Data Card (use only if KT=0) 50 mile total will be uniformly distributed
	E10.0		1-10	Total population for 50 mile radius
5.0				Annual Milk Production in Liters.
	(Same as population Subdeck 4, including distribution option KT)			
6.0				Annual Meat Production in Kilograms.
	(Same as population Subdeck 4, including distribution option KT)			
7.0				Annual Vegetation Production in Kilograms.
	(Same as population Subdeck 4, including distributon option KT)			

Card No.	Format	Variable	Columns	Description/Purpose/Units
	The following card sequences, sets of 8 (source term parameters), 9,10,11,12 (meteorological data for each source term) are input required for each source term specified as JC(2), Card 2. Subdeck 8 is required for all runs. Subdecks 9,10,11,12 are not used for Individual Dose only run. Source term control card includes an option to reuse MET Data (9,10,11,12) if applicable to successive release points.			
8.0	2X,78A1	ITITLE	3-80	Source Term Title Card release point, data source and date (one set 8.0-8.1.n required for each release point, ≤99).
8.1	E10.0,9X,I1,9X,I1,9X,F6.2			Source Term Control Card
	E10.0	UML	1-10	Multiplier applied to each release value enter by nuclide.
	I1	JC(1)	20	JC(1)=0 if new MET data follows. JC(1)=1 if last MET data can be reused. (First source term input of each run must include MET data input)
	I1	JC(2)	30	JC(2)=0 if new release data follows. JC(2)=1 if last source term release data input can be reused. (First source term input of each run must include release data input 8)
	F6.2	PURGE	40-45	Total annual release time in hours if the source term is a purge, contains C-14 and the run computes individual doses. Otherwise PURGE may be blank. This variable controls the calculation of C-14 dose to an individual.
8.1.n	2X,A2,5A1,E10.0			Release data cards, one for each nuclide released at this release point (≤33).
	A2	IA	3,4	Nuclide Symbol, left or right hand justified
	5A1	IM	5-9	Nuclide Mass number including M for metastable, as appropriate. (Read in A format)

Card No.	Format	Variable	Columns	Description/Purpose/Units
	E10.0	QQ	11-20	Annual release in Ci. (Usually determined by GALE Codes or equivalent.) Values can be adjusted by use of UML if input is not in Ci.
	(Blank Terminator Card must follow the n release data cards for each release point.)			
	The following subdecks 9,10,11,12 provide meteorological gaseous dispersion and deposition factors to be associated with the release point. The 50 mile regions are broken down into 16 sectors and 10 annuli as in subdeck 4 for population data. These decks are required for population dose calculations and are not present for individual dose only runs. There is no option for uniform distribution of data over the 50 mile area as in subdeck 4. Variable JC(1), Card 8.1 allows (9,10,11,12) to be reused for successive release points if applicable.			
9.0	2X,78A1			Title Card for X/Q, annual average gaseous dispersion factor in sec/m^3 for the release point.
	78A1	LS	3-80	Data source, date, height, release point, etc.
9.1	2I5			X/Q Control Card
	I5	IDAT	1-5	If IDAT=0, data read starts on north. If >0, starts on south.
	I5	KC	6-10	Number of data on first sector card, $2 \leq KC \leq 7$. Otherwise KC is set to 7 and data read starts at south.
9.1.na	3A1,2X,7E10.0			Sector X/Q data cards (16 required, each with KC values).
	3A1		1-3	Compass heading for start of sector X/Q data
	E10.0,E10.0, etc.		6-15,16-25, etc.	X/Q data for 1st KC subregions in the sector.
9.1.nb	8E10.0		1-10,11-20, etc.	Continuation Card, nth Section, (10-KC) entries.
	(Complete X/Q subdeck 9 for all 16 sectors (clockwise) thru cards 9.1.16 a & b)			

Card No.	Format	Variable	Columns	Description/Purpose/Units
10.0				Title Card for X/Q decayed
10.1	(Same as X/Q subdeck 9. Requires 34 cards)			
10.2				
11.0				Title Card for X/Q decayed and depleted.
11.1	(Same as x/Q subdeck 9. Requires 34 cards)			
11.2				
12.0				Title Card for $\bar{D}/Q$, average annual deposition (m^{-2})
12.1	(Same as X/Q subdeck 9. Requires 34 cards)			
12.2				
	(For population dose only run a blank card must follow each release point, subdecks 8-12 except for the last release point subdeck 12 must be followed by 3 blank cards.)			
13.n	I2,2A8,A4,F7.0,4E10.0,7I1			Special Location Card (selected individual dose maximum of 5. These cards supply MET data.
	I2	JS(n)	1,2	Controls printing of dose by nuclide, pathway and organ.* JS(n)=1 no details are printed by nuclide JS(n)=0 print control given to JSS variables below.
	2A8	Name	3-18	Special Location Name
	A4	(DIR)	19-22	Compass heading from site to special location
	F7.0	DIST	23-29	Distance in miles
	E10.0	X/Q	30-39	X/Q for this location (sec/m^3)

Card No.	Format	Variable	Columns	Description/Purpose/Units
	E10.0	XQD	40-49	X/Q decayed (sec/m^3)
	E10.0	XQDD	50-59	X/Q decayed and depleted (sec/m3)
	E10.0	DEP	60-69	Deposition (m^{-2})
	(If JSS >0, pathway breakdown is suppressed in output)*			
	I1	JSS(n,1)	70	Controls Plume Pathway
	I1	JSS(n,2)	71	Ground
	I1	JSS(n,3)	72	Vegetation
	I1	JSS(n,4)	73	Meat
	I1	JSS(n,5)	74	Cow Milk
	I1	JSS(n,6)	75	Goat Milk
	I1	JSS(n,7)	76	Inhalation

(For a combined run - Special location cards must occur and be in same order for each source term deck. A blank card must follow each set of special location cards.)

(Subdecks 8-13 are repeated as needed for each source term. Finally add 3 blank cards and run termination cards.)

*This option can be exercised on the set of special location cards inputed with the final release point if JC(3) of card 2.0 was set to 1.

Cards/Subdecks Needed	Title
9...(subdeck)	X/Q Met Data
10..(subdeck)	X/Q Decayed
11..(subdeck)	X/Q Decayed and Depleted
12..(subdeck	D/Q Deposition
13..(subdeck)	Special Location/Individual (Up to 5)
	Blank Cards (3) or card (1)*

The first card in the GASPAR input deck is a title card which is read and printed. Types of information which have been useful in the title are plant name and location, license status, meteorological data source and date, docket no., investigator, etc.

The Job Control card determines which program options are exercised and allows for variable data input. JC(1) determines which type of run will be exercised; JC(2) indicates the number of release points or source terms which will be inputted in subdeck 8; JC(3) provides two options for the printout of dose data from the various release points, cummulative or total (see Chapter 3); JC(4) provides an optional procedure for changing the data stored in BLOCK DATA for a particular run (see Appendix B); JC(5) provides options for changing data stored in the dose factor library and for permanently updating the dose factor library (see Appendix C). The dose factor library normally is contained with BLOCK DATA.

Site Specific Data card No. 3 is required on all runs and lists weather and agricultural variables specific to the location of the plant. Whenever possible, the information required on card 3 should be based on current documented data site specific information. Figure 1, page 2-11, provides NRC determined default values for growing and grazing seasons for use in lieu of site specific information. Conservative default values are provided in the program for each unspecified variable. The PDEN variable, the distance to the northeast region of the U.S., is read on this card. This parameter is used in the NEPA population dose

*Subdecks 8-13 may be repeated for each release point. If there is only one release point, 3 blank cards must be placed after Subdeck 13; if there is more than one release point, a single blank card is placed after each Subdeck 13, except the last one, which must have 3 blank cards after it.

Figure 1: Goegraphic Characterization of Agricultural Growing Season

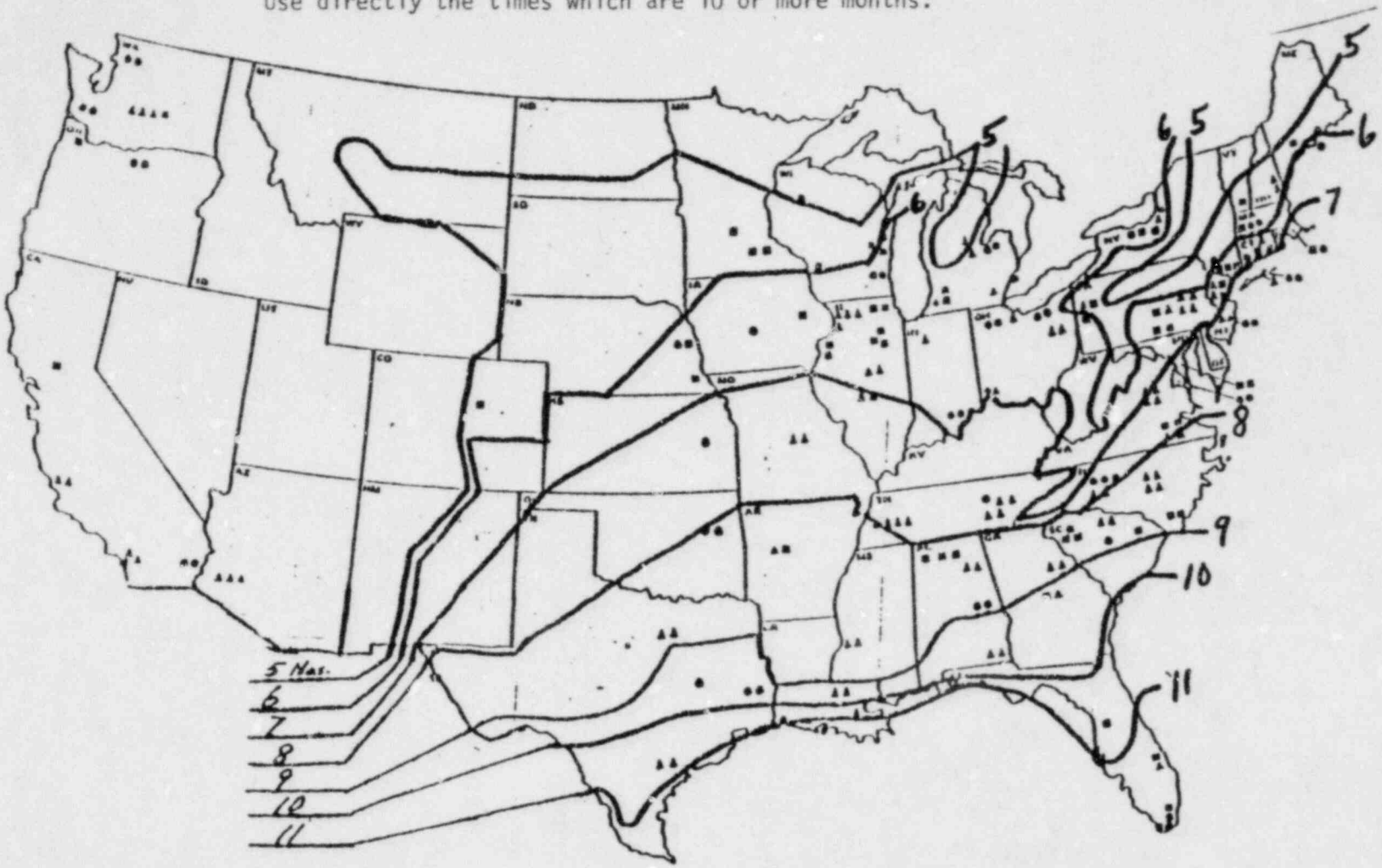
Use to derive the factors FP, FB and FGT for GASPAR input.

Isolines indicate months/yr that pasture is available for cows and beef. Add an additional month for goats.

The leafy vegetable factor FV is derived as follows:

Subtract 3 from times which are 5 through 8 months.
Subtract 2 from times which are equal to 9 months.

Use directly the times which are 10 or more months.



calculation as discussed in Appendix A. For individual run, only a dummy nonzero value must be supplied.

Component subdecks (4, 5, 6, and 7) are required only if a population dose run is being done, with or without individual dose calculations. These subdecks are not required for an individual dose only run.

The Population Distribution subdeck 4 has two options. The total population within 50 miles of the facility can be uniformly distributed over the entire area, in which case only three cards, 4.0, 4.1, and 4.2, are required. Or, the 50-mile area population can be distributed using 160 subregions formed by 16 radial sectors centered on the compass points (N, NNE, NE, etc.) and annuli at distances of 1, 2, 3, 4, 5, 10, 20, 30, 40, and 50 miles from the center of the facility. In this case a total of 34 cards is required, i.e., 4.0, 4.1, and 16 pairs of cards, one pair for each of the 10 population values found in each of the 16 sectors. Each pair of data cards (i.e., 4.1.1.a and b) will contain 10 subregion population values found in a particular sector segment in increasing distance from the plant. The program will read this subdeck clockwise, starting at north or south.

The Annual Milk Production subdeck 5 has the same structure as subdeck 4. Milk production data with a 50-mile radius circle centered at the plant can be uniformly distributed over the entire area or the annuli-sector distribution can be defined.

The Annual Meat Production, subdeck 6 and Annual Vegetation Production, subdeck 7 again have the same format and options as the population data subdeck 4.

The Release Point and Source Term subdeck 8 is required for all types of runs and a single GASPAR run can have as many as 99 separate release point subdecks. A title card, 8.0, provides a description of a release point and the mode of release. A control card, 8.1, is used to designate the number of plant units, options for the input of new or reuse of the current meteorological data associated with the release point and release time if a purge is involved. For each release point there follows up to 33 source term cards, 8.1.n, one for each nuclide released at that point. Although up to 99 release points may be

input, in the case of a population dose run only 10 release point inputs will be considered for the cost-benefit table (see Chapter 3). Each release point subdeck must be followed by a blank terminator card.

The control card (8.1) has four items. UML is a multiplier applied to each nuclide value. If two units are being considered but the nuclide release values are per unit then UML number may be 2.0, such that the computed dose values then would be for both units. The nuclide annual release values should be in units of Ci and the UML parameter can be used to convert from the units supplied to those required. For example if the source term information was supplied in terms of μCi/sec, then UML should be set to 1×10^{-6} Ci/μCi x 3.15×10^{7} sec/yr or 31.5. This variable must be decimal input.

The second variable JC(1) allows for reuse of Meteorological data (subdecks 9-12) for successive release points, if applicable. If JC(1) is set at 0, a complete set of MET data input cards (9-12) must follow the particular source term deck (8). If JC(1) = 1, then the last read MET data input is reused.

The third variable JC(2) allows for reuse of the n nuclide release cards for succeeding release points if applicable. If JC(2) = 1 then release data (8.1.n) last read is used for the next and succeeding release points. On the first source term, GASPAR will set JC(1) = JC(2) = 0, which requires input of 8.1.n and subdecks 9-12 if population doses are to be computed.

The variable purge is used only in calculating the C-14 dose to a selected individual. PURGE is left blank unless (1) the release is a purge, (2) the release contains C-14, and (3) individual doses are being calculated.

The nuclide release data cards ($\leq$ 33) for each release point follow the control card (8.1) for a particular release point unless JC(2) =1. Input data for these cards are generally determined using GALE Codes (see NUREG-0016 and NUREG-0017) or their equivalent. Each nuclide must be in the dose factor library (see Appendix C) and a "GRIEF" message is printed if a nuclide is encountered which does not appear in the library.

The order of nuclides that appear in output tables will be determined by the order in which they are entered on the first source term. The order of nuclides is irrelevant for subsequent release points. The position of the nuclide in output tables will be arranged to conform with the order of nuclides in the first release point source term, with any subsequent nuclides entered later tabulated following the earlier established order.

A blank terminator card must follow the n nuclide source term cards associated with each release point to terminate read logic.

For a population dose run the following four component subdecks provide meteorological data associated with each release point. These subdecks are titled (see Regulatory Guide 1.111):

Subdeck 9 - Average Annual Relative Gaseous Dispersion Factor X/Q

Subdeck 10 - Average Annual Relative Gaseous Dispersion Factor X/Q Decayed

Subdeck 11 - Average Annual Relative Gaseous Dispersion Factor X/Q Decayed and Depleted

Subdeck 12 - Average Annual Relative Ground Deposition D/Q

If JC(1) = 1 on card 8.1 the last input set of MET data subdecks will be reused for succeeding release points. For individual dose runs, the meteorological data is provided on selected location cards, Subdeck 13.

The format for these subdecks is similar to the Population Data Subdeck 4, except that there is no option for a uniform distribution of total value over the entire 50-mile region. Division into 160 subregions, 10 for each of the 16 compass headings, is required. Each of Subdecks 9..., 10..., 11... and 12... will have 34 cards, one title card (9.0), one control card (9.1) and 16 pairs of data input cards (9.1.n a and b), each pair providing 10 data values for a given sector.

The Special Location (Selected Individual) subdeck 13 provides the meteorological data for individual dose calculations. A maximum of five locations or five cards (one card per location) are allowed. These cards are not present for a

population dose only run; however, a single blank card must be included, i.e., subdeck 13 is a simple blank card. For a combined or individual run, special location cards must occur and be in the same order for each release point-source term subdeck. In other words, no coding is included in GASPAR to order the special location data sets for the various release points. The user must ensure that the order is preserved.

Card 13 includes some options for the form in which output is printed for each location. If JS(1) = 1 the output will not include a tabulation of the dose by nuclide for the location. If JS(1) = 0, then control of output is passed to JSS(n) variables for the seven various pathways considered. If JSS(n) = 0 the given pathway dose table is printed by nuclide (see Chapter 3).

Subdecks 8-13 are repeated as needed in a combined run for each release point. Finally a blank card and a final card signifying end of data are added to terminate the run.

2.3 Population Dose Only Run

The input card preparation for a population dose only run differs from a combined run as follows, note for population dose only run JC(1) = 0:

Cards/Decks Needed	Title
1	Plant Title Card
2	Job Control
3	Site Information
4...	Population Data
5...	Milk Data
6...	Meat Data
7...	Vegetation Data
8...	Release Point/Source Terms
9...	X/Q
10...	X/Q decayed
11...	X/Q decayed and depleted
12...	Deposition*
13...	Blank card
	Three blank cards to terminate or card 1 to start an additional run.

*Subdecks 8-13 may be repeated for each release point. If there is only one release point, 3 blank cards must be placed after Subdeck 13.

To make a population dose run without calculating the individual dose, the above deck is needed. Subdecks 8-12 along with a blank card at the end may be repeated as needed. See the GASPAR Input Deck Table I, Combined Run for options about reusing the previous Source Terms and the previous Met Data (decks 9-12).

2.4 Individual Dose Only Run

The input card preparation for an individual dose only run differs from a combined run as follows, note for an individual dose only run JC(1) > 0:

Cards/Decks Needed†	Title
1	Plant Title Card
2	Job Control
3	Site Information
8...	Release Point/Source Terms
13	Special Locations (Selected Individuals)
	Blank Card
	Three blank cards to terminate or card 1 to start an additional run.

To make an individual dose run without calculating population doses, the above deck is required. Subdecks 8 and 13, including a blank card at the end of 13, may be repeated as needed. Special location cards, up to five, must reoccur in the same order following each successive release point input.

†Subdecks 4-7 and 9-12 are deleted.

*Subdecks 8 and 13 are repeated for each release point. If there is only one release point, 3 blank cards must be placed after Subdeck 13; if there is more than one release point, a single blank card is placed after each Subdeck 13, except the last one, which must have 3 blank cards after it.

Chapter 3

GASPAR Output and Examples

3.1 Introduction

The output of the GASPAR code provides numerical calculations of dose to humans due to routine nuclear plant releases to the atmosphere pursuant to the requirements of 10 CFR Part 50, Appendix I, and the National Environmental Policy Act (NEPA; PL 91-190). Total dose to humans is computed for the population within 50 miles for implementation of the requirements of Appendix I, and for the entire U.S. population for implementation of the requirements of NEPA. In addition, the code provides options for calculating maximum individual doses at specified locations.

Each GASPAR run provides a print-back of the input in a modified form recognizable by an absence of bordering, and a border printout of the computed values. In general, the printout of the computed doses is extensive and requires several tables. There are, in general, several release points, each of which may release up to 33 nuclides, which travel to man through a network of seven pathways. For individual dose calculations, four age groups are considered; Infant (birth to 1 yr), Child (1 through 10 yrs), Teenagers (11 through 16 yrs) and Adults (17 yrs and over). Each of the age group doses are subdivided into 8 body organ dose categories and options exist for printing cumulative dose for successive release points or a final total dose tabulation only from each release point. Dose data are printed by release point, nuclide, pathway, age, and different body organ. GASPAR also provides the option to compute individual dose calculations for up to five special locations in addition to the population dose consideration. Table II provides a table of contents for a combined run output exercising all options.

Table II: Contents of GASPAR Output

1 - Title Page

2 - Block Data — Optional - constants stored in PHYS, TRANFR and USAGE as modified if JC(4)≠0

3 - Dose Factor Library — Optional - four tables, one for each age group if JC(5)=1,2 or 3.

4 - Site Population Data (1 table)

5 - Site Milk Production (1 table)

6 - Site Meat Production (1 table)

7 - Site Vegetable Production (1 table)

8 - Agricultural Productivity (1 table) — quantities produced, consumed and exported.

9 - Job Control Card 2 Print-Back

10 - Site Specific Information Card 3 Print-Back

(Items 11 through 16 will reoccur for each release point)

11 - Release point identification Card 8.0 Print-Back

12 - Release point job control Card 8.1 Print-Back

13 - Nuclide release data for release point Cards 8.1.n

14 - Meteorologcal data, release point, 4 tables (Cards 9-12)

15 - Special Location Data Print-Back - Individual run, 1 table (Cards 13.n)

16 - Environmental Inventory of Nuclides.

(Items 17 through 24 will occur for each release point if not suppressed.)

17 - ALARA Dose Summary
18 - NEPA Dose Summary
} always printed for population dose run.

19 - Total ALARA Doses from all release points by nuclide

20 - ALARA Doses by nuclide for pathways

21 - Total NEPA Doses from all release points

22 - NEPA Doses by nuclide for pathways

23 - Selected Location - Individual Doses, Summary tables for each location

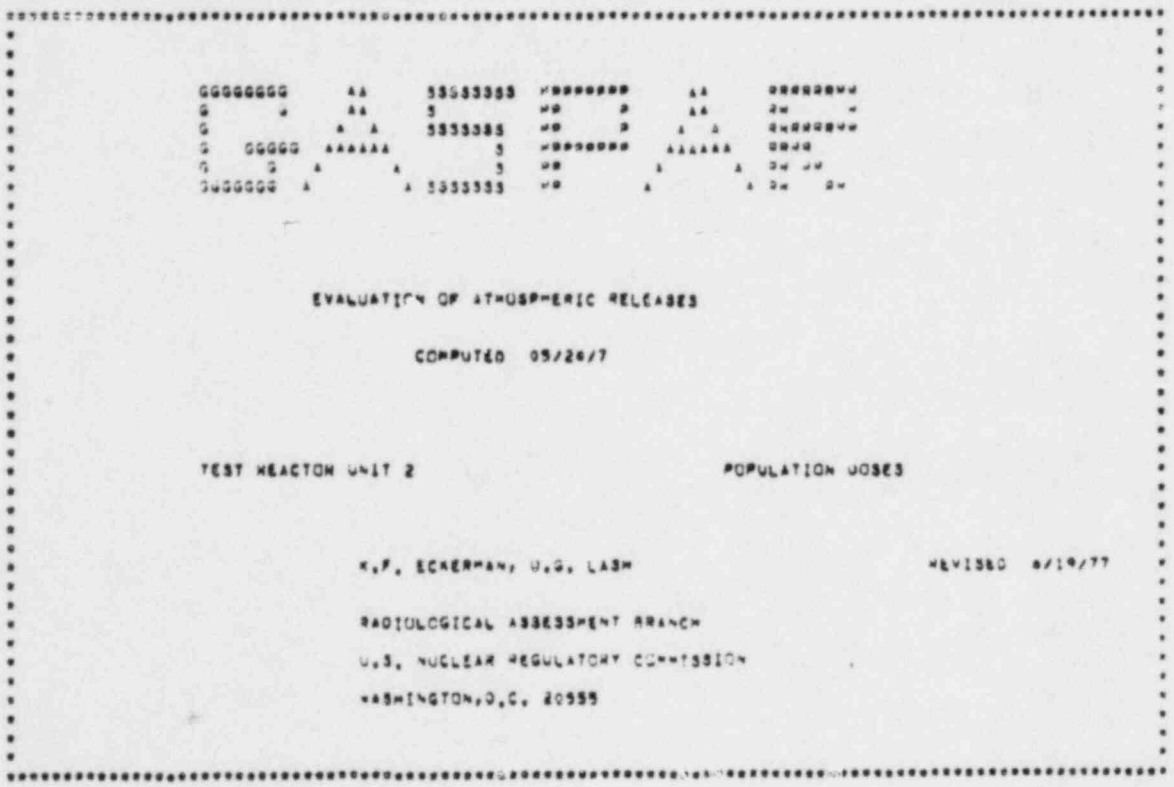
24 - Selected Location - Individual Doses by pathway and nuclide, sets of 20 tables for each location unless suppressed

25 - Cost-Benefit Tables

3.2 Annotated Samples of Output

This section discusses and provides examples of each kind of output in the order it appears in a combined run using all available options. The reader is advised to review Appendix E.

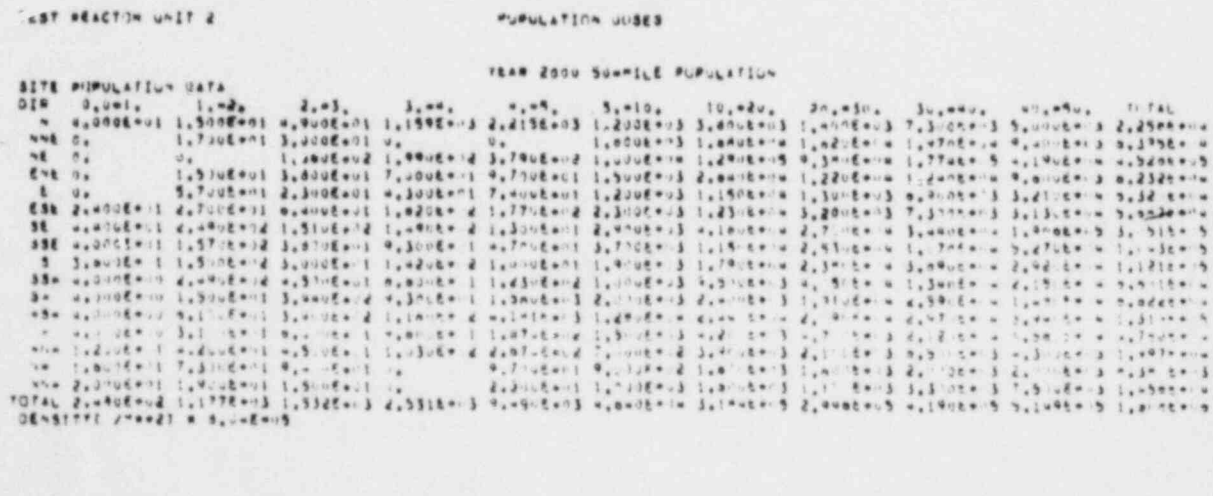
1. The GASPAR output begins with a Title Page, a print-back of identifying information provided on Card 1.0.



2. A BLOCK DATA printout occurs next if the option to change data stored in PHYS, TRANFR and usage is elected. If subdeck 2.1 is used, the revised tables of values will be printed (See Table 4, Appendix B, for definition of variables). An example printout is not included here.

3. If the option JC(5), to print or modify and print the stored Dose Factor Library is exercised, a printout of the dose factors occurs next. The printout would be similiar to the information in the current standard dose factor library appearing in Appendix C. Note that noble gasses are found only in the adult DFL since values are the same for all four age groups. If JC(5) = 0 these tables do not occur. An example printout is not included here.

4. If Site Population Data for 160 subregions are provided in subdeck 4, the data are printed as follows. Items 5, 6 & 7 of the table of contents for milk, meat, and vegetable production will follow the population data in 3 similar tables. These tables do not occur if the uniform distribution option is elected.



5. Milk Production Data

6. Meat Production Data

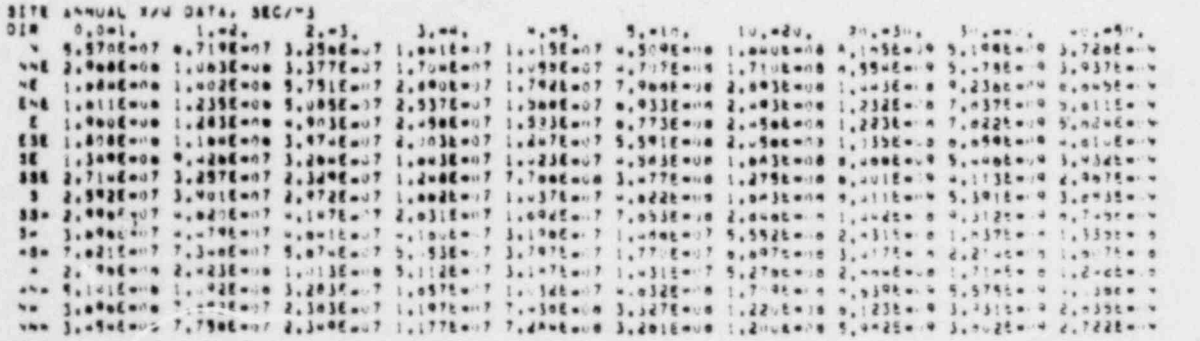
7. Vegetable Production Data

8. The four site data subdecks are followed by an agricultural productivity summary shown below. Units are Kg or liters. CAP USE is the annual per capita usage of the product, i.e., $\sum_{i=1}^{3} f_i P_i$ where f_i is the fraction of the population in the i th age group and P_i is the i th age group usage of the product. Production is the total amount produced within the 50-mile radius. Export is that quantity of produce from the 50-mile region not consumed by the population in the region. T. POP SERVED is the number of people served by the total production. Note the total population served can exceed the total population within the 50 mi. region in which case 'export' will be a non-zero entry. If the export entry is zero then the total poplation served may be less than or equal to the 50-mile population. The population served is the quotient of production and per capita use values.

AGRICULTURAL PRODUCTIVITY

Product	Cap Use	Production	Export	T.Pop Served
Vegetation	2.60E+02	2.84E+08	0.	1.09E+06
Milk	1.62E+02	4.62E+05	0.	1.62E+03
Meat	7.86E+01	4.58E+06	0.	5.83E+04

9. The next output item to appear is a printback of Job Control Card No. 2. Note that the Job Control card has 5 fields in addition to the fields for JC(1) through JC(5), for directing future program options. An example printout is not included here.



10. Site Specific Information provided on Card 3, such as agricultural parameters, humidity and a plant distance locator are next printed.

Fractions of:

Leafy vegetables from garden (FV) = .50
Other edibles from garden (FG) = .76
Humidity (G/M**3) = 8.00

Year milk cows/beef animals/goats on pasture (FP/FB/FGT) = 0.50/ .50/1.00
Milk cow/beef/goat daily intake from pasture (FPF/FBF/FPG) = 1.00/1.00/1.00
Distance to East coast (miles) = 5.30E+02

11. The Release Point identification card 8.0 is printed next, indicating plant name, release point and type of release. An example is not included here.

12. A printback of Job Control Card 8.1 for the release point follows. An examples is not provided here.

13. The next output item is a table of nuclide quantity releases provided by input cards 8.1 n for the first release point. Note that the final entry is a total for the 12 nuclides released at this particular release point. This table does not occur if previous nuclide release data is reused for a succeeding release point. The final line printed consists of two numbers, the first of which is the number of nuclides in the source term, e.g., 12, the second is the sum of the released activity.

Nuclide	CI/YR
36KR 85M	2.00E+00
36KR 85M	2.00E+00
36KR 85	2.00E+00
36KR 88	2.00E+00
54XE131M	4.00E+00
54XE133	9.20E+02
54XE135	8.00E+00
53I 131	4.40E-04
53I 133	3.9E-04
6C 14	1.00E+00
1H 3	1.20E+03
18AR 41	2.50E+01
12	2.17500083E+03

14. The Meteorological Data associated with the first release point input on subdecks 9, 10, 11 & 12 is printed next. The following example is one of four tables which appear if new MET data is input for a release point. This example is D/Q, average annual deposition and consists of 160 data entries input via subdeck 12. These tables do not occur if previous MET data is reused for a release point.

15. When a combined run or individual dose run is made, up to 5 Special Location Data card subdecks are input. The data are printed back as follows. In the example shown JS(1)=0 for all 5 special locations and control of dose printout options has been passed to the JSS variables associated with the seven pathways. All of the JSS variables are zero which means individual nuclide doses by pathway will be printed.

Greater County Nuclear Power Plant-Docket S0-000, Investigation, July 31, 1978

JS	Special Location	Dir	Miles	x/Q	x/Q DEC	x/Q DEP	Deposit	PL	GD	VT	MT	CM	GM	IN
-0	A site boundary	N	.17	1.10E-05	1.10E-05	1.078-05	3.75E-07	-0	-0	-0	-0	-0	-0	-0
-0	A site boundary	S	.41	2.33F-06	2.33E-06	2.278-06	5.72E-08	-0	-0	-0	-0	-0	-0	-0
-0	A Garden+Res	SW	.59	2.74E-06	2.74E-06	2.888-06	3.62E-08	-0	-0	-0	-0	-0	-0	-0
-0	Milk+Beef	NNE	2.20	8.05E-07	8.00E-07	7.858-07	2.18E-09	-0	-0	-0	-0	-0	-0	-0
-0	Alpha Cement	SSW	.30	2.078-06	2.07E-06	2.00F-06	8.62E-08	-0	-0	-0	-0	-0	-0	-0

16. At this point we receive the first set of computed data, the Environmental Inventory, which indicates how the nuclide release quantities are distributed to the various pathways. The RELEASE column is a summation of nuclide annual release from the release points. The ENVIRON column is a total activity of the nuclide residing in the environment assuming a continuous annual release rate over PLIFE years (projected plant lifetime-default value of 15 years). GROUND is the total activity on the ground plane within the 5^ mile region after PLIFE years of plant operation. This column is computed usng the D/Q data fo. the 50 mi. region. The ground plane activity should not exceed the ENVIRON value and in the case of nondepositing nuclides the value will be zero. The iodine value, in this example, reflects the assumption of one-half the iodine being deposited. Quantities under VEGETATION, MILK and MEAT headings denotes the annual activity of the nuclide (Ci) moving through these pathways to man.

RELEASE, ENVIRONS INVENTORY, AND ANNUAL PATHWAY INVENTORIES-CI

Nuclide	Release	Environ	Ground	Vegetation	Milk	Meat
AR 41	2.50E-01	7.55E-05	0.	0.	0.	0.
KR 83M	1.00E+00	3.05E-04	0.	0.	0.	0.
XE133	2.30E+03	4.77E+01	0.	0.	0.	0.
XE135	3.50E+02	5.23E-01	0.	0.	0.	0.
I 131	3.00E-02	9.53E-04	2.87E-04	1.03E-06	3.24E-07	2.97E-09
CS134	3.00E-06	8.83E-06	5.41E-06	3.72E-10	1.15E-10	2.86E-12
CS136	2.00E-06	1.04E-07	6.28E-08	5.90E-11	2.58E-11	2.78E-13
CS137	1.00E-05	1.27E-04	7.77E-05	1.37E-09	4.18E-10	1.05E-11
BA140	1.10E-05	5.56E-07	3.37E-07	3.14E-10	4.65E-12	1.18E-12

A combined run output will repeat items 11-16 as shown, for each release point input. If the JC(3) of card 2.0 is zero, items 17-24, discussed below, will be printed for the release point before items 11-16 appear for the next release point.

17. Computed dose data begins to appear with the ALARA Integrated Population Dose Summary table. This first table provides summaries of integrated dose (man-rem) to the population within 50 miles of the plant, used in the ALARA determination. Doses from each of six pathways are computed for 8 organs. Percentages of total dose to an organ are

provided for each pathway and total population dose to each organ is a summation over all pathways.

TEST REACTOR UNIT 2 POPULATION DOSES
ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (MANREM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	4.66E+00	4.66E+00	4.66E+00	4.66E+00	4.66E+00	4.66E+00	4.83E+00	1.28E+01
	81.76%	81.81%	50.65%	81.88%	81.58%	52.53%	82.30%	92.50%
GROUND	8.53E-03	8.53E-03	8.53E-03	8.53E-03	8.53E-03	8.53E-03	8.53E-03	1.04E-02
	.15%	.15%	.09%	.15%	.15%	.10%	.15%	.07%
INHAL	8.31E-02	8.20E-02	3.69E-03	8.59E-02	8.98E-02	1.33E+00	8.21E-02	8.07E-02
	1.46%	1.44%	.04%	1.50%	1.54%	14.93%	1.40%	.58%
VEGET	4.05E-01	4.05E-01	1.90E+00	4.07E-01	4.06E-01	1.11E+00	4.04E-01	4.04E-01
	7.11%	7.10%	20.73%	7.12%	7.13%	12.53%	6.88%	2.93%
COW MILK	4.16E-01	4.14E-01	1.98E+00	4.16E-01	4.20E-01	1.82E+00	4.13E-01	4.13E-01
	7.29%	7.26%	21.54%	7.32%	7.34%	16.26%	7.04%	3.00%
MEAT	1.28E-01	1.28E-01	6.20E-01	1.28E-01	1.28E-01	1.46E-01	1.27E-01	1.27E-01
	2.24%	2.24%	6.76%	2.23%	2.23%	1.65%	2.17%	.92%
TOTAL	5.70E+00	5.70E+00	9.17E+00	5.71E+00	5.72E+00	9.68E+00	5.87E+00	1.38E+01

18. The NEPA Integrated Population Dose Summary table follows. This table has the same format as the preceding ALARA but presents the dose received by all individuals in the U.S., in units of man-rem.

TEST REACTOR UNIT 2 POPULATION DOSES
NEPA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (MANREM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	8.18E+00	8.18E+00	8.18E+00	8.18E+00	8.18E+00	8.18E+00	8.42E+00	1.84E+01
	22.02%	22.03%	5.51%	22.01%	21.99%	15.84%	22.77%	45.31%
GROUND	8.53E-03	8.53E-03	8.53E-03	8.53E-03	8.53E-03	8.53E-03	8.53E-03	1.04E-02
	.03%	.03%	.01%	.03%	.03%	.02%	.03%	.03%
INHAL	1.17E-01	1.16E-01	3.69E-03	1.20E-01	1.23E-01	1.36E+00	1.16E-01	1.15E-01
	.42%	.42%	.00%	.43%	.44%	3.45%	.41%	.29%
VEGET	1.20E+01	1.20E+01	5.82E+01	1.20E+01	1.20E+01	1.98E+01	1.20E+01	1.20E+01
	42.97%	42.96%	52.02%	42.98%	43.00%	49.75%	42.54%	30.13%
COW MILK	3.53E+00	3.52E+00	1.71E+01	3.53E+00	3.56E+00	6.10E+00	3.52E+00	3.52E+00
	12.61%	12.61%	15.29%	12.62%	12.63%	15.50%	12.49%	8.84%
MEAT	8.14E+00	8.14E+00	3.04E+01	8.14E+00	8.14E+00	8.14E+00	8.14E+00	8.14E+00
	21.95%	21.96%	27.18%	21.93%	21.92%	15.83%	21.70%	15.41%
TOTAL	2.80E+01	2.80E+01	1.12E+02	2.80E+01	2.80E+01	3.94E+01	2.82E+01	3.94E+01

A comparison of the two previous tables is instructive. The NEPA total dose values are larger than the corresponding ALARA values reflecting the contribution to the population dose beyond the 50-mile region. This contribution arises from noble gas effluents dispersing beyond the 50-mile region (the PLUME entry) as well as H-3 and C-14 entering food pathway beyond the 50-mile region. Food export as discussed above can also contribute to the entries. For further details see Appendix A.

19. Following the summary tables, GASPAR prints a table for total ALARA Dose by nuclide summed for all release points and pathways.

TEST REACTOR UNIT 2 POPULATION DOSES
ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (MANREM)
PATHWAY = *TOTAL*

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
AR 41	2.02E-02	2.02E-02	2.02E-02	2.02E-02	2.02E-02	2.02E-02	2.02E-02	3.58E-02
	.35%	.35%	.22%	.35%	.35%	.23%	.34%	.20%
KR 83M	4.33E-08	4.33E-08	4.33E-08	4.33E-08	4.33E-08	4.33E-08	3.37E-06	1.23E-05
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
KR 85M	4.10E-01	4.10E-01	4.10E-01	4.10E-01	4.10E-01	4.10E-01	4.30E-01	[illegible]
	7.29%	7.29%	4.53%	7.28%	7.27%	4.66%	[illegible]	[illegible]
KR 85	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.[illegible]	[illegible]	5.37E-06
	.04%	.04%	.02%	.04%	.0[illegible]	[illegible]	0.00%	0.00%
KR 87	5.20E-02	5.20E-02	5.20E-02	5.20[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	.92%	.92%	.57%	[illegible]	.[illegible]	[illegible]	0.00%	.01%
KR 88	1.70E+00	1.70E+00	[illegible]	[illegible]	[illegible]	3.37E-06	1.40E-06	1.89E-06
	30.69%	[illegible]	[illegible]	0.00%	0.00%	0.00%	0.00%	0.00%
KR 89	[illegible]	[illegible]	4.05E-03	2.13E-03	1.88E-03	1.44E-03	1.52E-03	1.86E-03
	[illegible]	.03%	2%	.04%	.03%	.02%	.03%	.01%
	[illegible]	3.72E-05	1.9[illegible]E-05	2.94E-06	2.93E-06	2.92E-06	1.34E-06	3.34E-06
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CE141	1.32E-07	2.07E-06	2.81E-07	2.09E-07	1.81E-07	1.21E-07	2.53E-06	1.37E-07
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TOTAL	5.70E+00	5.70E+00	9.17E+00	5.71E+00	5.72E+00	8.88E+00	5.87E+00	1.38E+01

20. The total dose by nuclide is then followed by 6 tables of ALARA dose by nuclide, one for each pathway.

TEST REACTOR UNIT 2 POPULATION DOSES
ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (MANREM)
PATHWAY = PLUME

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
AR 41	2.02E-02	2.02E-02	2.02E-02	2.02E-02	2.02E-02	2.02E-02	2.02E-02	3.59E-02
	.41%	.41%	.41%	.41%	.41%	.41%	.42%	.26%
KR 83M	4.33E-08	4.33E-08	4.33E-08	4.33E-08	4.33E-08	4.33E-08	3.37E-08	1.23E-05
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
KR 85M	4.18E-01	4.18E-01	4.18E-01	4.18E-01	4.18E-01	4.18E-01	4.30E-01	1.52E-00
	8.92%	8.92%	8.92%	8.92%	8.92%	8.92%	8.89%	11.9%
KR 85	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	2.12E-03	7.04E-03	3.55E-01
	.05%	.05%	.05%	.05%	.05%	.05%	.15%	2.78%
KR 87	5.26E-02	5.26E-02	5.26E-02	5.26E-02	5.26E-02	5.26E-02	5.44E-02	2.34E-01
	1.13%	1.13%	1.13%	1.13%	1.13%	1.13%	1.13%	1.83%
KR 88	1.76E-00	1.76E-00	1.76E-00	1.76E-00	1.76E-00	1.76E-00	1.77E-00	2.59E-00
	37.77%	37.77%	37.77%	37.77%	37.77%	37.77%	36.81%	20.30%
KR 89	3.41E-06	3.41E-06	3.41E-06	3.41E-06	3.41E-06	3.41E-06	3.45E-06	8.09E-06
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
XE131M	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.14E-03	3.90E-03	3.80E-02
	.07%	.07%	.07%	.07%	.07%	.07%	.08%	.30%
XE133M	1.88E-03	1.88E-03	1.88E-03	1.88E-03	1.88E-03	1.88E-03	1.85E-03	1.55E-02
	.04%	.04%	.04%	.04%	.04%	.04%	.04%	.12%
XE133	1.74E-00	1.74E-00	1.74E-00	1.74E-00	1.74E-00	1.74E-00	1.77E-00	5.95E-00

21. A total NEPA Dose by nuclide table prints in the same format as item 19.

TEST REACTOR UNIT 2 POPULATION DOSES
NEPA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (MANREM)
PATHWAY = *TOTAL*

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
AR 41	2.23E-02	2.23E-02	2.23E-02	2.23E-02	2.23E-02	2.23E-02	2.23E-02	3.96E-02
	.08%	.08%	.02%	.08%	.08%	.08%	.08%	.10%
KR 83M	4.75E-08	4.75E-08	4.75E-08	4.75E-08	4.75E-08	4.75E-08	3.71E-08	1.35E-05
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
KR 85M	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.63E-01	4.75E-01	1.68E-00
	1.88%	1.88%	.41%	1.88%	1.88%	1.88%	1.88%	1.88%
KR 85	5.37E-03	5.37E-03	5.37E-03	5.37E-03	5.37E-03	5.37E-03	1.78E-02	1.59E-00
	.09%	.09%	.09%	.09%	.09%	.09%	.09%	.09%
			8.41E-03	8.90E-03	2.80E-03	1.44E-03	1.85E-03	1.84E-03
		0.00%	0.00%	.02%	0.00%	0.00%	0.00%	0.00%
BA140	1.08E-05	1.79E-04	1.30E-04	3.08E-06	2.97E-06	2.92E-06	1.35E-04	3.34E-06
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
CE141	1.32E-07	1.39E-05	2.84E-07	2.13E-07	1.83E-07	1.21E-07	2.53E-06	1.37E-07
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TOTAL	2.60E+01	2.60E+01	1.12E+02	2.60E+01	2.60E+01	3.94E+01	2.82E+01	3.96E+01

22. The total NEPA dose table is followed by 6 tables of NEPA Doses by Nuclide, one for each pathway.

REACTOR UNIT 2 POPULATION DOSES
NEPA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (MANREM)
PATHWAY = GROUND

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
I 131	7.79E-04	7.79E-04	7.79E-04	7.79E-04	7.79E-04	7.79E-04	7.79E-04	9.43E-04
	9.13%	9.13%	9.13%	9.13%	9.13%	9.13%	9.13%	9.41%
I 133	2.43E-04	2.43E-04	2.43E-04	2.43E-04	2.43E-04	2.43E-04	2.43E-04	2.98E-04
	2.85%	2.85%	2.85%	2.85%	2.85%	2.85%	2.85%	2.94%
CR 51	7.03E-07	7.03E-07	7.03E-07	7.03E-07	7.03E-07	7.03E-07	7.03E-07	8.31E-07
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
MN 54	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.01E-04	1.19E-04
	1.19%	1.19%	1.19%	1.19%	1.19%	1.19%	1.19%	1.18%
FE 59	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	3.93E-06	4.61E-06
	.05%	.05%	.05%	.05%	.05%	.05%	.05%	.05%
CO 58	7.58E-06	7.58E-06	7.58E-06	7.58E-06	7.58E-06	7.58E-06	7.58E-06	8.88E-06
	.09%	.09%	.09%	.09%	.09%	.09%	.09%	.09%
CO 60	5.25E-03	5.25E-03	5.25E-03	5.25E-03	5.25E-03	5.25E-03	5.25E-03	6.16E-03
	61.61%	61.61%	61.61%	61.61%	61.61%	61.61%	61.61%	61.51%
ZN 65	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.47E-05	3.99E-05

If JC(3)=1, only the final tables, summed over all release points, will be printed.

In the examples just discussed, items 19-22, an option exists for modifying the output sequence. If JC(3)=0 of card 2.0, the 4 tables would be repeated for each release point with doses cumulating from one release point to the next. In a combined run, (JC(1)=0) if JC(3)=0 cumulating individual dose tables follow the cumulating population dose tables for each release point.

23. If an individual or combined run is executed the next item of output is Dose to Selected Individual at a special location. If JC(3)=1 on Card 2, cumulating dose by release point is suppressed and summary tables are printed, one for each special location up to 5. These tables present

organ doses by the various pathways, distributed by age group where appropriate. Note that annual beta and gamma air doses from noble gas effluents are provided and that doses from pathways PLUME and GROUND are not age dependent. In addition note that GASPAR considers all pathways to be operational for the location; however no summation over pathways is performed. The user must sum the values over the operational pathways at the location.

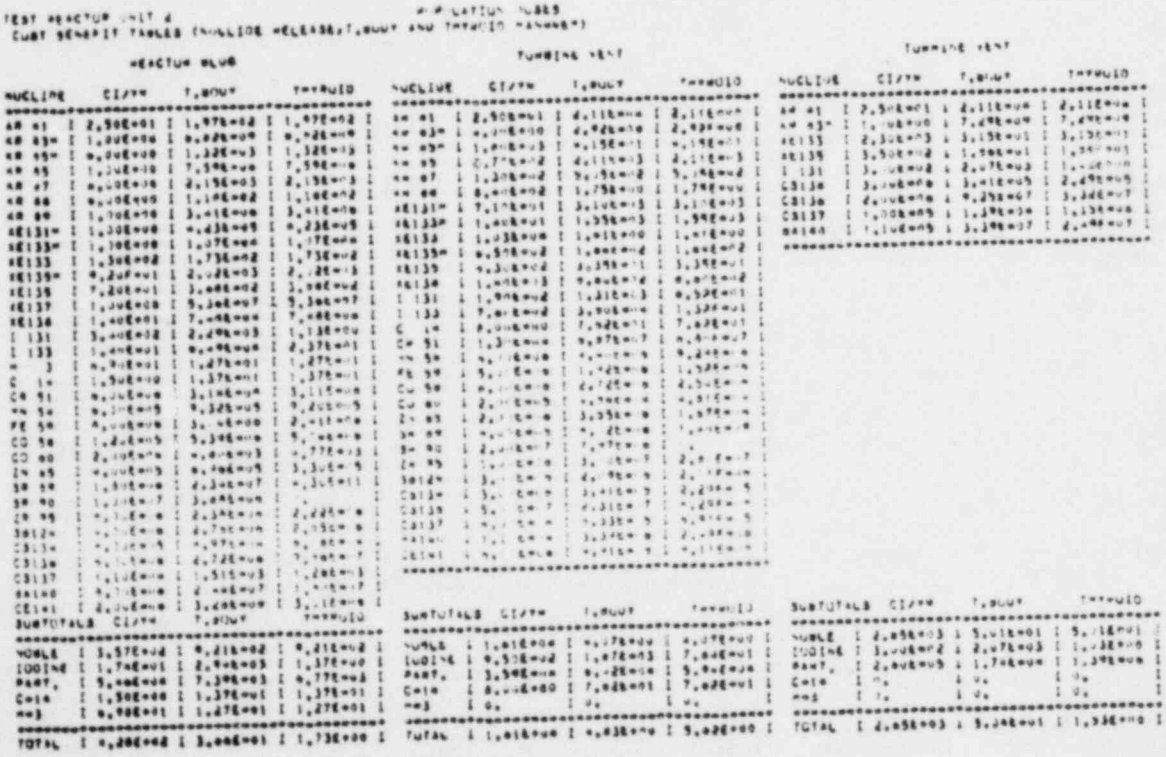
NUCLEAR PLANT NO GASEOUS RELEASE
SPECIAL LOCATION NO. 1
AT .03 MILES

ANNUAL BETA AIR DOSE = 5.00E+00 MILLRADS
ANNUAL GAMMA AIR DOSE = 9.22E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	0.20E+00	0.20E+00	0.20E+00	0.20E+00	0.20E+00	0.20E+00	0.20E+00	1.20E+01
GROUND	4.32E+02	4.32E+02	4.32E+02	4.32E+02	4.32E+02	4.32E+02	4.32E+02	5.05E+02
VEGET								
ADULT	2.52E+02	8.08E+01	4.09E+02	2.49E+02	4.23E+01	1.02E+02	2.59E+01	0.
TEEN	2.50E+02	9.55E+01	5.93E+02	3.99E+02	1.36E+02	6.93E+01	5.00E+01	0.
CHILD	2.97E+02	7.15E+01	1.30E+03	6.70E+02	2.19E+02	1.40E+02	7.54E+01	0.
MEAT								
ADULT	1.51E+01	6.98E+00	1.53E+01	4.08E+01	7.82E+00	1.16E+01	1.93E+00	0.
TEEN	7.45E+00	4.81E+00	1.19E+01	1.04E+01	6.12E+00	6.40E+00	1.79E+00	0.
CHILD	6.14E+00	2.48E+00	2.04E+01	2.09E+01	7.48E+00	1.27E+01	2.08E+00	0.
COW MILK								
ADULT	1.13E+02	1.31E+01	1.10E+02	1.60E+02	5.86E+01	3.20E+02	1.68E+01	0.
TEEN	1.13E+02	1.56E+01	1.92E+02	2.79E+02	1.01E+02	5.06E+02	3.33E+01	0.
CHILD	1.00E+02	1.07E+01	4.45E+02	4.69E+02	1.63E+02	9.9AE+02	5.05E+01	0.
INFANT	1.01E+02	4.70E+01	8.96E+02	8.95E+02	2.55E+02	2.43E+03	9.04E+01	0.
GOATMILK								
ADULT	5.02E+02	1.72E+01	6.79E+02	8.97E+02	2.39E+02	1.16E+03	7.68E+01	0.
TEEN	4.85E+02	2.18E+01	8.45E+02	1.22E+03	4.16E+02	1.84E+03	1.58E+02	0.
CHILD	3.75E+02	1.62E+01	1.98E+03	2.08E+03	6.79E+02	3.63E+03	2.38E+02	0.
INFANT	3.55E+02	2.30E+01	3.12E+03	3.96E+03	1.08E+03	8.82E+03	4.22E+02	0.
INHAL								
ADULT	1.53E+02	5.65E+03	9.31E+02	2.12E+02	9.33E+03	1.53E+01	7.65E+02	0.
TEEN	1.29E+02	5.80E+03	7.58E+02	2.90E+02	1.28E+02	1.88E+01	1.20E+01	0.
CHILD	8.17E+03	2.42E+03	8.42E+02	2.81E+02	1.19E+02	2.08E+01	1.01E+01	0.
INFANT	3.33E+03	1.07E+03	3.97E+02	1.94E+02	6.60E+03	1.90E+01	7.35E+02	0.

24. If there are n special locations and JC(3)=0, the n summary tables are followed by n sets of dose tables by nuclide for each pathways and age groups. This section of output could include n sets of 20 dose tables for a maximum of 100 tables. The individual doses will occur with cumulating dose for successive release points if JC(3)=0. This extensive output can be reduced by using JS(n) and JSS(n,m) variables on Card 13. If JS(n)=1 or all JSS(n,m)=1, no dose details will be printed by nuclide and the output is significantly reduced (see Table I). An example is not provided here.

25. The final output of a combined or population only run is the Cost-Benefit Table. This table tabulates the nuclide contribution via each release point to the ALARA population dose. Note the release points will be identified by the information contained on card 8.0 of the input data. The summary tables provide subtotals for noble gasses, iodine, particulates, carbon-14 and tritium. These tables are printed only at the end of a run and are printed twice - the second copy supplied to individual responsible for the cost/benefit analysis.



Appendix A

Computational Models Used in GASPAR

I. Introduction

The GASPAR code computes two population dose quantities: (1) the ALARA population dose, and (2) the NEPA population dose. As noted earlier the ALARA population dose is restricted to consideration of the pouplation residing within the 50-mile region of the facility and is used in the cost-benefit analysis required by 10 CFR, Part 50, Appendix I. The NEPA population dose estimate is, as implied by its name, used as a measure of the radiological impact for presentation in environmental assessments. This latter quantity represents the annual population dose to U.S. residents from the facility effluents. The NEPA dose estimate has the ALARA population dose as its initial value. Incremental additions arise as a result of (1) export of agricultural items from the 50-mile region, and (2) the dispersion of radionuclides beyond the 50-mile region. These contributions to the NEPA dose are discussed below.

II. Export of Activity from the 50 Mile Region

As noted above, the ALARA population dose is restricted to consideration of only the population residing within 50 miles. In this calculation it is assumed that all the food consumed by the 50-mile population is produced in the 50-mile region, provided the production rate within the region is equal to or greater than the consumption rate. For calculating the NEPA dose it is necessary to include the contribution from agricultural products being transported outside of the 50-mile region. This is done by comparing the difference between the annual 50-mile food production and food consumption. If this difference is positive the excess food is considered in the NEPA dose. If it is negative or zero, it is assumed that there is no transport out the region and thus no incremental contributions to the NEPA dose. It should be noted that this simple approach greatly simplifies the handling of food transport. This approach was necessary as it is nearly an impossible task to assemble and handle actual information on food transport patterns with a 50-mile region. It should also be noted that the spatial distribution of agricultural activities may be input into the code for these calculations. This information, coupled with the

spatially dependent dispersion, is used to determine the annual total activity entering the various food pathways.

To aid the user in understanding the relationship between the fifty mile population and the agricultural productivity of the region a summary table is printed during execution of a population dose calculation. The table is printed by subroutine AGPROD which is called from the main program after the population and agricultural data have been read in. For each of these agricultural productions (vegetation, milk, and meat) tabulated are: a) the per capita consumption rate, b) the annual 50-mile production, c) the amount (kg or liters) exported beyond the 50-mile region, and d) the total population served by the food item. Inspection of this table will indicate if food products are being exported beyond the 50-mile region. The user can, of course, compare the 'total population served' to the 50-mile population value to note the extent of food import required to sustain the population (see p. 3-8).

III. Dispersion of Effluents Beyond 50 Mile Region

A. Deposition of Particulates.

Nuclides with negligible deposition velocities will remain airborne for time periods in excess of those required to transport the effluent beyond 50 miles. Of the effluents released from LWR's, the noble gases, tritium (HTO), and carbon-14 ($^{14}CO_2$) are of primary concern in this stage of dispersion. It is, of course, possible that the atmospheric dispersion conditions might be such that a fraction of the particulate releases may escape the 50-mile region. The code has been formulated on the assumption that the particulates released from the facility will deposit onto the ground plane within the 50-mile region. However, to permit the user to review this assumption a tabulation is printed for each of the release points in the population dose calculation. The tabulation, printed by subroutine DOSIT, is entitled 'RELEASE, ENVIRONS INVENTORY AND ANNUAL PATHWAY INVENTORIES-CI". Tabulated under the column headed 'ENVIRONS' is the total activity deposited in the environment, assuming a constant release rate of the nuclide. The following equation shows how these values are generated.

$$\text{ENVIRON} = \frac{Q}{\lambda} \left[1-\exp(-\lambda \cdot \text{PLIFE})\right],$$

where Q is the nuclide release rate (Ci/yr),
λ the radiological decay constant (yr^{-1}), and
PLIFE is the midpoint of plant life (default = 15yr).

This quantity is tabulated for all nuclides released. The total activity calculated to be on the ground surface within the 50-mile region at the time PLIFE, as determined from the deposition data (D/Q array), is tabulated under the column 'GROUND'. 'GROUND' is computed as

$$\text{GROUND} = \frac{Q}{\lambda}\,(1-e^{-\lambda t}) \sum_i \sum_j D/Q(i,j)\, A(i,j),$$

where D/Q(i,j) is the deposition parameter value for the ith sector, jth ring element (m^{-2}), A(i,j) is the area of the ith sector, jth ring element (m^2).

If the activity is totally deposited within the 50-mile region the values tabulated under the ENVIRON and GROUND column should be in agreement. Small disagreements may be noted, however, in general agreement is indicated by differences less than 2. It should be recalled that the radioiodine entries will not be in agreement due to the assumptions of the chemical forms being released and its impact on the deposition considerations. This mass balance check can also serve to determine if the D/Q values are indicating excessive depositions of material.

The code is presently structured on the assumption that all particulate activity is deposited within the fifty mile region. The only mechanism by which particulates contribute an additional increment of population dose to the NEPA calculation, above that of the ALARA population dose, is the export of food products.

B. Dispersion models for the region beyond fifty miles.

GASPAR considers three dispersion regimes. The first region, the 50-mile regime, is treated in detail utilizing dispersion data for a spatial grid superimposd on the facility. The two additional regimes considered are referred to as the first pass and the world wide regimes. The latter two regimes are discussed below.

1. First Pass Dispersion Model.

Consider the release of a pollutant to the atmosphere being transported in the downwind direction. As the pollutant is transported it disperses in both the lateral and vertical directions. The vertical dspersion is constrained by the presence of both the ground plane and the stable atmospheric layer aloft, the height of which determines the mixing depth. These constraints in the vertical result in the material being uniformly distributed in the vertical direction after a travel time characteristic of the meteorology and geometry. The shape of such a plume geometry can be visualized as a right cylindrical wedge whose height is equal to the mixing depth. This model is obviously a simplification of far field atmospheric transport, however, dispersion conditions approaching the wedge characterization do occur at downwind distances and such a geometry is often included in dispersion models[1-3]. For the moment we assume that there are no material losses through deposition or radiological decay.

The total amount of material passing through a surface A at the downwind distance r over the time period T is given by

$$\int_T \chi(r)w(r)\, L\, v\, dt, \text{ where}$$

$\chi(r)$ is the airborne concentration at location r (Ci/m^3),
$w(r)$ the lateral dimension of the plume at r (m)
L the vertical mixing depth (m), and
v the wind speed (m/sec).

For a conserving material, i.e., nondecaying - nondepositing, the time integrated quantity passing through the surface A must be equal to the amount released, Q, where

$$Q = \int \dot{Q}\, dt, \quad \dot{Q} \text{ being the release rate.}$$

Thus

$$\int \dot{Q}\, dt = \int \chi(r)w(r)\, L\, v\, dt. \qquad (1)$$

Assuming time invariant wedge parameters, then

$$\chi(r) = \frac{\dot{Q}}{w(r)\ L\ v} \qquad (2)$$

noting the familiar expression

$$\chi(r) = \dot{Q}\ \chi/Q(r), \qquad (3)$$

where $\chi/Q(r)$ is the atmosphere dispersion factor (sec/m^3) applicable to location r, then equating Equation 2 and 3,

$$\chi/Q(r) = \frac{1}{w(r)\ L\ v} \qquad (4)$$

For the wedge dispersion geometry, χ/Q is thus inversely related to the width of the wedge, the height of the mixing depth, and the wind speed. For a decaying material Equation 4 is modified by the factor, $\exp(-\lambda\ r/v)$. A similar modification could be introduced for deposition, however as noted above in GASPAR, particulate matter was assumed to be deposited in the first dispersion regime, i.e., within 50 miles.

The population dose is just the spatial integral of the airborne concentrations weighted by the population,

$$D(R) = K\ \dot{Q} \int_0^R X/Q(r)\ \exp(-\lambda\ r/v)\ \rho(r)\ w(r)dr, \qquad (5)$$

where = K is a nuclear-pathway specific dose conversion factor (rem/Ci),

$\rho(r)$ is the population density at location r (m^{-2}).

R is the total plume pathway length (m).

Assuming that the population density $\rho(r)$ is independent of r, i.e., $\rho(r) = \rho$, and substituting Equation 4 into 5 and integrating over the plume path length d, the population dose is:

$$D(R) = \frac{K \dot{Q} \rho}{L \lambda} \left[1 - \exp\left(-\lambda R/v\right)\right] . \qquad (6)$$

Note that population dose is only dependent on the depth of the mixing layer and not on the lateral dispersion, w(r). This, of course, results because the airborne concentrations are inversely proportional to w(r) however the number of individuals exposed is directly proportional to w(r). Equation 6 is used in GASPAR to evaluate the population dose from noble gases, tritrium and carbon-14 during their first pass over the U.S. In GASPAR the following wedge parameter values are assigned.

Mixing Depth L : 1000 meters
Wind Speed v : 2 m/sec
Population Density ρ : 160 people/mi^2

The plume path length, R, is required in the input stream of GASPAR (see Table I, card no. 3.0). In population dose calculations this parameter is typically taken to be an estimate of the distance from the facility to the northeast corner of the U.S.

2. World Wide Dispersion

World-wide dispersion is considered for nondepositing effluents of half life greater than one year (typically Kr-85, carbon-14 and tritium). As discussed earlier only the annual collective dose to the U.S. population is evaluated in GASPAR. The models employed for each of these analysis is discussed below:

a) Noble gases effluents, $T_{\frac{1}{2}} > 1$ year.

The total environmental inventory of noble gas nuclides existing at the midpoint of plant life, PLIFE, is assumed to be uniformly dispersed in the atmosphere. The resultant incremental population dose is computed as follows:

$$D = 1.0 \times 10^9 \, USPØP \cdot SF \cdot DFA \cdot ENVIRON/VA,$$

where

USPØP s the population of the U.S. (default value of 2.6×10^8)

SF is the shielding correction factor (default value of 0.5)

DFA is the dose conversion factor of Table B-1 of RG 1.109 (mrem - m^3/pCi-yr) for the nuclide of interest,

ENVIRØN is the environmental inventory of the nuclide at the midpoint of plant life (Ci),

VA is the volume of the atmosphere (default value of 3.8×10^{18} m^3).

The constant 1.0×10^9 represents 10^{-3} rem/mrem x 10^{12} pCi/Ci.

b) Tritium

The tritium world wide dispersion model is similar to that employed with long lived noble gases with the exception that the tritium is placed into the upper 75 meters of the world oceans.

The world circulating waters are assumed to be in equilibrium and the incremental dose is estimated as

$$D = 3.65 \times 10^{11} \cdot USPOP.ENIV.DFL/VHS$$

where

ENIV is the total tritium residing in the environment at the mid point of plant life (Ci).

DFL is the dose conversion factor of ingestion of tritium (mrem/pCi)

VHS is the volume of the world oceans to a depth of 75 meters (2.7×10^{19} liters)

The constant 3.65×10^{11} represents 10^{-3} rem/mrem x 10^{12} pCi/Ci x 365.d/yr x 1 l/d.

The U.S. population is assumed to ingest an equivalent intake of 1 liter per day of the circulating world wide water per person. The resulting tritium population dose is distributed among the various food pathway as

vegetation - 48% of the dose
milk - 28%
meat - 24%.

The percentage values are based on the estimated hydrogen intake through these pathways.

c) Carbon-14

The two-compartment carbon-14 model of Hayes and McMurdo as outlined by U. R. Veluri et al., is used in GASPAR. For a constant release of $\dot{Q}$ Ci/yr of C-14, the atmospheric specific activity at time t is given as:

$$SpA = \frac{Q}{VA} \frac{1}{0.16} \left(\frac{A^1}{\lambda_1} (1 - e^{-\lambda_1 t}) + \frac{A^2}{\lambda_2} (1 - e^{-\lambda_2 t}) \right) ,$$

where

SpA is the C-14 specific activity in Ci/g of carbon,

$\dot{Q}$ is the release rate (Ci/yr)

VA is the volume of the atmosphere (default value of 3.8×10^{18} m^3)

0.16 the concentration of natural carbon in the atmosphere (g/m^3)

t is the time in year.

The parameters A_1, λ_1, A_2, λ_2 are taken from Veluri et al. as 0.96, 0.0209 yr^{-1}, 0.04, and 0.00125 yr^{-1}, respectively.

The incremental population base is given as:

$$D = K \, USP\emptyset P \, SpA$$

where K is $1.57 \times 10^8 \frac{rem\text{-}g}{Ci\text{-}yr}$

The numerical value above is based on ICRP-2 estimate that a body burden of 400 μCi of C-14 yields 5 rems/yr.

Appendix B

Input Card Preparation for Changing Data Blocks

The option to change physical, transfer and usage data is controlled by variable JC(4), column 7, 8 on Input Card No. 2. This is provided in order that certain constants stored in BLOCK DATA, intended as default values, may be changed to reflect site specific information. Table III describes the input and preparation for making changes. Changes in stored data are temporary in that upon termination of the run, BLOCK DATA reverts to the original values for subsequent runs. (See Appendix C for permanent updating.) Constants stored in BLOCK DATA are listed in Table IV with reference to their origin in Regulatory Guide 1.109. If the variable is a single constant, the current value is given with units. Arrays of data are indicated only by an index numbers and units.

In order to change a value, the variable JC(4) on Input Card No. 2 is set to 1 (one). This causes MAIN to call the subroutine BLKDAT which in turn reads the changes input on cards 2.1. The format for card 2.1 is detailed in Table 2. Card 2.1 may be repeated as many times as needed to make all the desired data changes.

In order to terminate the reading of cards 2.1... by BLKDAT, a blank terminator card is inserted causing return of program control to MAIN. In the case that changes are also desired in the Dose Factor Library, cards 2.2, etc., must follow 2.1, including the blank card.

Some specific examples of data changes are presented.

Example A: Change variable PLIFE, No. 2 in PHYS from 4.73 E08 seconds (15 years) to 6.31 E08 seconds (20 years)

Card 2.1

Punch	in	Column	Comment
P		1	Denotes PHYS Data Block
2		5	Index of variable in PHYS block
6.31 E+09		23-30	Effects change in this variable for this run.

Table III: Input Card Preparation Table for Changing Constants in Block Data

Card No.	Format	Variable	Columns	Description/Purpose/Units
2.1				Change Constants Stored in PHYS, TRANFR, USAGE
	A1	NCOM	1	P, T or U according to the labeled common to be changed PHYS (P), TRANFR (T) or USAGE (U).
	I4	N	2-5	Index of variable (see Table 3 for Variable index).
	I4	I1	6-9	Initial Index if the variable is an array of values. See Sample Problem 4 output. (Indices can be determined from a printout of stored data.)
	I4	I2	10-13	Terminal Index if variable is an array.
	6E10.0	Data	21-30 . . . 71-80	New data values. One card is required for each variable. For an array up to six consecutive values may be changed on one card. If more than six, a continuation card is required.
	8E10.0	Data	1-10 . . . 71-80	Continuation of card 2.1 for changing more than six consecutive values in an array. Right justification is required for exponential entries.

Table IV: Block Data Variable List

Index	Variable	Estimate or Default Valve	Units	Description/Reference
		PHYS (P) Physical Constants		
1	Area	Array-10 values	m^2	Area in m^2 of annular sections inside 1, 2, 3, 4, 5, 10, 20, 30, 40, 50 miles.
2	PLIFE	4.73 E08	secs (15 years)	Midpoint of reactor operation lifetime (t_b: 1.109-14).
3	SF	.7	none	External radiation shielding factor for individuals (S_F: 1.109-68).
4	SSF	.5	none	External radiation shielding factor for population (1.109-68).
5	VHS	2.7×10^{19}	litres	Volume of the hydrosphere, i.e., top 75m of the oceans.
6	VNA	3.8×10^{18}	m^3	Volume of the atmosphere.
7	FID	0.5	none	Fraction of iodine which deposits (1.109-26).
		TRANFR (T) Agricultural Constants		
1	BLDAY	60	days	Exposure time of man's vegetation to plume (t_e: 1.109-68).
2	COWIN	50	Kg/day	Cow Ingestion Rate (Q_F: 1.109-27).
3	GOATIN	6.	Kg/day	Goat Ingestion Rate (Q_F: 1.109-27).
4	IGOT	Array-14 values	none	Atomic numbers for which goat milk transfer rates are known (1.109-38).

Number	Variable	Estimate or Default Valve	Units	Description/Reference
5	PARTUP	0.2	none	Retention fraction on vegetables of particulates other than iodine (1.109-26 ¶3).
6	REMVEG	5.73 E-07	1/sec	Removal constant corresponding to 14 days. (λ_w: 1.109-4).
7	SD	240	Kg/m^2	Effective surface density for soil. (P: 1.109-3).
8	Soil	Array-100 values	none	Soil transfer parameters (B_{iv} 1.109-37).
9	VIORET	1.0	none	Retention fraction on vegetables of iodine (r: 1.109-26 H2).
10	YA1	.75	Kg/m^2	Pasture grass density (Y_v: 1.109-69).
11	YA2	2.0	Kg/m^2	Other crop density (Y_v: 1.109-69).
12	YV	2.0	Kg/m^2	Garden vegetation density (Y_v: 1.109-69).
13	ZGMLK	Array-14 values	day/litre	Goat milk transfer parameters (F_m: 1.109-38).
14	ZMET	Array-100 values	day/Kg	Meat transfer parameters (F_f: 1.109-37).
15	ZMLK	Array-100 values	day/litre	Cows milk transfer parameters (F_m: 1.109-37).
16	TIM	Array-8 values	secs	Eight holdup and transport times as follows.
	TIM(1)	1.73 E06	secs (20 days)	Transport - Meat to Population (1.109-32).
	(2)	3.46 E05	secs (4 days)	Transport - Milk to Population (1.109-32).
	(3)	1.21 E06	secs (14 days)	Transport - Fruits, Grains and Vegetables (1.109-32).
	(4)	5.18 E06	secs (60 days)	Hold up - Vegetation after harvest (t_h: 1.109-69).

Number	Variable	Estimate or Default Valve	Units	Description/Reference
	(5)	1.73 E05	secs (2 days)	Transport - Cow feeding to receptor (t_f: 1.109-27).
	(6)	5.64 E04	secs (1 day)	Holdup - Leafy Vegetables (t_b: 1.109-69).
	(7)	2.59 E06	secs (30 days)	Exposure time of plume to pasture grass (t_e: 1.109-68).
	(8)	7.78 E06	secs (90 days)	Storage time for animals food (t_h: 1.109-69).
		USAGE (U) Consumption Rates for age groups		
		(Used for population dose calculations - 1.109-39)		
1	AVINH	(3700., 8000., 8000.)	m^3/yr	Average inhalation rates for 3 age groups (1) children and infants, (2) teenagers, and (3) adults.
2	AVLVEG	(10., 20., 30.)	Kg/yr	Average leafy vegetable intake for (1), (2) and (3).
3	AVMET	(37., 59., 95.)	Kg/yr	Average meat intake for (1), (2) and (3).
4	AVMLK	(170., 200., 110.)	ℓ/yr	Average milk intake for (1), (2) and (3).
5	AVVEG	(200., 240., 190.)	Kg/yr	Average vegetable intake for (1), (2) and (3).
6	POPF	(.18, .11, .71)	none	Fraction of population in (1), (2) and (3).
7	USPOP	2.6 E08	people	Estimated U.S. population for 2000.
		(Used for individual dose calculations - 1.109-40)		
8	SLVEG	(0., 26., 42., 64.)	Kg/yr	Leafy Vegetable intake for (1) infants, (2) children, (3) teens, and (4) adults.
9	SPINH	(1400., 3700., 8000., 8000.)	m^3/yr	Inhalation Rates for (1) thru (4).

Number	Variable	Estimate or Default Valve	Units	Description/Reference
10	SPMET	(0., 41., 65., 110.)	Kg/yr	Meat intake for (1) thru (4).
11	SPMLK	(330., 330., 400., 310.)	ℓ/yr	Milk intake for (1) thru (4).
12	SPVEG	(0., 520., 630., 520.)	Kg/yr	Vegetable intake for (1) thru (4).

Example B: Change cows milk transfer parameter array ZMLK, index 15 in TRANFR, ZMLK(3) thru ZMLK(10) to 5.3E-02, 9.7E-05, 2.5E-03, 1.3E-02, 1.8E-02, 2.3E-02, 1.8E-02, 1.2E-04, respectively.

Card 2.1

Punch	in	Column	Comment
T		1	Denotes TRANFR Data Block
15		4, 5	Index of Variable in TRANFR block
3		9	Initial Index
10		12, 13	Terminal Index
5.3E-02		24-30	ZMLK(3) new valve
9.7E-05		34-40	ZMLK(4) new valve
.		.	.
.		.	.
.		.	.
.		.	.
2.3E-02		74-80	ZMLK(8) new valve

Card 2.1 Continuation

Punch	in	Column	Comment
1.8E-02		4-10	ZMLK(9) new valve
1.2E-04		14-20	ZMLK(10) new valve

Place a blank card at the end of the completed 2.1... card deck if no changes are to be made in the Dose Factor Library. The deck then continues with card No. 3.0 of the MAIN program.

Caution should be taken if several jobs are being computed on a single GASPAR run. If data changes are to be in effect for each succeeding job, then these changes need be made only on the first job. If only one of several jobs requires data changes it should be the last job done in a particular run.

Appendix C

Input Card Preparation for Changing Dose Factor Library

The option to change data in the dose factor library (DFL) is controlled by variable JC(5), column 10 on Input Card No. 2. Table V describes the input card preparation for making changes. The JC(5) variable controls reading, printing and special punching of the dose factor library. The DFL provides stored data for converting the amount of radioactive material inhaled or ingested, to dose by nuclide, age group and organ. The DFL in current use (as of July 1978) has two sources. The dose factors for noble gasses are the same as found in Regulatory Guide 1.109. The remaining dose factors will be found in NUREG-0172. A complete printout of the DFL currently in use by NRC is included here as Table VI.

There are four allowed values for JC(5), 0, 1, 2 and 3. If JC(5)=0 or blank, GASPAR uses the dose factor library which resides in BLOCK DATA.

If JC(5)=1, MAIN will call REDDF to print the dose factor library as stored in BLOCK DATA. The run will use this DFL and no additional cards are required in this case.

If JC(5)=2, MAIN will call REDDF which will now read a prepared dose factor library subdeck 2.2 (see Table VI) print back the library read, and complete the run with the new dose factor library. In any subsequent run, i.e., once the run with revised dose factor library is terminated, the originally stored DFL will be back in use unless the subdeck 2.2 is read again.

If JC(5)=3, REDDF will read the prepared DFL (subdeck 2.2), print back the library and complete the run with the new values. In addition, a revised dose factor library subdeck which can be used to permanently update BLOCK DATA with the new dose factors will be punched. The implementation of this feature will vary according to installation and will not be discussed here. The new deck, however, will greatly facilitate updating of the dose factor library residing in BLOCK DATA if such update is needed.

Table V: Input Card Preparation Table for Changing Dose Factor Library

Card No.	Format	Variable	Columns	Description/Purpose/Units
2.2A	2X,78A1	LS	3-80	Title Card for Adult Dose Factor Library.
2.2AK				First Nuclide Data Card (K=1).
	I3	IZ(K)	2-4	Atomic Number.
	I3	IMASS(K)	5-7	Atomic Mass Number.
	A1	META(K)	8	Metastable: M if yes; blank if no.
	E8.0	TAV(K)	9-16	Decay Factor: Ln2/half life in seconds.
	E8.0	EXG(K)1	17-24	External Dose Factor from ground deposits: Total Body.
	E8.0	EXG(K)2	33-40	External Dose Factor from ground deposits: Skin.
2.2AKa				Ingestion Dose Factor for first nuclide.
	E8.0	DFL	1-8	Bone
	E8.0		9-16	Liver
	E8.0		17-24	Total Body
	E8.0		25-32	Thyroid
	E8.0		33-40	Kidney
	E8.0		41-48	Lung
	E8.0		49-56	GI-LLI
2.2AKb				Inhalation Dose Factors for first nuclide.
	7E8.0	DFA	1-8	Bone (gamma air dose factor for noble gasses)
			9-16	Liver (beta air dose factor for noble gasses)

Card No.	Format	Variable	Columns	Description/Purpose/Units
			17-24	Total Body (submersion dose factor for noble gasses)
			25-32	Thyroid (skin beta dose factor for noble gasses)
			33-40	Kidney
			41-48	Lung (lung internal dose factor for noble gasses)
			49-56	GI-LLI
	(Repeat 2.2AK, 2.2AKa and 2.2AKb for up to 33 nuclides for Adult)			
	(Blank Card)			
2.2T				Title Card for Teen Dose Factor Library
2.2TK				K Nuclide Data Cards for Teen
	Same as for Adult, up to K=33			(noble gasses not required)
2.2TKa				Ingestion Dose Factors for Kth nuclide
	Same as for Adult			
2.2TKb				Inhalation Dose Factors for Kth nuclide
	Same as for Adult			
	(Blank Card)			
2.2C				Title Card for Child Dose Factor Library
2.2CK				K Nuclide Data Cards for Child
	Same as for Adult, up to K=33			(noble gasses not required)
2.2CKa				Ingestion Dose Factors for Kth nuclide
	Same as Adult			

Card No.	Format	Variable	Columns	Description/Purpose/Units
2.2CKb				Inhalation Dose Factors for Kth nuclide
	Same as Adult			
	(Blank Card)			
2.2I				Title Card for Infant Dose Factor Library
2.2IK				K Nuclide Data Cards for Child
	Same as for Adult, up to K=33			(noble gasses not required)
2.2IKa				Ingestion Dose Factors for Kth nuclide
	Same as Adult			
2.2IKb				Ingestion Dose Factors for Kth nuclide
	Same as Adult			
	(Blank Card)			

INHALATION DOSE FACTORS FOR ADULTS

(mrem per pCi inhaled)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H 3	No data	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
C 14	2.27E-06	4.26E-07	4.26E-07	4.26E-07	4.26E-07	4.26E-07	4.26E-07
CR 51	No data	No Data	1.25E-08	7.44E-09	2.85E-09	1.80E-06	4.15E-07
MN 54	No data	4.95E-06	7.87E-07	No data	1.23E-06	1.75E-04	9.67E-06
FE-55	3.07E-06	2.12E-06	4.93E-07	No data	No data	9.01E-06	7.54E-07
FE-59	1.47E-06	3.47E-06	1.32E-06	No data	No data	1.27E-04	2.35E-05
CO 58	No data	1.98E-07	2.59E-07	No data	No data	1.16E-04	1.33E-05
CO 60	No data	1.44E-06	1.85E-06	No data	No data	7.46E-04	3.56E-05
ZN 65	4.05E-06	1.29E-05	5.82E-06	No data	8.63E-06	1.08E-04	6.68E-06
SR 89	8.30E-05	No data	1.09E-06	No data	No data	1.75E-04	4.37E-05
SR 90	1.24E-02	No data	7.62E-04	No data	No data	1.20E-03	9.02E-05
ZR 95	1.34E-05	4.30E-06	2.91E-06	No data	6.77E-06	2.21E-04	7.88E-05
SB124	3.90E-06	7.36E-08	1.55E-06	9.44E-09	No data	3.10E-04	5.08E-05
T 131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	No data	7.85E-07
T 133	1.08E-06	1.85E-06	5.65E-07	2.69E-04	3.23E-06	No data	1.11E-06
CS134	4.66E-05	1.06E-04	9.10E-05	No data	3.59E-05	1.22E-05	1.30E-06
CS136	4.88E-06	1.83E-05	1.38E-05	No data	1.07E-05	1.50E-06	1.46E-06
CS137	5.98E-05	7.76E-05	5.35E-05	No data	2.78E-05	9.40E-06	1.05E-06
BA140	4.88E-06	6.13E-09	3.21E-07	No data	2.09E-09	1.59E-04	2.73E-05
CE141	2.49E-06	1.69E-06	1.91E-07	No data	7.83E-07	4.52E-05	1.50E-05
CE144	4.29E-04	1.79E-04	2.30E-05	No data	1.06E-04	9.72E-04	1.02E-04

Table VI. Inhalation and Ingestion Dose Factors
Contained in GASPAR

INHALATION DOSE FACTORS FOR TEENAGER

(mrem per pCi inhaled)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H 3	No data	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07
C 14	3.25E-06	6.09E-07	6.09E-07	6.09E-07	6.09E-07	6.09E-07	6.09E-07
CR 51	No data	No data	1.69E-08	9.37E-09	3.84E-09	2.62E 06	3.75E-07
MN 54	No data	6.39E-06	1.05E-06	No data	1.59E-06	2.48E-04	8.35E-06
FE 55	4.18E-06	2.98E-06	6.93E-07	No data	No data	1.55E-05	7.99E-07
FE 59	1.99E-06	4.62E-06	1.79E-06	No data	No data	1.91E-04	2.23E-05
CO 58	No data	2.59E-07	3.47E-07	No data	No data	1.68E-04	1.19E-05
CO 60	No data	1.89E-06	2.48E-06	No data	No data	1.09E-03	3.24E-05
ZN 65	4.82E-06	1.67E-05	7.80E-06	No data	1.08E-05	1.55E-04	5.83E-06
SR 89	5.43E-05	No data	1.56E-06	No data	No data	3.02E-04	4.64E-05
SR 90	1.34E-02	No data	8.35E-04	No data	No data	2.06E-03	9.56E-05
ZR 95	1.82E-05	5.73E-06	3.94E-06	No data	8.42E-06	3.36E-04	1.86E-05
I 124	5.38E-06	9.92E-08	2.10E-06	1.22E-08	No data	4.81E-04	4.98E-05
I 131	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	No data	8.11E-07
I 133	1.52E-06	2.56E-06	7.78E-07	3.65E-04	4.49E-06	No data	1.29E-06
CS134	6.28E-05	1.41E-04	6.86E-05	No data	4.69E-05	1.83E-05	1.22E-06
CS136	6.44E-06	2.42E-05	1.71E-05	No data	1.38E-05	2.22E-06	1.36E-06
CS137	8.38E-05	1.06E-04	3.89E-05	No data	3.80E-05	1.51E-05	1.06E-06
BA140	6.84E-06	8.38E-09	4.40E-07	No data	2.85E-09	2.54E-04	2.86E-05
CE141	3.55E-06	2.37E-06	2.71E-07	No data	1.11E-06	7.67E-05	1.58E-05
CE144	6.11E-04	2.53E-04	3.28E-05	No data	1.51E-04	1.67E-03	1.08E-04

INHALATION DOSE FACTORS FOR CHILD

(mrem per pCi inhaled)

Nuclice	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H 3	No data	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07
C 14	9.70E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06
CR 51	No data	No data	4.17E-08	2.31E-08	6.57E-09	4.59E-09	2.93E-07
MN 54	No data	1.16E-05	2.57E-06	No data	2.71E-06	4.26E-04	6.19E-06
FE 55	1.28E-05	6.80E-06	2.10E-06	No data	No data	3.00E-05	7.75E-07
FE 59	5.59E-06	9.04E-06	4.51E-06	No data	No data	3.43E-04	1.91E-05
CO 58	No data	4.79E-07	8.55E-07	No data	No data	2.99E-04	9.29E-06
CO 60	No data	3.55E-06	6.12E-06	No data	No data	1.91E-03	2.60E-05
ZN 65	1.15E-05	3.06E-05	1.90E-05	No data	1.93E-05	2.69E-04	4.41E-06
SR 89	1.69E-04	No data	4.66E-06	No data	No data	5.83E-04	4.52E-05
SR 90	2.73E-02	No data	1.74E-03	No data	No data	3.99E-03	9.28E-05
ZR 94	5.13E-05	1.13E-05	1.00E-05	No data	1.61E-05	6.03E-04	1.65E-05
I 124	1.55E-05	2.00E-07	5.41E-06	3.41E-08	No data	8.76E-04	4.43E-05
I 131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	No data	7.68E-07
I 133	4.48E-06	5.49E-06	2.08E-06	1.04E-08	9.13E-06	No data	1.48E-06
CS134	1.76E-04	2.74E-04	6.07E-05	No data	8.93E-05	3.27E-05	1.04E-06
CS136	1.76E-05	4.62E-05	3.14E-05	No data	2.58E-05	3.93E-06	1.13E-06
CS137	2.45E-04	2.23E-04	3.47E-05	No data	7.63E-05	2.81E-05	9.78E-07
BA140	2.00E-05	1.75E-08	1.17E-06	No data	5.71E-09	4.71E-04	2.75E-05
CE141	1.06E-05	5.28E-06	7.83E-07	No data	2.31E-06	1.47E-04	1.53E-05
CE144	1.83E-03	5.72E-04	9.77E-05	No data	3.17E-04	3.23E-03	1.05E-04

INHALATION DOSE FACTORS FOR INFANT

(mrem per pCi inhaled)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H 3	No data	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07
C 14	1.89E-05	3.79E-06	3.79E-06	3.79E-06	3.79E-06	3.79E-06	3.79E-06
CR 51	No data	No data	6.39E-08	4.11E-08	9.45E-09	9.17E-06	2.55E-07
MN 54	No data	1.81E-05	3.56E-06	No data	3.56E-06	7.14E-04	5.04E-06
FE 55	1.41E-05	8.39E-06	2.38E-06	No data	No data	6.21E-05	7.82E-07
FE 59	9.69E-06	1.68E-05	6.77E-06	No data	No data	7.25E-04	1.77E-05
CO 58	No data	8.71E-07	1.30E-06	No data	No data	5.55E-04	7.95E-06
CO 60	No data	5.73E-06	8.41E-06	No data	No data	3.22E-03	2.28E-05
ZN 65	1.38E-05	4.47E-05	2.22E-05	No data	2.32E-05	4.62E-04	3.67E-05
SR 89	2.84E-04	No data	8.15E-06	No data	No data	1.45E-03	4.57E-05
SR 90	2.92E-02	No data	1.85E-03	No data	No data	8.03E-03	9.36E-05
ZR 95	8.24E-05	1.99E-05	1.45E-05	No data	2.22E-05	1.25E-03	1.55E-05
LB124	2.71E-05	3.97E-07	8.56E-06	7.18E-08	No data	1.89E-03	4.22E-05
I 131	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	No data	7.56E-07
I 133	9.46E-06	1.37E-05	4.00E-06	2.54E-03	1.60E-05	No data	1.54E-06
CS134	2.83E-04	5.02E-04	5.32E-05	No data	1.36E-04	5.69E-05	9.53E-07
CS136	3.45E-05	9.61E-05	3.78E-05	No data	4.03E-05	8.40E-06	1.02E-06
CS137	3.92E-04	4.37E-04	3.25E-05	No data	1.23E-04	5.09E-05	9.53E-07
BA140	4.00E-05	4.00E-08	2.07E-06	No data	9.59E-09	1.14E-03	2.74E-05
CE141	1.98E-05	1.19E-05	1.42E-06	No data	3.75E-06	3.69E-04	1.54E-05
CE144	2.28E-03	8.65E-04	1.26E-04	No data	3.84E-04	7.03E-03	1.06E-04

INGESTION DOSE FACTORS FOR ADULTS

(mrem per pCi ingested)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H 3	No data	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07
C 14	2.84E-06	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07
CR 51	No data	No data	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
MN 54	No data	4.57E-06	8.72E-07	No data	1.36E-06	No data	1.40E-05
FE 55	2.75E-06	1.90E-06	4.43E-07	No data	No data	1.06E-06	1.09E-06
FE 59	4.34E-06	1.02E-05	3.91E-06	No data	No data	2.85E-06	3.40E-05
CO 58	No data	7.45E-07	1.67E-06	No data	No data	No data	1.51E-05
CO 60	No data	2.14E-06	4.72E-06	No data	No data	No data	4.02E-05
ZN 65	4.84E-06	1.54E-05	6.96E-06	No data	1.03E-05	No data	9.70E-06
SR 89	3.08E-04	No data	8.84E-06	No data	No data	No data	4.94E-05
SR 90	7.58E-03	No data	1.86E-03	No data	No data	No data	2.19E-04
ZR 95	3.04E-08	9.75E-09	6.60E-09	No data	1.53E-08	No data	3.09E-05
LB124	2.80E-06	5.29E-08	1.11E-06	6.79E-09	No data	2.18E-06	7.95E-05
I 131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	No data	1.57E-06
I 133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	No data	2.22E-06
CS134	6.22E-05	1.48E-04	1.21E-04	No data	4.79E-05	1.59E-05	2.59E-06
CS136	6.51E-06	2.57E-05	1.85E-05	No data	1.43E-05	1.96E-06	2.92E-06
CS137	7.97E-05	1.09E-04	7.14E-05	No data	3.70E-05	1.23E-05	2.11E-06
SA140	2.03E-05	2.55E-08	1.33E-06	No data	8.67E-09	1.46E-08	4.18E-05
CE141	9.36E-09	6.33E-09	7.18E-10	No data	2.94E-09	No data	2.42E-05
CE144	4.88E-07	2.04E-07	2.62E-08	No data	1.21E-07	No data	1.65E-04

INGESTION DOSE FACTORS FOR TEENAGER

(mrem per pCi ingested)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H 3	No data	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07
C 14	4.06E-06	8.12E-07	8.12E-07	8.12E-07	8.12E-07	8.12E-07	8.12E-07
CR 51	No data	No data	3.60E-09	2.00E-09	7.89E-10	5.14E-09	6.05E-07
MN 54	No data	5.90E-06	1.17E-06	No data	1.76E-06	No data	1.21E-05
FE 55	3.78E-06	2.68E-06	6.25E-07	No data	No data	1.70E-06	1.16E-06
FE 59	5.87E-06	1.37E-05	5.29E-06	No data	No data	4.32E-06	3.24E-05
CO 58	No data	9.72E-07	2.24E-06	No data	No data	No data	1.34E-05
CO 60	No data	2.81E-06	6.33E-06	No data	No data	No data	3.66E-05
ZN 65	5.76E-06	2.00E-05	9.33E-06	No data	1.28E-05	No data	8.47E-06
SR 89	4.40E-04	No data	1.26E-05	No data	No data	No data	5.24E-05
SR 90	8.30E-03	No data	2.05E-03	No data	No data	No data	2.33E-04
ZR 95	4.12E-08	1.30E-08	8.94E-09	No data	191E-08	No data	8.00E-05
LB124	3.87E-06	7.13E-08	1.51E-06	8.78E-09	No data	3.38E-06	7.80E-05
I 131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	No data	1.62E-06
I 133	2.01E-06	3.41E-06	1.04E-06	4.76E-04	5.98E-06	No data	2.58E-06
CS134	8.37E-05	1.97E-04	9.14E-05	No data	6.26E-05	2.39E-05	2.45E-06
CS136	8.59E-06	3.38E-05	2.27E-05	No data	1.84E-05	2.90E-06	2.72E-06
CS137	1.12E-04	1.49E-04	5.19E-05	No data	5.07E-05	1.97E-05	2.12E-06
BA140	2.84E-05	3.48E-08	1.83E-06	No data	1.18E-08	2.34E-08	4.38E-05
CE141	1.33E-08	8.88E-09	1.02E-09	No data	4.18E-09	No data	2.54E-05
CE144	6.96E-07	2.88E-07	3.74E-08	No data	1.72E-07	No data	1.75E-04

INGESTION DOSE FACTORS FOR CHILD

(mrem per pCi ingested)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H 3	No data	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07
C 14	1.21E-05	2.42E-06	2.42E-06	2.42E-06	2.42E-06	2.42E-06	2.42E-06
CR 51	No data	No data	8.90E-09	4.94E-09	1.35E-09	9.02E-09	4.72E-07
MN 54	No data	1.07E-05	2.85E-06	No data	3.00E-06	No data	8.98E-06
FE 55	1.15E-05	6.10E-06	1.89E-06	No data	No data	3.45E-06	1.13E-06
FE 59	1.65E-05	2.67E-05	1.33E-05	No data	No data	7.74E-06	2.78E-05
CO 58	No data	1.80E-06	5.51E-06	No data	No data	No data	1.05E-05
CO 60	No data	5.29E-06	1.56E-05	No data	No data	No data	2.93E-05
ZN 65	1.37E-05	3.65E-05	2.27E-05	No data	2.30E-05	No data	6.41E-06
SR 89	1.32E-03	No data	3.77E-05	No data	No data	No data	5.11E-05
SR 90	1.70E-02	No data	4.31E-03	No data	No data	No data	2.29E-04
ZR 95	1.16E-07	2.55E-08	2.27E-08	No data	3.65E-08	No data	2.66E-05
LB124	1.11E-05	1.44E-07	3.89E-06	2.45E-08	No data	6.16E-06	6.95E-05
I 131	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	No data	1.54E-06
I 133	5.92E-06	7.32E-06	2.77E-06	1.36E-03	1.22E-05	No data	2.95E-06
CS134	2.34E-04	3.84E-04	8.10E-05	No data	1.19E-04	4.27E-05	2.07E-06
CS136	2.34E-05	6.46E-05	4.18E-05	No data	3.44E-05	5.13E-06	2.27E-06
CS137	3.27E-04	3.13E-04	4.62E-05	No data	1.02E-04	3.67E-05	1.96E-06
BA140	8.31E-05	7.28E-08	4.85E-06	No data	2.37E-08	4.34E-08	4.21E-05
CE141	3.97E-08	1.98E-08	2.94E-09	No data	8.68E-09	No data	2.47E-05
CE144	2.08E-06	6.52E-07	1.11E-07	No data	3.61E-07	No data	1.70E-04

INGESTION DOSE FACTORS FOR INFANT

(mrem per pCi ingested)

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H 3	No data	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07
C 14	2.37E-05	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06
CR 51	No data	No data	1.41E-08	9.20E-09	2.01E-09	1.79E-08	4.11E-07
MN 54	No data	1.99E-05	4.51E-06	No data	4.41E-06	No data	7.31E-06
FE 55	1.39E-05	8.98E-06	2.40E-06	No data	No data	4.39E-06	1.14E-06
FE 59	3.08E-05	5.38E-05	2.12E-05	No data	No data	1.59E-05	2.57E-05
CO 58	No data	3.60E-06	8.98E-06	No data	No data	No data	8.97E-06
CO 60	No data	1.08E-05	2.55E-05	No data	No data	No data	2.57E-05
ZN 65	1.84E-05	6.31E-05	2.91E-05	No data	3.06E-05	No data	5.33E-05
SR 89	2.51E-03	No data	7.20E-05	No data	No data	No data	5.18E-05
SR 90	1.85E-02	No data	4.71E-03	No data	No data	No data	2.31E-04
ZR 95	2.06E-07	5.02E-08	3.56E-08	No data	5.41E-08	No data	2.50E-05
LB124	2.14E-05	3.15E-07	6.63E-06	5.68E-08	No data	1.34E-05	6.60E-05
I 131	3.59E-05	4.23E-05	1.86E-05	1.39E-04	4.94E-05	No data	1.51E-06
I 133	1.25E-05	1.82E-05	5.33E-06	3.31E-03	2.14E-05	No data	3.08E-06
CS134	3.77E-04	7.03E-04	7.10E-05	No data	1.81E-04	7.42E-05	1.91E-06
CS136	4.59E-05	1.35E-04	5.04E-05	No data	5.38E-05	1.10E-05	2.05E-06
CS137	5.22E-04	6.11E-04	4.33E-05	No data	1.64E-04	6.64E-05	1.91E-06
BA140	1.71E-04	1.71E-07	8.81E-06	No data	4.06E-08	1.05E-07	4.20E-05
CE141	7.87E-08	4.80E-08	5.65E-09	No data	1.48E-08	No data	2.48E-05
CE144	2.98E-06	1.22E-06	1.67E-07	No data	4.93E-07	No data	1.71E-04

Note that if any changes are to be made in the dose factor library, a complete library (subdeck 2.2) must be prepared and read. This option does not allow changing just one or two values and using the remaining values stored in BLOCK DATA.

After completing Subdeck 2.2, a blank terminator card is inserted and REDDF will read and print the revised DFL and then return control to MAIN for completion of the run.

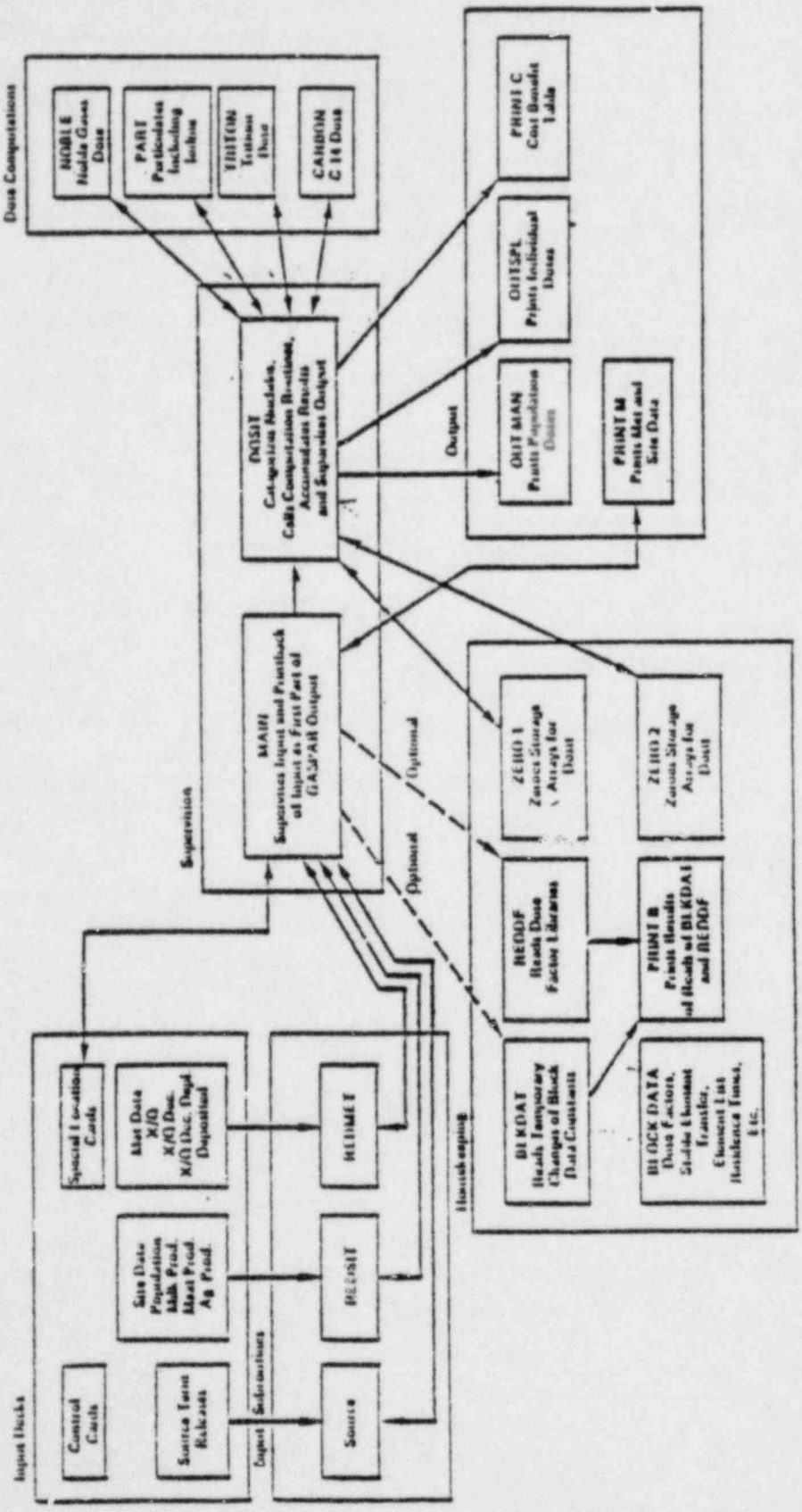
The structure for Subdeck 2.2, detailed in Table 4 is as follows: A title card (2.2), one for each of the four age groups, adult, teen, child and infant. Sets of three cards for up to 33 nuclides will follow each age group title card: 2.2K - Nuclide identification card; 2.2 Ka - Ingestion Dose Factors by organ for nth nuclide; 2.2 Kb - Inhalation Dose Factors by organ for nth nuclide. Thus a complete DFL subdeck could have as many as 404 cards including the blank terminator cards inserted after each age group. However, cards for noble gases are required only for the adult group.

Appendix D

GASPAR Subroutines and Program Diagram

Subroutine	Function
MAIN	Controls input, reads special locations and controls the print back of the input.
DØSIT	Controls computations, does some computation, and controls output.
PART	Computes doses of particulates, including iodine.
CARBØN	Computes carbon-14 doses.
NØBLE	Computes doses from noble gases.
TRITØN	Computes tritium dose.
ØUTSPL	Prints individual doses for special locations.
ØUTMAN	Prints integrated population doses (ALARA and NEPA).
REDDF	On request reads, prints and punches dose factor library.
SØURCE	Reads and prints source terms. Catalogs source term items.
REDMET	Reads Met data (printed by PRINTM which is called by MAIN).
PRINTM	Prints Site & Met data.
AGPRØD	Computes agricultural productivity consumed and exported in 50 mile area.
PRINTB	Prints changes to BLØCK DATA made through BLKDAT.
EXFCT(X)	Evaluates the function 1-exp(-x).
PRINTC	Prints Cost Benefit table (2 copies).
ZERØ1	Zeroes arrays.
ZERØ2	Zeroes arrays.
BLKDAT	Reads various consumption and agricultural constants if default values are not wanted. (See text).
BLØCK DATA	-obvious-

Figure II: GASPAR PROGRAM DIAGRAM



Appendix E

Example of Input Deck For A Combined Run

Table VII is a computer generated printout of all of the cards required in the input deck of a combined population and individual dose GASPAR run. In this example there are three release points and five selected locations. The 50-mile regional population is distributed into 160 subregions and as can be seen in the table Subdeck 4... consists of 34 cards. However, milk, meat and vegetable production, Subdecks 5..., 6... and 7... have been uniformly distributed over the 50-mile region. These subdecks therefore contain only three cards each. Note that nuclide release (Subdeck 8.1.n) data and meteorological data (Subdecks 9-12) have been inputted for all three release points. The five special location input cards follow the MET data cards in the same order for all three release points. Note that individual card numbers have been included in the left column according to the numbering system suggested in Chapter 2, Table 1. Cards 5.1, 6.1, 7.1 and 9.1, job control cards for various data input subdecks, are indicated in the computer printout as blank. This occurs only because the variable options in these cases were all zero or blank.

Table VII: Printout of Input Deck for a Combined Run

Card Number	1 5	1 0	1 5	2 0	2 5	3 0	3 5	4 0	4 5	5 0	5 5	6 0	6 5	7 0	7 5
1	GREATER COUNTY NUCLEAR POWER PLANT-DOCKET 50-000, INVESTIGATOR, JULY 31,78														
2	0 3 0 0 0														
3	480.	0.25		0.5		0.76		0.75		45.		80.		0.75	1.0	0.75	1.0
4.0	GREATER COUNTY POPULATION-YEAR 2000=2.167E06														
4.1		6	10												
4.1.1a	N	3.		3.		27.		55.		208.		1542.			
4.1.1b	4469.	12540.		119012.		218198.									
4.1.2a	NNE	0.		0.		51.		60.		1198.		5991.			
4.1.2b	9049.	24644.		142567.		186325.									
4.1.3a	NE	0.		19.		63.		109.		122.		12462.			
4.1.3b	12144.	13652.		12363.		12075.									
4.1.4a	ENE	0.		220.		163.		148.		148.		1507.			
4.1.4b	7299.	4326.		49886.		36950.									
4.1.5a	E	3.		145.		83.		126.		191.		1054.			
4.1.5b	3161.	10460.		5210.		4184.									
4.1.6a	ESE	3.		243.		177.		140.		87.		873.			
4.1.6b	2210.	6509.		10916.		68632.									
4.1.7a	SE	0.		351.		163.		105.		126.		996.			
4.1.7b	4667.	20514.		12316.		29826.									
4.1.8a	SSE	0.		280.		191.		203.		246		3235.			
4.1.8b	8293.	17994		36212.		59415.									
4.1.9a	S	0.		15.		37.		83.		119.		5658.			
4.1.9b	25149.	76165.		232587.		227654.									
4.1.10a	SSW	3.		208.		261.		659.		613.		18311.			
4.1.10b	70603.	33848.		22037.		101414.									
4.1.11a	SW	115.		321.		148.		422.		247.		3345.			
4.1.11b	10664.	9135.		20878.		22651.									
4.1.12a	WSW	47.		0.		287.		186.		702.		2684.			
4.1.12b	8487.	3797.		2092.		13830.									
4.1.13a	W	13.		13.		134.		.80		416.		1407.			
4.1.13b	1163.	2676.		4341.		2728.									
4.1.14a	WNW	3.		33.		17.		106.		247.		686.			
4.1.14b	2069.	2123.		3630.		6192.									
4.1.15a	NW	0.		0.		106.		68.		302.		1450.			
4.1.15b	2939.	2623.		2821.		14039.									
4.1.16a	NNW	3.		9.		95.		95.		98.		1459.			
4.1.16b	4377.	3628.		7024.		13494.									
5.0	MILK DATA FROM APPLICANT														
5.1	* * B L A N K C A R D * *														
5.2	2.62 E+05														

```
Number   1    5    0    5    0    5    0    5    0    5    0    5    0    5    0    5    0
-------------------------------------------------------------------------------------------
6.0        MEAT PRODUCTION DATA
6.1        * * B L A N K  C A R D * *
6.2       4.58  E+06
7.0        VEGETATION DATA
7.1        * * B L A N K  C A R D * *
7.2       2.84  E+08
8.0.1      GCNPP REACTOR PURGE - DEC 13,76 + APR 77 MET DATA (SOURCE A)
8.1       1.                  0         0         384.
8.1.1      KR 85M  2.
8.1.2      KR 85   2.
8.1.3      KR 88   2.
8.1.4      XE 131M 4.
8.1.5      XE 133M 11.
8.1.6      XE 133  920.
8.1.7      XE 135  8.
8.1.8      I 131   0.00044
8.1.9      I 133   0.00039
8.1.10     C 14    1.
8.1.11     H 3     1200.
8.1.12     AR 41   25.
Blank     * * B L A N K  C A R D * *
9.0.1     NO DECAY,      UNDEPLETED     PURGE
9.1       * * B L A N K  C A R D * *
9.1.1a      S  1.938E-06 1.113E-06 5.378E-07 3.209E-07 2.124E-07 9.478E-08 3.352E-08
9.1.1b    1.631E-08 1.023E-08 7.249E-09
9.1.2a    SSW  1.682E-06 8.555E-07 3.819E-07 2.193E-07 1.425E-07 6.285E-08 2.189E-08
9.1.2b    1.046E-08 6.491E-09 4.562E-09
9.1.3a     SW  1.113E-06 4.286E-07 1.539E-07 7.745E-08 4.719E-08 2.039E-08 6.901E-09
9.1.3b    3.232E-09 1.991E-09 1.393E-09
9.1.4a    WSW  2.387E-07 1.161E-07 5.377E-08 3.077E-08 1.970E-08 8.449E-09 2.855E-09
9.1.4b    1.357E-09 8.451E-10 5.964E-10
9.1.5a      W  1.221E-07 7.041E-08 3.700E-08 2.229E-08 1.474E-08 6.461E-09 2.170E-09
9.1.5b    1.017E-09 6.273E-10 4.393E-10
9.1.6a    WNW  1.159E-07 7.566E-08 3.785E-08 2.158E-08 1.396E-08 6.106E-09 2.080E-09
9.1.6b    9.903E-10 6.169E-10 4.353E-10
9.1.7a     NW  3.593E-07 1.897E-07 7.785E-08 4.088E-08 2.543E-08 1.104E-08 3.789E-09
9.1.7b    1.812E-09 1.132E-09 7.999E-10
9.1.8a    NNW  1.017E-06 4.963E-07 2.065E-07 1.088E-07 6.785E-08 2.939E-08 1.016E-08
9.1.8b    4.894E-09 3.069E-09 2.175E-09
9.1.9a      N  4.166E-06 1.788E-06 6.743E-07 3.402E-07 2.095E-07 9.133E-08 3.179E-08
-------------------------------------------------------------------------------------------
                1    1    2    2    3    3    4    4    5    5    6    6    7    7    8
          1    5    0    5    0    5    0    5    0    5    0    5    0    5    0    5    0
```

Card Number	1 5	10 15	20 25	30 35	40 45	50 55	60 65	70 75	80
9.1.9b	1.532E-08	9.597E-09	6.798E-09						
9.1.10a	NNE	1.425E-06	7.434E-07	3.438E-07	2.044E-07	1.393E-07	6.506E-08	2.389E-08	
9.1.10b	1.221E-08	7.836E-09	5.565E-09						
9.1.11a	NE	6.941E-07	4.685E-07	2.458E-07	1.522E-07	1.025E-07	4.610E-08	1.646E-08	
9.1.11b	8.072E-09	5.090E-09	3.621E-09						
9.1.12a	ENE	8.693E-07	6.048E-07	2.797E-07	1.471E-07	9.218E-08	4.073E-08	1.445E-08	
9.1.12b	7.056E-09	4.453E-09	3.170E-09						
9.1.13a	E	1.012E-06	6.625E-07	2.961E-07	1.523E-07	9.450E-08	4.206E-08	1.502E-08	
9.1.13b	7.324E-09	4.617E-09	3.284E-09						
9.1.14a	ESE	2.007E-06	9.848E-07	3.447E-07	1.726E-07	1.064E-07	4.682E-08	1.658E-08	
9.1.14b	8.076E-09	5.091E-09	3.620E-09						
9.1.15a	SE	1.460E-06	8.660E-07	3.803E-07	1.947E-07	1.205E-07	5.350E-08	1.913E-08	
9.1.15b	9.367E-09	5.925E-09	4.225E-09						
9.1.16a	SSE	2.315E-06	1.236E-06	5.107E-07	2.605E-07	1.611E-07	7.067E-08	2.494E-08	
9.1.16b	1.213E-08	7.632E-09	5.420E-09						
10.0.1	2.260 DAY DECAY, UNDEPLETED PURGE								
10.1	* * B L A N K C A R D * *								
10.1.1a	S	1.934E-06	1.108E-06	5.336E-07	3.172E-07	2.091E-07	9.244E-08	3.185E-08	
10.1.1b	1.495E-08	9.052E-09	6.194E-09						
10.1.2a	SSW	1.680E-06	8.525E-07	3.794E-07	2.171E-07	1.406E-07	6.151E-08	2.094E-08	
10.1.2b	9.701E-09	5.838E-09	3.982E-09						
10.1.3a	SW	1.111E-06	4.269E-07	1.527E-07	7.656E-08	4.648E-08	1.990E-08	6.569E-09	
10.1.3b	2.973E-09	1.772E-09	1.201E-09						
10.1.4a	WSW	2.382E-07	1.155E-07	5.324E-08	3.031E-08	1.931E-08	8.188E-09	2.680E-09	
10.1.4b	1.219E-09	7.272E-10	4.920E-10						
10.1.5a	W	1.217E-07	6.996E-08	3.656E-08	2.191E-08	1.442E-08	6.234E-09	2.018E-09	
10.1.5b	8.990E-10	5.274E-10	3.516E-10						
10.1.6a	WNW	1.155E-07	7.515E-08	3.740E-08	2.121E-08	1.365E-08	5.894E-09	1.936E-09	
10.1.6b	8.768E-10	5.200E-10	3.494E-10						
10.1.7a	NW	3.582E-07	1.886E-07	7.699E-08	4.023E-08	2.491E-08	1.069E-08	3.544E-09	
10.1.7b	1.617E-09	9.648E-01	5.516E-10						
10.1.8a	NNW	1.015E-06	4.942E-07	2.048E-07	1.075E-07	6.677E-08	2.864E-08	9.643E-09	
10.1.8b	4.477E-09	2.707E-09	1.851E-09						
10.1.9a	N	4.160E-06	1.783E-06	6.703E-07	3.373E-07	2.071E-07	8.968E-08	3.062E-08	
10.1.9b	1.437E-08	8.779E-09	6.063E-09						
10.1.10a	NNE	1.423E-06	7.410E-07	3.417E-07	2.026E-07	1.376E-07	6.376E-08	2.291E-08	
10.1.10b	1.135E-08	7.070E-09	4.876E-09						
10.1.11a	NE	6.924E-07	4.661E-07	2.436E-07	1.502E-07	1.007E-07	4.482E-08	1.554E-08	
10.1.11b	7.318E-09	4.435E-09	3.033E-09						
10.1.12a	ENE	8.666E-07	6.011E-07	2.768E-07	1.4:9E-07	9.041E-08	3.949E-08	1.357E-08	

	1 5	10 15	20 25	30 35	40 45	50 55	60 65	70 75	80

Number	1	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0
10.1.12b	6.340E-09	3.832E-09	2.614E-09														
10.1.13a	E	1.009E-06	6.587E-07	2.931E-07	1.502E-07	9.275E-08	4.082E-08	1.413E-08									
10.1.13b	6.602E-09	3.992E-09	2.723E-09														
10.1.14a	ESE	2.001E-06	9.795E-07	3.414E-07	1.702E-07	1.045E-07	4.550E-08	1.563E-08									
10.1.14b	7.309E-09	4.423E-09	3.022E-09														
10.1.15a	SE	1.457E-07	8.615E-07	3.767E-07	1.921E-07	1.185E-07	5.202E-08	1.806E-08									
10.1.15b	8.496E-09	5.164E-09	3.540E-09														
10.1.16a	SSE	2.310E-06	1.230E-06	5.062E-07	2.572E-07	1.584E-07	6.884E-08	2.364E-08									
10.1.16b	1.107E-08	6.709E-09	4.591E-09														
11.0.1	8.000 DAY DECAY,			DEPLETED				PURGE									
11.1	* * B L A N K	C A R D * *															
11.1.1a	S	1.906E-06	1.093E-06	5.248E-07	3.109E-07	2.023E-07	8.605E-08	2.757E-08									
11.1.1b	1.213E-08	7.043E-09	4.675E-09														
11.1.2a	SSW	1.649E-06	8.326E-07	3.655E-07	2.077E-07	1.326E-07	5.576E-08	1.760E-08									
11.1.2b	7.601E-09	4.355E-09	2.875E-09														
11.1.3a	SW	1.063E-06	3.816E-07	1.293E-07	6.306E-08	3.734E-08	1.527E-08	4.578E-09									
11.1.3b	1.883E-09	1.050E-09	6.750E-10														
11.1.4a	WSW	2.330E-07	1.085E-07	4.644E-08	2.592E-08	1.623E-08	6.569E-09	1.957E-09									
11.1.4b	8.161E-10	4.596E-10	2.976E-10														
11.1.5a	W	1.200E-07	6.659E-08	3.282E-08	1.944E-08	1.262E-08	5.247E-09	1.562E-09									
11.1.5b	6.456E-10	3.612E-10	2.328E-10														
11.1.6a	WNW	1.143E-07	7.155E-08	3.270E-08	1.826E-08	1.156E-08	4.784E-09	1.437E-09									
11.1.6b	6.004E-10	3.382E-10	2.189E-10														
11.1.7a	NW	3.510E-07	1.722E-07	6.637E-08	3.388E-08	2.050E-08	8.398E-09	2.536E-09									
11.1.7b	1.063E-09	5.995E-10	3.883E-10														
11.1.8a	NNW	9.968E-07	4.592E-07	1.722E-07	8.762E-08	5.312E-08	2.165E-08	6.577E-09									
11.1.8b	2.775E-09	1.571E-09	1.020E-09														
11.1.9a	N	4.062E-06	1.633E-06	5.554E-07	2.685E-07	1.603E-07	6.587E-08	2.019E-08									
11.1.9b	8.535E-09	4.836E-09	3.144E-09														
11.1.10a	NNE	1.393E-06	7.272E-07	3.350E-07	1.983E-07	1.341E-07	6.041E-08	1.984E-08									
11.1.10b	8.846E-09	5.244E-09	3.486E-09														
11.1.11a	NE	6.873E-07	4.634E-07	2.418E-07	1.489E-07	9.861E-08	4.228E-08	1.366E-08									
11.1.11b	6.056E-09	3.533E-09	2.353E-09														
11.1.12a	ENE	8.635E-07	5.669E-07	2.298E-07	1.169E-07	7.113E-08	2.956E-08	9.193E-09									
11.1.12b	3.919E-09	2.226E-09	1.448E-09														
11.1.13a	E	1.002E-06	6.197E-07	2.427E-07	1.203E-07	7.231E-08	3.032E-08	9.522E-09									
11.1.13b	4.053E-09	2.301E-09	1.495E-09														
11.1.14a	ESE	1.956E-06	8.809E-07	2.820E-07	1.359E-07	8.111E-08	3.356E-08	1.043E-08									
11.1.14b	4.438E-09	2.519E-09	1.637E-09														
11.1.15a	SE	1.438E-06	8.050E-07	3.109E-07	1.531E-07	9.178E-08	3.833E-08	1.204E-08									

			1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
1	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	

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Card                    1    1    2    2    3    3    4    4    5    5    6    6    7    7    8
Number   1    5        0    5    0    5    0    5    0    5    0    5    0    5    0    5    0
-------------------------------------------------------------------------------------------------
11.1.15b 5.151E-09  2.934E-09  1.913E-09
11.1.16a SSE  2.275E-06  1.147E-06  4.171E-07  2.047E-07  1.226E-07  5.059E-08  1.569E-08
11.1.16b 6.672E-09  3.783E-09  2.456E-09
12.0.1                DEPOSITION                    PURGE
12.1     * * B L A N K  C A R D * *
12.1.1a    S  1.339E-08  3.252E-09  1.065E-09  8.845E-10  7.105E-10  2.966E-10  8.666E-11
12.1.1b  3.507E-11  1.873E-11  1.159E-11
12.1.2a  SSW  1.497E-08  3.822E-09  1.232E-09  8.399E-10  6.101E-10  2.542E-10  7.483E-11
12.1.2b  3.000E-11  1.602E-11  9.915E-12
12.1.3a   SW  1.242E-08  3.306E-09  9.664E-10  4.367E-10  2.479E-10  9.651E-11  2.877E-11
12.1.3b  1.140E-11  6.089E-12  3.769E-12
12.1.4a  WSW  2.640E-09  7.758E-10  2.688E-10  1.359E-10  7.956E-11 3.219E-11  9.312E-12
12.1.4b  3.691E-12  1.971E-12  1.220E-12
12.1.5a    W  9.811E-10  3.322E-10  1.293E-10  6.818E-11  3.961E-11  1.691E-11  5.259E-12
12.1.5b  2.084E-12  1.113E-12  6.889E-13
12.1.6a  WNW  7.189E-10  2.521E-10  1.069E-10  5.497E-11  3.183E-11  1.346E-11  4.159E-12
12.1.6b  1.648E-12  8.802E-13  5.448E-13
12.1.7a   NW  1.832E-09  6.529E-10  2.302E-10  1.060E-10  6.114E-11  2.521E-11  7.694E-12
12.1.7b  3.050E-12  1.629E-12  1.008E-12
12.1.8a  NNW  6.768E-09  2.428E-09  9.112E-10  4.330E-10  2.490E-10  9.823E-11  2.842E-11
12.1.8b  ' 126E-11  6.015E-12  3.723E-12
12.1.9a    N  3.412E-08  1.162E-08  4.161E-09  1.913E-09  1.086E-09  4.189E-10  1.222E-10
12.1.9b  4.841E-11  2.585E-11  1.600E-11
12.1.10a NNE  1.139E-08  2.757E-09  8.258E-10  4.384E-10  3.158E-10  1.908E-10  8.714E-11
12.1.10b 3.478E-11  1.717E-11  1.063E-11
12.1.11a  NE  2.651E-09  7.446E-10  2.738E-10  2.586E-10  2.415E-10  1.048E-10  3.068E-11
12.1.11b 1.248E-11  6.667E-12  4.126E-12
12.1.12a ENE  1.541E-09  9.637E-10  5.969E-10  2.774E-10  1.580E-10  6.222E-11  1.832E-11
12.1.12b 7.261E-12  3.877E-12  2.400E-12
12.1.13a   E  2.902E-09  1.330E-09  7.097E-10  3.239E-10  1.841E-10  7.202E-11  2.147E-11
12.1.13b 8.0504E-12  4.541E-12  2.811E-12
12.1.14a ESE  8.706E-09  3.213E-09  1.035E-09  4.661E-10  2.642E-10  1.022E-10  3.002E-11
12.1.14b 1.190E-11  6.353E-12  3.932E-12
12.1.15a  SE  6.848E-09  2.599E-09  1.168E-09  5.307E-10  3.010E-10  1.168E-10  3.436E-11
12.1.15b 1.362E-11  7.272E-12  4.501E-12
12.1.16a SSE  1.224E-08  4.464E-09  1.903E-09  8.641E-10  4.905E-10  1.887E-10  5.497E-11
12.1.16b 2.191E-11  1.170E-11  7.243E-12
13.1      A SITE BOUNDARY    N    0.17  1.102E-05  1.102E-05  1.072E-05  3.752E-07
13.2      A SITE BOUNDARY    S    0.41  2.331E-07  2.329E-07  2.266E-06  5.721E-08
13.3      A GARDEN+RES       SW   0.59  2.743E-06  2.740E-06  2.659E-06  3.621E-08
-------------------------------------------------------------------------------------------------
                        1    1    2    2    3    3    4    4    5    5    6    6    7    7    8
1    5                  0    5    0    5    0    5    0    5    0    5    0    5    0    5    0
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Number	1 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0
13.4	MILK+BEEF NNE 2.20 8.047E-07 8.004E-07 7.848E-07 2.176E-09
13.5	ALPHA CEMENT SSW 0.30 2.066E-06 2.065E-06 2.000E-06 8.617E-08
Blank	* * B L A N K C A R D * *
8.0.2	GCNPP TURBINE BLDG VENT-CONT. GLR - DEC 13,76 + APR 77 MET DATA (SOURCE B)
8.1	1.
8.1.1	I 131 0.0011
8.1.2	I 133 0.0013
Blank	* * B L A N K C A R D * *
9.0.2	NO DECAY, UNDEPLETED TURBINE BLDG. CONT. GLR
9.1	* * B L A N K C A R D * *
9.1.1a	S 1.242E-05 3.023E06 9.558E-07 4.867E-07 3.035E-07 1.349E-07 4.829E-08
9.1.1b	2.365E-08 1.492E-08 1.061E-08
9.1.2a	SSW 8.662E-06 2.087E-06 6.475E-07 3.257E-07 2.013E-07 8.814E-08 3.082E-08
9.1.2b	1.482E-08 9.252E-09 6.527E-09
9.1.3a	SW 3.052E-06 7.070E-07 2.114E-07 1.040E-07 6.333E-08 2.714E-08 9.198E-09
9.1.3b	4.346E-09 2.688E-09 1.886E-09
9.1.4a	WSW 1.235E-06 2.820E-07 8.433E-08 4.163E-08 2.541E-08 1.097E-08 3.778E-09
9.1.4b	1.814E-09 1.135E-09 8.031E-10
9.1.5a	W 9.658E-07 2.216E-07 6.594E-08 3.238E-08 1.968E-08 8.432E-09 2.860E-09
9.1.5b	1.352E-09 8.373E-10 5.878E-10
9.1.6a	WNW 8.808E-07 2.044E-07 6.191E-08 3.074E-08 1.884E-08 8.171E-09 2.831E-09
9.1.6b	1.363E-09 8.538E-10 6.044E-10
9.1.7a	NW 1.564E-06 3.638E-07 1.105E-07 5.511E-08 3.388E-08 1.477E-08 5.162E-09
9.1.7b	2.499E-09 1.569E-09 1.113E-09
9.1.8a	NNW 4.003E-06 9.417E-07 2.896E-07 1.456E-07 9.000E-08 3.960E-08 1.402E-08
9.1.8b	6.838E-09 4.313E-09 3.068E-09
9.1.9a	N 1.216E-05 2.890E-06 8.969E-07 4.528E-07 2.807E-07 1.238E-07 4.396E-08
9.1.9b	2.145E-08 1.352E-08 9.611E-09
9.1.10a	NNE 9.268E-06 2.247E-06 7.111E-07 3.629E-07 2.267E-07 1.010E-07 3.638E-08
9.1.10b	1.790E-08 1.133E-08 8.077E-09
9.1.11a	NE 5.861E-06 1.429E-06 4.560E-07 2.338E-07 1.465E-07 6.559E-08 2.378E-08
9.1.11b	1.175E-08 7.460E-09 5.328E-09
9.1.12a	ENE 5.025E-06 1.229E-06 3.947E-07 2.029E-07 1.273E-07 5.719E-08 2.082E-08
9.1.12b	1.031E-08 6.553E-09 4.684E-09
9.1.13a	E 5.279E-06 1.292E-06 4.144E-07 2.127E-07 1.334E-07 5.979E-08 2.170E-08
9.1.13b	1.073E-08 6.809E-09 4.862E-09
9.1.14a	EST 5.873E-06 1.430E-06 4.566E-07 2.339E-07 1.465E-07 6.559E-08 2.376E-08
9.1.14b	1.174E-08 7.451E-09 5.321E-09
9.1.15a	SE 6.632E-06 1.610E-06 5.157E-07 2.651E-07 1.665E-07 7.487E-08 2.733E-08
9.1.15b	1.359E-08 8.654E-09 6.197E-09

		1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
1	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0

Card Number	1 5	10 15	20 25	30 35	40 45	50 55	60 65	70 75	80
9.1.16a	SSE	8.994E-06	2.202E-06	7.008E-07	3.582E-07	2.239E-07	9.994E-08	3.603E-08	
9.1.16b	1.773E-08	1.122E-08	7.996E-09						
10.0.2	2.260 DAY DECAY,		UNDEPLETED		TURBINE BLDG CONT GLR				
10.1	* * B L A N K C A R D * *								
10.1.1a	S	1.237E-05	3.002E-06	9.438E-07	4.780E-07	2.964E-07	1.299E-07	4.473E-08	
10.1.1b	2.076E-08	1.243E-08	8.391E-09						
10.1.2a	SSW	8.636E-06	2.074E-06	6.406E-07	3.208E-07	1.973E-07	8.539E-08	2.889E-08	
10.1.2b	1.328E-08	7.928E-09	5.354E-09						
10.1.3a	SW	3.042E-06	7.025E-07	2.090E-07	1.024E-07	6.202E-08	2.625E-08	8.600E-09	
10.1.3b	3.878E-09	2.293E-09	1.539E-09						
10.1.4a	WSW	1.230E-06	2.798E-07	8.312E-08	4.078E-08	2.474E-08	1.051E-08	3.463E-09	
10.1.4b	1.564E-09	9.224E-10	6.157E-10						
10.1.5a	W	9.613E-07	2.196E-07	6.488E-08	3.164E-08	1.910E-08	8.041E-09	2.597E-09	
10.1.5b	1.147E-09	6.644E-10	4.366E-10						
10.1.6a	WNW	8.766E-07	2.025E-07	6.089E-08	3.002E-08	1.827E-08	7.782E-09	2.563E-09	
10.1.6b	1.150E-09	6.724E-10	4.444E-10						
10.1.7a	NW	1.557E-06	3.607E-07	1.088E-07	5.390E-08	3.292E-08	1.411E-08	4.702E-09	
10.1.7b	2.131E-09	1.255E-09	8.346E-10						
10.1.8a	NNW	8.988E-06	9.352E-07	2.860E-07	1.430E-07	8.795E-08	3.816E-08	1.300E-08	
10.1.8b	6.010E-09	3.597E-09	2.430E-09						
10.1.9a	N	1.213E-05	2.876E-06	8.890E-07	4.470E-07	2.761E-07	1.206E-07	4.163E-08	
10.1.9b	1.955E-08	1.187E-08	8.132E-09						
10.1.10a	NNE	9.240E-06	2.234E-06	7.037E-07	3.575E-07	2.223E-07	9.791E-08	3.412E-08	
10.1.10b	1.605E-08	9.719E-09	6.634E-09						
10.1.11a	NE	5.836E-06	1.417E-06	4.494E-07	2.290E-07	1.426E-07	6.285E-08	2.180E-08	
10.1.11b	1.014E-08	6.062E-09	4.081E-09						
10.1.12a	ENE	5.002E-06	1.218E-06	3.884E-07	1.984E-07	1.237E-07	5.458E-08	1.893E-08	
10.1.12b	8.777E-09	5.224E-9	3.500E-09						
10.1.13a	E	5.255E-06	1.281E-06	4.081E-07	2.081E-07	1.296E-07	5.713E-08	1.978E-08	
10.1.13b	9.168E-09	5.459E-09	3.660E-09						
10.1.14a	ESE	5.848E-06	1.418E-06	4.499E-07	2.291E-07	1.426E-07	6.278E-08	2.173E-08	
10.1.14b	1.008E-08	6.015E-09	4.040E-09						
10.1.15a	SE	6.604E-06	1.597E-06	5.083E-07	2.598E-07	1.621E-07	7.174E-08	2.505E-08	
10.1.15b	1.171E-08	7.020E-09	4.735E-09						
10.1.16a	SSE	8.959E-06	2.186E-06	6.913E-07	3.513E-07	2.184E-07	9.599E-08	3.318E-08	
10.1.16b	1.541E-08	9.216E-09	6.210E-09						
11.0.2	8.000 DAY DECAY,		DEPLETED		TURBINE BLDG CONT. GLR				
11.1	* * B L A N K C A R D * *								
11.1.1a	S	1.112E-05	2.587E-06	7.744E-07	3.786E-07	2.282E-07	9.508E-08	2.977E-08	
11.1.1b	1.268E-08	7.172E-09	4.641E-09						

	1 5	10 15	20 25	30 35	40 45	50 55	60 65	70 75	80

Number	1 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0
11.1.2a	SSW 7.759E-06 1.787E-06 5.250E-07 2.536E-07 1.515E-07 6.228E-08 1.907E-08
11.1.2b	7.995E-09 4.483E-09 2.885E-09
11.1.3a	SW 2.734E-06 6.055E-07 1.714E-07 8.099E-08 4.766E-08 1.918E-08 5.691E-09
11.1.3b	2.341E-09 1.301E-09 8.322E-10
11.1.4a	WSW 1.106E-06 2.414E-07 6.831E-08 3.237E-08 1.910E-08 7.731E-09 2.324E-09
11.1.4b	9.679E-10 5.419E-10 3.484E-10
11.1.5a	W 8.651E-07 1.896E-07 5.339E-08 2.516E-08 1.478E-08 5.935E-09 1.755E-09
11.1.5b	7.185E-10 3.973E-10 2.529E-10
11.1.6a	WNW 7.889E-07 1.749E-07 5.011E-08 2.388E-08 1.414E-08 5.747E-09 1.735E-09
11.1.6b	7.232E-10 4.042E-10 2.592E-10
11.1.7a	NW 1.401E-06 3.114E-07 8.949E-08 4.283E-08 2.544E-08 1.040E-08 3.169E-09
11.1.7b	1.329E-09 7.460E-10 4.800E-10
11.1.8a	NNW 3.586E-06 8.062E-07 2.347E-07 1.133E-07 6.769E-08 2.793E-08 8.644E-09
11.1.8b	3.667E-09 2.074E-09 1.343E-09
11.1.9a	N 1.089E-05 2.476E-06 7.275E-07 3.528E-07 2.115E-07 8.760E-08 2.727E-08
11.1.9b	1.162E-08 6.595E-09 4.285E-09
11.1.10a	NNE 8.302E-06 1.923E-06 5.765E-07 2.825E-07 1.706E-07 7.135E-08 2.250E-08
11.1.10b	9.651E-09 5.491E-09 3.571E-09
11.1.11a	NE 5.248E-06 1.222E-06 3.692E-07 1.817E-07 1.100E-07 4.617E-08 1.461E-08
11.1.11b	6.271E-09 3.561E-09 2.310E-09
11.1.12a	ENE 4.499E-06 1.051E-06 3.195E-07 1.576E-07 9.561E-08 4.021E-08 1.276E-08
11.1.12b	5.481E-09 3.112E-09 2.018E-09
11.1.13a	E 4.727E-06 1.105E-06 3.355E-07 1.653E-07 1.002E-07 4.205E-08 1.331E-08
11.1.13b	5.709E-09 3.239E-09 2.098E-09
11.1.14a	ESE 5.260E-06 1.223E-06 3.697E-07 1.818E-07 1.101E-07 4.616E-08 1.459E-08
11.1.14b	6.257E-09 3.551E-09 2.302E-09
11.1.15a	SE 5.939E-09 1.377E-06 4.176E-07 2.061E-07 1.251E-07 5.269E-08 1.679E-08
11.1.15b	7.245E-09 4.129E-09 2.685E-09
11.1.16a	SSE 8.055E-06 1.884E-06 5.676E-07 2.785E-07 1.683E-07 7.040E-08 2.217E-08
11.1.16b	9.479E-09 5.372E-09 3.480E-09
12.0.2	DEPOSITION TURBINE BLDG CONT. GLR
12.1	* * B L A N K C A R D * *
12.1.1a	S 4.998E-08 1.024E-08 2.673E-09 1.200E-09 6.790E-10 2.611E-10 7.554E-11
12.1.1b	2.994E-11 1.599E-11 9.896E-12
12.1.2a	SSW 4.377E-08 8.966E-09 2.341E-09 1.051E-09 5.947E-10 2.287E-10 6.616E-11
12.1.2b	2.622E-11 1.400E-11 8.667E-12
12.1.3a	SW 1.857E-08 3.804E-09 9.932E-10 4.461E-10 2.523E-10 9.704E-11 2.807E-11
12.1.3b	1.113E-11 5.942E-12 3.678E-12
12.1.4a	WSW 5.871E-09 1.203E-09 3.139E-10 1.410E-10 7.976E-11 3.067E-11 8.873E-12
12.1.4b	3.517E-12 1.878E-12 1.162E-12

		1	1	2	2	3	3	4	4	5	5	6	6	7	7	8
1	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0

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Card                1   1   2   2   3   3   4   4   5   5   6   6   7   7   8
Number    1    5    0   5   0   5   0   5   0   5   0   5   0   5   0   5   0
-------------------------------------------------------------------------------
12.1.5a     W 3.117E-09 6.385E-10 1.667E-10 7.486E-11 4.235E-11 1.629E-11 4.712E-12
12.1.5b  1.867E-12 9.972E-13 6.172E-13
12.1.6a   WNW 2.494E-09 5.108E-10 1.333E-10 5.989E-11 3.388E-11 1.303E-11 3.769E-12
12.1.6b  1.494E-12 7.978E-13 4.938E-13
12.1.7a    NW 4.754E-09 9.737E-10 2.542E-10 1.142E-10 6.458E-11 2.484E-11 7.185E-12
12.1.7b  2.848E-12 1.521E-12 9.413E-13
12.1.8a   NNW 1.837E-08 3.762E-09 9.821E-10 4.411E-10 2.495E-10 9.595E-11 2.776E-11
12.1.8b  1.100E-11 5.875E-12 3.636E-12
12.1.9a     N 8.022E-08 1.643E-08 4.289E-09 1.926E-09 1.090E-09 4.191E-10 1.212E-10
12.1.9b  4.805E-11 2.566E-11 1.588E-11
12.1.10a  NNE 4.486E-08 9.189E-09 2.399E-09 1.077E-09 6.095E-10 2.344E-10 6.781E-11
12.1.10b 2.687E-11 1.435E-11 8.883E-12
12.1.11a   NE 1.712E-08 3.506E-09 9.154E-10 4.111E-10 2.326E-10 8.944E-11 2.587E-11
12.1.11b 1.025E-11 5.476E-12 3.390E-12
12.1.12a  ENE 1.177E-08 2.410E-09 6.292E-10 2.826E-10 1.599E-10 6.148E-11 1.779E-11
12.1.12b 7.049E-12 3.764E-12 2.330E-12
12.1.13a    E 1.387E-08 2.841E-09 7.418E-10 3.331E-10 1.885E-10 7.247E-11 2.097E-11
12.1.13b 8.310E-12 4.438E-12 2.747E-12
12.1.14a  ESE 1.961E-08 4.017E-09 1.049E-09 4.710E-10 2.665E-10 1.025E-10 2.964E-11
12.1.14b 1.175E-11 6.274E-12 3.883E-12
12.1.15a   SE 2.244E-08 4.597E-09 1.200E-09 5.390E-10 3.049E-10 1.173E-10 3.392E-11
12.1.15b 1.345E-11 7.180E-12 4.444E-12
12.1.16a  SSE 3.624E-08 7.423E-09 1.938E-09 8.703E-10 4.923E-10 1.893E-10 5.477E-11
12.1.16b 2.171E-11 1.159E-11 7.175E-12
13.1      B SITE BOUNDARY     N    0.17  1.392E-04  1.391E-04  1.336E-04  8.362E-07
13.2      B SITE BOUNDARY     S    0.41  3.127E-05  3.120E-05  2.887E-05  1.369E-07
13.3      B GARDEN+RES        SW   0.59  4.532E-06  4.520E-06  4.092E-06  2.825E-08
13.4      B MILK+BEEF         NNE  2.20  8.916E-07  8.831E-07  7.296E-07  3.095E-09
13.5      B ALPHA CEMENT      SSW  0.30  3.562E-05  3.557E-05  3.343E-05  1.953E-07
Blank     * * B L A N K  C A R D * *
8.0.3      GCNPP PLANT VENT - CONT.AGL - DEC 13, 76 + APR 77 MEI DATA (SOURCE C)
8.1       1.
8.1.1       KR 85M  3.
8.1.2       KR 85   270.
8.1.3       KR 87   1.
8.1.4       KR 88   6.
8.1.5       XE 131M 2.
8.1.6       XE 133M 1.
8.1.7       XE 133  86.
8.1.8       XE 135  8.
-------------------------------------------------------------------------------
                1   1   2   2   3   3   4   4   5   5   6   6   7   7   8
          1    5    0   5   0   5   0   5   0   5   0   5   0   5   0   5   0
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Number	1 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0
8.1.9	XE 138 1.
8.1.10	I 131 0.05
8.1.11	I 133 0.061
8.1.12	CU 60 0.00034
8.1.13	CU 58 0.00075
8.1.14	FE 59 0.000075
8.1.15	MN 54 0.00023
8.1.16	CS 137 0.00038
8.1.17	CS 134 0.00023
8.1.18	SR 90 0.000003
8.1.19	SR 89 0.000016
8.1.20	C 14 7.
Blank	* * B L A N K C A R D * *
9.0.3	NO DECAY, UNDEPLETED PLANT VENT-CONT. AGL
9.1	* * B L A N K C A R D * *
9.1.1a	S 2.666E-06 1.324E-06 5.915E-07 3.388E-07 2.185E-07 9.634E-08 3.388E-08
9.1.1b	16.43E-08 1.031E-08 7.303E-09
9.1.2a	SSW 2.281E-06 1.007E-06 4.178E-07 2.313E-07 1.471E-07 6.413E-08 2.214E-08
9.1.2b	1.055E-08 6.549E-09 4.603E-09
9.1.3a	SW 1.382E-06 4.820E-07 1.637E-07 8.060E-08 4.867E-08 2.071E-08 6.933E-09
9.1.3b	3.248E-09 2.001E-09 1.400E-09
9.1.4a	WSW 3.171E-07 1.423E-07 6.016E-08 3.229E-08 1.988E-08 8.456E-09 2.858E-09
9.1.4b	1.358E-09 8.459E-10 5.969E-10
9.1.5a	W 1.739E-07 9.341E-08 4.391E-08 2.435E-08 1.530E-08 6.509E-09 2.172E-09
9.1.5b	1.018E-09 6.278E-10 4.397E-10
9.1.6a	WNW 1.683E-07 9.566E-08 4.277E-08 2.298E-08 1.433E-08 6.137E-09 2.081E-09
9.1.6b	9.907E-10 6.172E-10 4.354E-10
9.1.7a	NW 4.854E-07 2.246E-07 8.421E-08 4.248E-08 2.591E-08 1.111E-08 3.796E-09
9.1.7b	1.816E-09 1.134E-09 8.015E-10
9.1.8a	NNW 1.321E-06 5.676E-07 2.178E-07 1.114E-07 6.840E-08 2.953E-08 1.021E-08
9.1.8b	4.921E-09 3.085E-09 2.187E-09
9.1.9a	N 5.214E-06 1.972E-06 6.957E-07 3.469E-07 2.129E-07 9.246E-08 3.212E-08
9.1.9b	1.548E-08 9.702E-09 6.873E-09
9.1.10a	NNE 1.977E-06 8.917E-07 3.839E-07 2.214E-07 1.481E-07 6.807E-08 2.466E-08
9.1.10b	1.241E-08 7.918E-09 5.623E-09
9.1.11a	NE 9.917E-07 5.683E-07 2.729E-07 1.612E-07 1.053E-07 4.672E-08 1.659E-08
9.1.11b	8.111E-09 5.115E-09 3.639E-09
9.1.12a	ENE 1.196E-06 7.011E-07 2.420E-07 1.498E-07 9.304E-08 4.089E-08 1.449E-08
9.1.12b	7.076E-09 4.467E-09 3.180E-09
9.1.13a	E 1.372E-06 7.604E-08 3.073E-07 1.554E-07 9.604E-08 4.243E-08 1.507E-08
	1 1 2 2 3 3 4 4 5 5 6 6 7 7 8
	1 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0

Card Number	1 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
9.1.13b	7.348E-09	4.633E-09	3.295E-09													
9.1.14a	ESE	2.531E-06	1.066E-06	3.508E-07	1.7[illegible]7E-07	1.074E-07	4.711E-08	1.664E-08								
9.1.14b	8.105E-09	5.109E-09	3.634E-09													
9.1.15a	SE	1.925E-06	9.841E-07	3.924E-07	1.977E-07	1.221E-07	5.393E-08	1.921E-08								
9.1.15b	9.408E-09	5.952E-09	4.244E-09													
9.1.16a	SSE	2.977E-06	1.384E-06	5.251E-07	2.640E-07	1.628E07	7.128E-08	2.511E-08								
9.1.16b	1.220E-08	7.678E-09	5.452E-09													
10.0.3	2.260 DAY DECAY,			UNDEPLETED			PLANT VENT-CONT. AGL									
10.1	* * B L A N K C A R D * *															
10.1.1a	S	2.661E-06	1.319E-06	5.867E-07	3.348E-07	2.151E-07	9.395E-08	3.219E-08								
10.1.1b	1.506E-08	9.119E-09	6.240E-09													
10.1.2a	SSW	2.277E-06	1.003E-06	4.149E-07	2.290E-07	1.451E-07	6.275E-08	2.118E-08								
10.1.2b	9.785E-09	5.890E-09	4.017E-09													
10.1.3a	SW	1.379E-06	4.800E-07	1.623E-07	7.965E-08	4.793E-08	2.021E-08	6.600E-09								
10.1.3b	2.988E-09	1.781E-09	1.207E-09													
10.1.4a	WSW	3.164E-07	1.415E-07	5.954E-08	3.180E-08	1.949E-08	8.195E-09	2.682E-09								
10.1.4b	1.220E-09	7.278E-10	4.924E-10													
10.1.5a	W	1.733E-07	9.277E-08	4.338E-08	2.393E-08	1.495E-08	6.279E-09	2.020E-09								
10.1.5b	8.997E-10	5.279E-10	3.519E-10													
10.1.6a	WNW	1.677E-07	9.501E-08	4.226E-08	2.258E-08	1.401E-08	5.924E-09	1.937E-09								
10.1.6b	8.772E-10	5.202E-10	3.496E-10													
10.1.7a	NW	4.839E-07	2.232E-07	8.326E-08	4.180E-08	2.538E-08	1.075E-08	3.551E-09								
10.1.7b	1.621E-09	9.668E-10	6.529E-10													
10.1.8a	NNW	1.319E-06	5.650E-07	2.160E-07	1.100E-07	6.731E-08	2.878E-08	9.693E-09								
10.1.8b	4.501E-09	2.722E-09	1.862E-09													
10.1.9a	N	5.206E-07	1.966E-06	6.915E-07	3.439E-07	2.104E-07	9.078E-08	3.094E-08								
10.1.9b	1.453E-08	8.873E-09	6.128E-09													
10.1.10a	NNE	1.9[illegible]4E-06	8.887E-07	3.814E-07	2.193E-07	1.462E-07	6.669E-08	2.364E-08								
10.1.10b	1.153[illegible]-08	7.142E-09	4.926E-09													
10.1.11a	[illegible]E	9.893E-07	5.654E-07	2.703E-07	1.591E-07	1.035E-07	4.542E-08	1.566E-08								
10.1.11b	7.354E-09	4.457E-09	3.048E-09													
10.1.12a	ENE	1.192E-06	6.969E-07	2.889E-07	1.476E-07	9.125E-08	3.964E-08	1.360E-08								
10.1.12b	6.359E-09	3.844E-09	2.622E-09													
10.1.13a	E	1.368E-06	7.560E-07	3.043E-07	1.532E-07	9.426E-08	4.118E-08	1.418E-08								
10.1.13b	6.624E-09	4.005E-09	2.733E-09													
10.1.14a	ESE	2.524E-06	1.060E-06	3.475E-07	1.723E-07	1.055E-07	4.578E-08	1.569E-08								
10.1.14b	7.336E-09	4.440E-09	3.033E-09													
10.1.15a	SE	1.920E-06	9.789E-07	3.888E-07	1.951E-07	1.200E-07	5.244E-08	1.814E-08								
10.1.15b	8.534E-09	5.188E-09	3.556E-09													
10.1.16a	SSE	2.971E-06	1.377E-06	5.205E-07	2.606E-07	1.601E-07	6.943E-08	2.379E-08								
	1 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80

Number	1 5	0 5	0 5	0 5	0 5	0 5	0 5	0 5
10.1.16b	1.114E-08	6.750E-09	4.620E-09					
11.0.3	8.000 DAY DECAY,		DEPLETED		PLANT VENT-CONT. AGL			
11.1	* * B L A N K	C A R D * *						
11.1.1a	S	2.606E-06	1.292E-06	5.722E-07	3.235E-07	2.043E-07	8.577E-08	2.726E-08
11.1.1b	1.192E-08	6.911E-09	4.580E-09					
11.1.2a	SSW	2.219E-06	9.686E-07	3.966E-07	2.161E-07	1.344E-07	5.582E-08	1.741E-08
11.1.2b	7.479E-09	4.287E-09	2.818E-09					
11.1.3a	SW	1.318E-06	4.322E-07	1.369E-07	6.458E-08	3.781E-08	1.517E-08	4.472E-09
11.1.3b	1.836E-09	1.022E-09	6.560E-10					
11.1.4a	WSW	3.062E-07	1.329E-07	5.148E-08	2.692E-08	1.610E-08	6.446E-09	1.918E-09
11.1.4b	7.990E-10	4.496E-10	2.908E-10					
11.1.5a	W	1.699E-07	8.853E-08	3.862E-08	2.091E-08	1.280E-08	5.142E-09	1.516E-09
11.1.5b	6.250E-10	3.491E-10	2.246E-10					
11.1.6a	WNW	1.654E-07	9.072E-08	3.682E-08	1.925E-08	1.168E-08	4.711E-09	1.405E-09
11.1.6b	5.863E-10	3.299E-10	2.133E-10					
11.1.7a	NW	4.735E-07	2.051E-07	7.120E-08	3.435E-08	2.030E-08	8.179E-09	2.453E-09
11.1.7b	1.025E-09	5.770E-10	3.729E-10					
11.1.8a	NNW	1.284E-06	2.252E-07	1.806E-07	8.935E-08	5.316E-08	2.157E-08	6.553E-09
11.1.8b	2.764E-09	1.564E-09	1.016E-09					
11.1.9a	N	5.042E-06	1.798E-06	5.697E-07	2.736E-07	1.627E-07	6.647E-08	2.031E-08
11.1.9b	8.587E-09	4.866E-09	3.163E-09					
11.1.10a	NNE	1.923E-06	8.676E-07	3.701E-07	2.118E-07	1.406E-07	6.230E-08	2.022E-08
11.1.10b	8.923E-09	5.260E-09	3.496E-09					
11.1.11a	NE	9.760E-07	5.587E-07	2.669E-07	1.561E-07	9.991E-08	4.220E-08	1.354E-08
11.1.11b	5.972E-09	3.479E-09	2.315E-09					
11.1.12a	ENE	1.185E-06	6.601E-07	2.400E-07	1.189E-07	7.151E-08	2.950E-08	9.159E-09
11.1.12b	3.905E-09	2.218E-09	1.442E-09					
11.1.13a	E	1.355E-06	7.139E-07	2.519E-07	1.227E-07	7.340E-08	3.050E-08	9.505E-09
11.1.13b	4.046E-09	2.296E-09	1.492E-09					
11.1.14a	ESE	2.460E-06	9.583E-07	2.863E-07	1.370E-07	8.156E-08	3.358E-08	1.040E-08
11.1.14b	4.423E-09	2.510E-09	1.631E-09					
11.1.15a	SE	1.889E-06	9.177E-07	3.206E-07	1.554E-07	9.291E-08	3.856E-08	1.205E-08
11.1.15b	5.156E-09	2.937E-09	1.914E-09					
11.1.16a	SSE	2.916E-06	1.287E-06	4.286E-07	2.073E-07	1.238E-07	5.094E-08	1.575E-08
11.1.16b	6.692E-09	3.794E-09	2.464E-09					
12.0.3		DEPOSITION			PLANT VENT-CONT. AGL			
12.1	* * B L A N K	C A R D * *						
12.1.1a	S	1.490E-08	3.803E-09	1.380E-09	1.062E-09	7.188E-10	2.766E-10	8.040E-11
12.1.1b	3.251E-11	1.736E-11	1.075E-11					
12.1.2a	SSW	1.655E-08	4.531E-09	1.466E-09	9.661E-10	6.217E-10	2.392E-10	7.007E-11

	1 1	2 2	3 3	4 4	5 5	6 6	7 7	8
1 5	0 5	0 5	0 5	0 5	0 5	0 5	0 5	0

Card Number	1 5	1 0	1 5	2 0	2 5	3 0	3 5	4 0	4 5	5 0	5 5	6 0	6 5	7 0	7 5	8 0
12.1.2b	2.806E-11	1.498E-11	9.273E-12													
12.1.3a	SW	1.295E-08	3.400E-09	9.710E-10	4.380E-10	2.473E-10	9.686E-11	2.845E-11								
12.1.3b	1.127E-11	6.021E-12	3.727E-12													
12.1.4a	WSW	3.479E-09	8.769E-10	2.981E-10	1.397E-10	8.286E-11	3.186E-11	9.218E-12								
12.1.4b	3.654E-12	1.951E-12	1.208E-12													
12.1.5a	W	1.242E-09	3.528E-10	1.454E-10	6.850E-11	4.362E-11	1.777E-11	5.141E-12								
12.1.5b	2.038E-12	1.088E-12	6.735E-13													
12.1.6a	WNW	9.141E-10	2.660E-10	1.179E-10	5.516E-11	3.474E-11	1.409E-11	4.076E-12								
12.1.6b	1.616E-12	8.628E-13	5.340E-13													
12.1.7a	NW	1.964E-09	7.232E-10	2.328E-10	1.094E-10	6.696E-11	2.575E-11	7.449E-12								
12.1.7b	2.952E-12	1.577E-12	9.758E-13													
12.1.8a	NNW	9.149E-09	2.518E-09	9.572E-10	4.387E-10	2.542E-10	9.776E-11	2.828E-11								
12.1.8b	1.121E-11	6.986E-12	3.705E-12													
12.1.9a	N	4.258E-08	1.198E-08	4.259E-09	1.917E-09	1.086E-09	4.197E-10	1.219E-10								
12.1.9b	4.803E-11	2.581E-11	1.597E-11													
12.1.10a	NNE	1.251E-08	2.988E-09	9.032E-10	4.648E-10	3.416E-10	1.988E-10	7.988E-11								
12.1.10b	3.125E-11	1.553E-11	9.611E-12													
12.1.11a	NE	3.154E-09	9.368E-10	3.680E-10	3.351E-10	2.549E-10	9.810E-11	2.855E-11								
12.1.11b	1.160E-11	6.195E-12	3.834E-12													
12.1.12a	ENE	2.030E-09	1.001E-09	6.115E-10	2.780E-10	1.613E-10	6.284E-11	1.818E-11								
12.1.12b	7.205E-12	3.847E-12	2.381E-12													
12.1.13a	E	3.647E-09	1.375E-09	7.271E-10	3.281E-10	1.861E-10	7.219E-11	2.135E-11								
12.1.13b	8.460E-12	4.518E-12	2.796E-12													
12.1.14a	ESE	9.569E-09	3.279E-09	1.037E-09	4.669E-10	2.639E-10	1.024E-10	2.984E-11								
12.1.14b	1.183E-11	6.316E-12	3.910E-12													
12.1.15a	SE	8.275E-09	2.682E-09	1.187E-09	5.343E-10	3.027E-10	1.170E-10	3.426E-11								
12.1.15b	1.358E-11	7.252E-12	4.489E-12													
12.1.16a	SSE	1.421E-08	4.616E-09	1.924E-09	8.659E-10	4.907E-10	1.886E-10	5.489E-11								
12.1.16b	2.187E-11	1.168E-11	7.227E-12													
13.1	C SITE BOUNDARY	N	0.17	8.897E-06	8.895E-06	8.624E-06	1.913E-07	111								
13.2	C SITE BOUNDARY	S	0.41	2.384E-06	2.382E-06	2.308E-06	3.471E-08	111								
13.3	C GARDEN+RES	SW	0.59	1.785E-06	1.782E-06	1.729E-06	1.835E-081	111								
13.4	C MILK+BEEF	NNE	2.20	4.663E-07	4.637E-07	4.487E-07	1.251E-09									
13.5	C ALPHA+CEMENT	SSW	0.30	2.107E-06	2.106E-06	2.032E-06	4.739E-08111111									
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ABSTRACT (200 words or less) The document is a user's guide for the GASPAR code, a computer rogram written for the evaluation of radiological impacts due to the release of radio- ctive material to the atmosphere during normal operation of light water reactors. The ASPAR code implements the radiological impact models of NRC Regulatory Guide 1.109, evision 1, for atmospheric releases. The code is currently used by NRC in reactor icensing evaluations to estimate (1) the collective or population dose to the opulation within a 50-mile radius of a facility, (2) the total collective dose to the S. population, and (3) the maximum individual doses at selected locations in the cinity of the plant.

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