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Dose Commitments Due to Radioactive Releases from Nuclear Power Plant Sites

Methodology and Data Base

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Abstract

This manual describes a dose assessment system used to estimate the population or collective dose commitments received via both airborne and waterborne pathways by persons living within a 2- to 80-kilometer region of a commercial operating power reactor for a specific year of effluent releases. Computer programs, data files, and utility routines are included which can be used in conjunction with an IBM or compatible personal computer to produce the required dose commitments and their statistical distributions. In addition, maximum individual airborne and waterborne dose commitments are estimated and compared to 10 CFR Part 50, Appendix I, design objectives. This supplement is the last report in the NUREG/CR-2850 series.

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Summary

This manual describes a dose assessment system used to estimate the dose to the maximally exposed individual and the population or collective dose commitments received via both airborne and waterborne pathways by persons living within the region of the site of a commercial operating power reactor for a specific year of effluent releases. Computer programs, data files, and procedures are included which can be used in conjunction with an IBM or compatible personal computer to produce the required dose commitments.

All commercial nuclear power reactors release small amounts of radioactive materials to the environment during normal operation. Because of these releases, concern was expressed about the magnitude of the collective dose received by the general population residing around these nuclear power plants. In response to this concern, the Pacific Northwest National Laboratory (PNNL) contracted with the Nuclear Regulatory Commission (NRC) to undertake a series of studies to estimate radiation dose commitments produced by radionuclide releases from commercial light-water power reactors starting in 1975. In this series of studies (NUREG/CR-2850) the collective (population) dose commitment is estimated from both the liquid and gaseous releases to four age groups making up the population residing in the region of the site: infant (0 to 1 yr), child (1 to 11 yr), teenager (11 to 17 yr), and adult (17 yr and older). In addition, air doses at the site boundary and dose commitments are estimated for the maximally exposed individual living near each of the sites and compared with the following 10 CFR Part 50, Appendix I, design objectives:

- **Air**
  Noble Gases:
  10 mrad for gamma and 20 for beta at site boundary
  5 mrem to total body at residence

  Iodines and Particulate Material:
  15 mrem to organ from inhalation at residence and
  ingestion of garden products and pasture food products

- **Liquid**
  3 mrem to total body
  10 mrem to organ

The particular organs of reference in this study are listed in Table S.1. The major pathways by which radionuclides travel from the reactor to the individual receptors are shown in Table S.2. Other possible liquid pathways such as direct exposure from waterborne activities (swimming, boating, shoreline recreation, except for individual doses) and internal exposure through ingestion of food produced using contaminated irrigation water (except for individual doses) were not included.

The "source terms" used to estimate dose commitments produced from each site were the annual measured releases of radioactive materials as reported to the NRC by the plant licensees, subsequently published in the NUREG/CR-2907 series of reports. In addition, annual dilution flows for liquid releases were taken from these documents. As used in this report, dose commitment describes the total-body or specified organ dose equivalent in rem (1 rem = 0.01 sievert) received over 50 years from intake during the year in which radioactive materials were released into the enviornment from the power plants.

The regional population for which collective dose commitments are estimated included those persons estimated to be living in a region between 2 and 80 km around the reactor sites during the year. Population distributions were supplied

1 Introduction

1.1 Scope

This manual describes the Commercial Power Reactor Dose (CPRD) System of dose assessment. The CPRD System is used to estimate fifty-year dose equivalent commitments to the maximum individual and the general population living between 2 and 80 kilometers from a commercial light-water-cooled nuclear power plant site from the radioactive materials released during one year of operation. The results of this calculational methodology are published in the NUREG/CR-2850 series of documents. The doses to the maximally exposed individual are derived from inhalation and direct radiation at a location at the site boundary. In addition, ingestion doses from vegetables grown at a garden at the residence and milk and meat from the closest pasture are estimated. Releases of past years are not included in the dose estimate. The population is considered to be made up of four groups divided by age: infants, children, teenagers, and adults, which are considered in four separate calculations. Doses to individual organs are considered for both airborne and waterborne (liquid) pathways (see Tables 1.1 and 1.2).

Table 1.1 Pathways considered

Airborne
• Air submersion • Ground irradiation • Inhalation • Ingestion of food crops and animal products • Gamma and beta air doses for individual at site boundary
Waterborne
• Ingestion of drinking water • Ingestion of fish and invertebrates • Shoreline for individual • Irrigated food products for individual

Table 1.2 Organs considered

Airborne	**Waterborne**
• Total body	• Total body
• Thyroid	• Thyroid
• Bone	• Bone
• GI-tract	• GI-tract
• Liver	• Liver
• Lung	

For the airborne pathways, the population dose estimates include the pathways of air submersion, ground irradiation, inhalation, and ingestion of vegetables, milk, and meat for the six organs and four age groups. The maximum individual doses for the Appendix I comparison are made up of the air gamma and beta doses at the site boundary and the external total-body doses from noble gases in the plume at the residence. The organ doses from the iodines and particles emitted are made up of inhalation at the residence, ingestion of vegetables and produce grown in the garden, and milk and meat from animals grazed on the pasture. The dose from the ground irradiation pathway is not used for this Appendix I comparison although it is calculated in the program.

For the waterborne pathways, the population dose estimates include the pathways of ingestion of drinking water and of fish and/or invertebrates for the five organs and four age groups. The maximum individual doses for the Appendix I comparison (both total-body and organ) are made up of drinking water and fish and/or invertebrate consumption for the organs and age groups. Irrigated food products are included when indicated by the licensee. Also, the direct dose from shoreline irradiation is included in the total-body dose.

The doses for each organ and age group are compared, and the highest dose is selected for both air and water pathways.

1.2 Overview

The models used for these dose estimates are those standardized in the NRC Regulatory Guides 1.109 (NRC 1977a), 1.111 (NRC 1977b), and 1.113 (NRC 1977c) and those which have been used in NRC dose assessment programs, such as XOQDOQ (Sagendorf et al. 1982), GASPAR (Eckerman et al. 1980; Strenge et al. 1987), and LADTAP (Simpson and McGill 1980, Strenge et al. 1986). The CPRD System of programs has been written in Microsoft BASIC PDS 7.1 and run under the DOS 5.0 operating system on an IBM Personal Computer or compatible system. A complete description and instructions for use are given in Chapter 3 of this manual along with a sample run using typical data values (see Appendix E). Listings of all programs are presented in Appendixes A and B. Listings of generic input data files and examples of site-specific files are presented in Appendix D.

The data used in the dose estimates are contained in the programs or in separate files, which are read into the computer memory during each run. The data files are divided into two general categories: 1) generic or fixed files and 2) site-specific files. The generic files include the dose-factors, radiological decay constants, bioaccumulation factors, and terrestrial food-transfer factors. The site-specific files contain data that are particular to a specific site, such as population distribution, atmospheric transport factors, release rates, etc. Table 1.3 summarizes the data files used with the programs discussed below. Listings of these data files are given in Appendix B.

The dose commitments are estimated using four programs. CPRDA is used for airborne releases and CPRDL for waterborne releases. Doses from direct plume irradiation from noble gases emitted from tall stacks are estimated using the program AirGamma. The program XOQ2, a PC version of the NRC program XOQDOQ, is used to generate dilution factors from site annual joint frequency distributions of wind speed, direction, and Pasquill stability category, physical release data, and locations of receptors. A discussion of XOQDOQ is not included in this report, but may be found in Sagendorf et al. (1982). Other programs listed in Table 1.4 generate special summaries of the results or are used as utilities to read or list various files.

The output files generated by CPRDA, CPRDL, AirGamma, and XOQ2 are summarized in Table 1.5.

The following sections of this report describe the input data files, programs, and output result files which are summarized in Tables 1.3 and 1.4.

Table 1.3 Input data files

Name	Update frequency	Contents
Generic		
GENERIC.DAT	Constant	Decay constants, food-transfer factors, bioaccumulation factors
INFANT.DAT	Constant	Infant dose-commitment factors
CHILD.DAT	Constant	Child dose-commitment factors
TEEN.DAT	Constant	Teen dose-commitment factors
ADULT.DAT	Constant	Adult dose-commitment factors
AIRGAMMA.DAT	Constant	Gamma energies times abundances and dose factors for noble gases
Site-Specific		
POPyySnn.DAT	Constant	Population distribution (updated when available)
CHIyySnn.DAx	Annually	Atmosphere transport distributions (output from XOQ2)
RELyySnn.DAT	Annually	Population factor, liquid stream flow, energy output, and releases
SITEPOPyy	Annually	Site city populations
SSD.DAT	Constant	Miscellaneous site-specific parameters
XOQyySnn.INx	Annually	XOQ2 input data
Setup		
CPRD.SET	Annually	Run parameters and input-file location pathways for CPRD, CPRDL, and AIRGAMMA programs.

Notes: nn = Site Number; yy = Year of Release; x = Release type (G, E, or M).
Site-specific files designated constant may be updated when revised information is available from NRC or the Licensee.

Table 1.4 Programs

Name	Purpose	Input files	Output files	Printouts
Main				
CPRDA.EXE	Calculate dose commitment from airborne releases	GENERIC.DAT INFANT.DAT CHILD.DAT TEEN.DAT ADULT.DAT SSD.DAT POPyySnn.DAT CHIyySnn.DAx RELyySnn.DAT CPRD.SET	SUMyySnn.OUx AIRyySnn.OUx	QA
CPRDL.EXE	Calculate dose commitment from waterborne releases	Same as above except CHIyySnn.DAx	SUMyySnn.OUx LIQyySnn.OUT	QA
AIRGAMMA.EXE	Calculate noble-gas doses from tall stacks	XOQyySnn.INx RELyySnn.DAT AIRGAMMA.DAT GENERIC.DAT CPRD.SET	SUMyySnn.OUx	Yes
XOQ2.EXE	Calculated dilution factors	XOQyySnn.INx	CHIyySnn.DAx XOQnn.OUx	None
Utility				
ADDNOTES.EXE	Adds notes to bottom of pages of Site Summary	NOTESyy.IN SUMyy.WP	SUMyy.WP	None
CPRDEDIT	Edit output file	SUMyySnn.OUx	SUMyySnn.OUx	None
CPRDUMP.EXE	Print SUMyySnn.Oux file	SUMyySnn.OUx	None	Yes
CPRDPRNT.EXE	Print out dose reports	SUMyySnn.OUx AIRyySnn.OUx LIQyySnn.OUT	None	
RELGEN.EXE	Generate REL files	Brookhaven Releasee file	RELyySnn.DAT REL.EXP	None
SSUM.EXE	Generate Site Summary pages for annual report	SUMyySnn.OUx SITEPOPyy.DAT	SUMyy.WP	None
SUMTAB.BAS	Calculate Table 4 data for annual report	SUMyySnn.OUx	None	Table 4 data for annual report

Table 1.5 Output result files

Name	Contents
SUMyySnn.OUx	Normal run documentation and dose results for each site for both air and liquid paths
AIRyySnn.OUx	Detailed file of adult air population doses by nuclide and organ
LIQyySnn.OUT	Detailed file of adult liquid population doses by nuclide and pathway-organ
CHIyySnn.DAX	Atmospheric transport factors for input to CPRDA

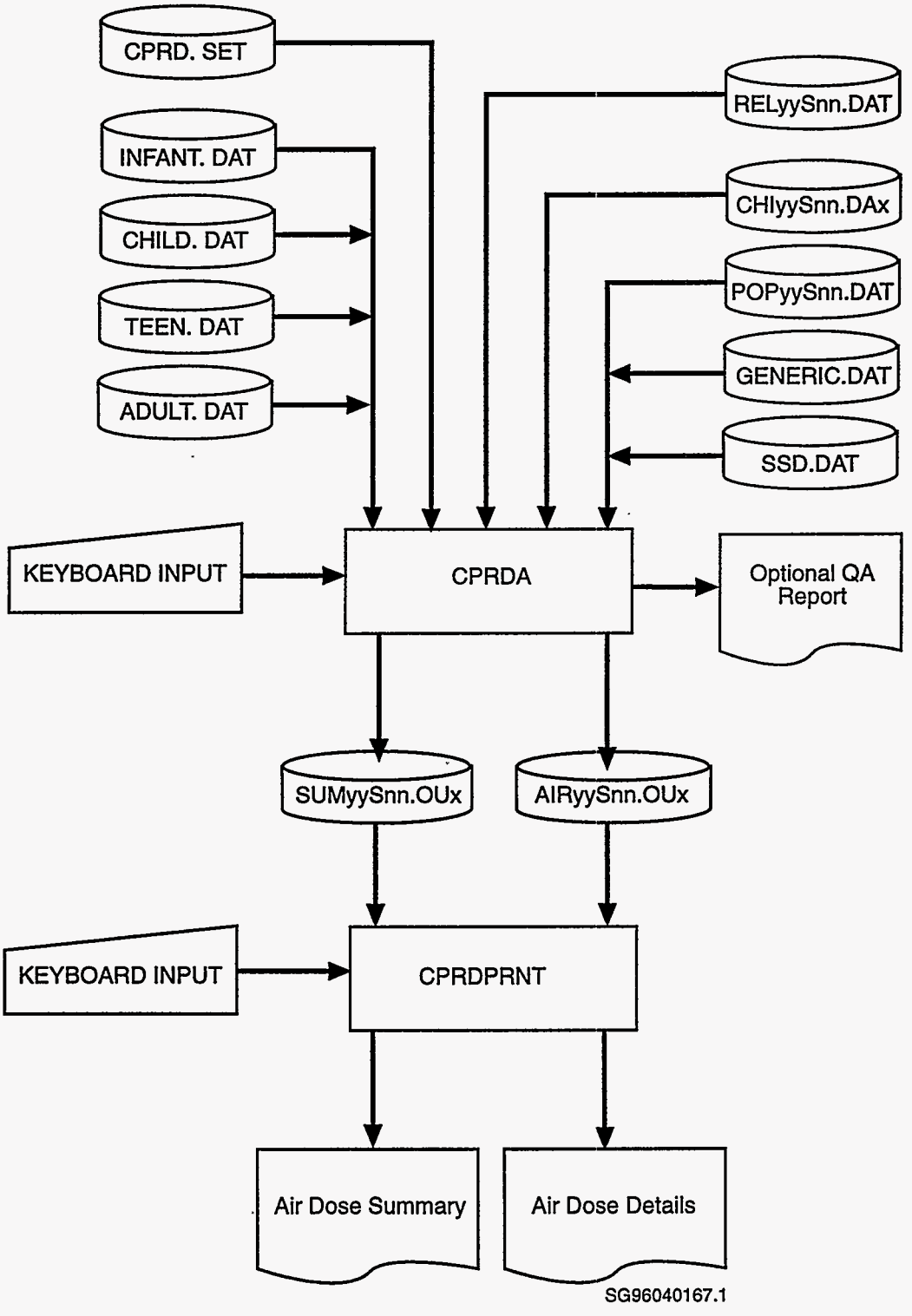

Figure 1.1 CPRDA flow

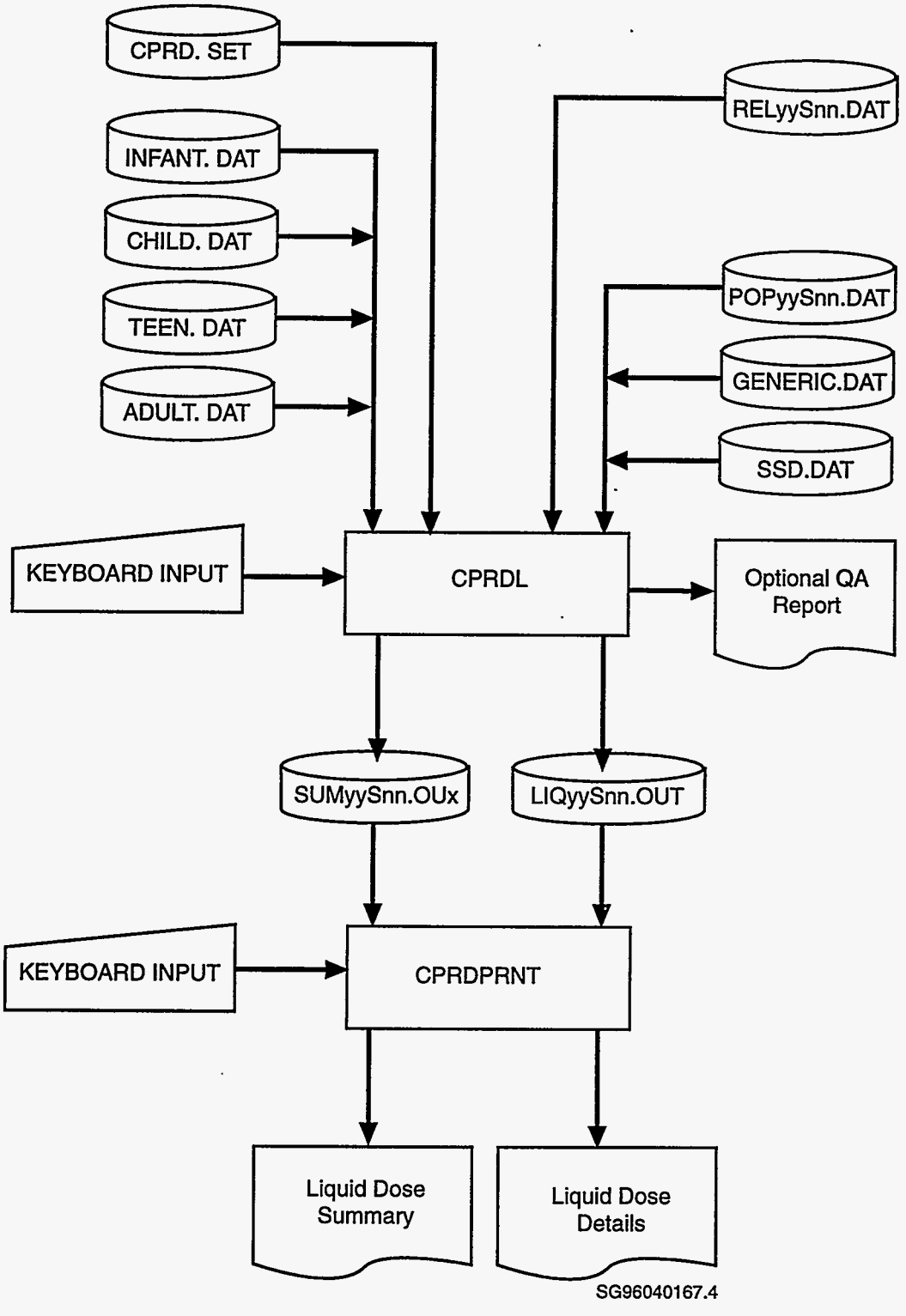

Figure 1.2 CPRDL flow

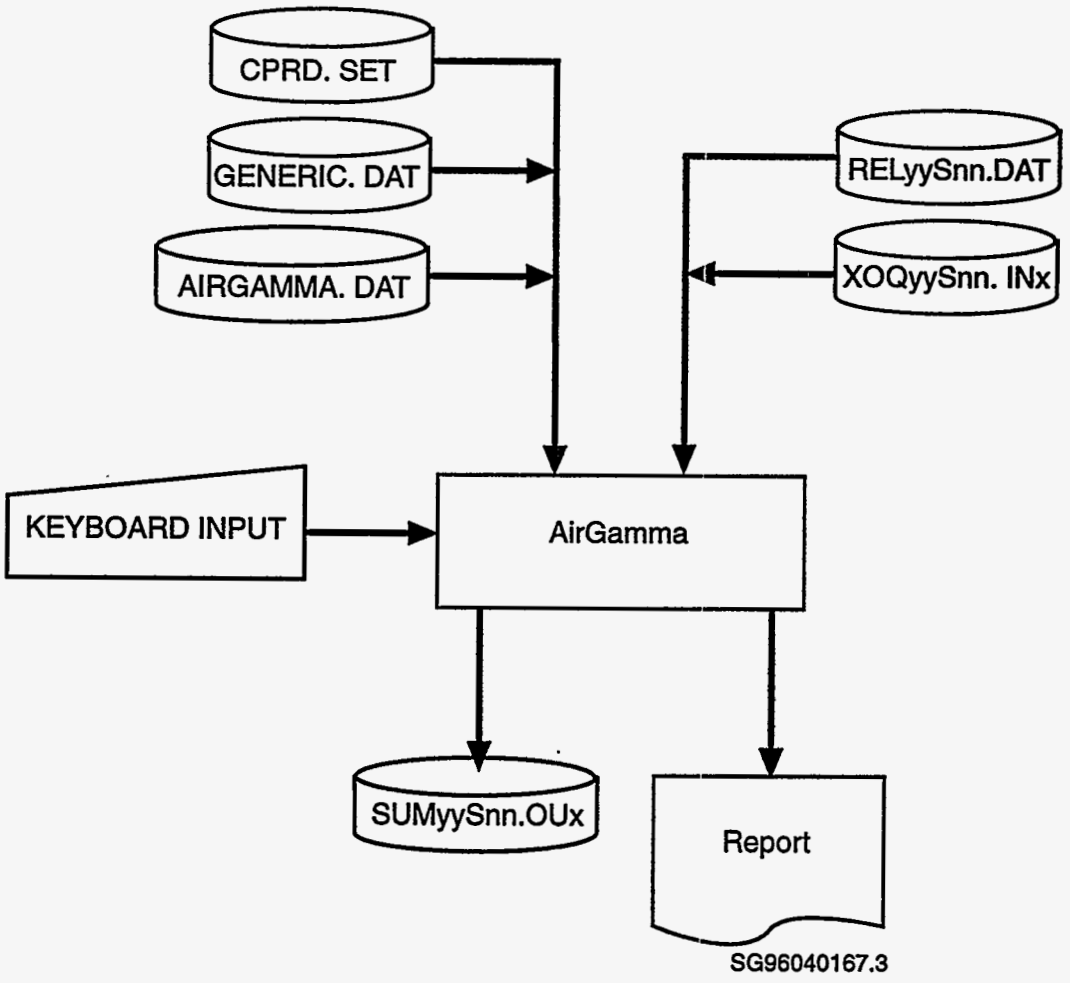

Figure 1.3 AIRGAMMA flow

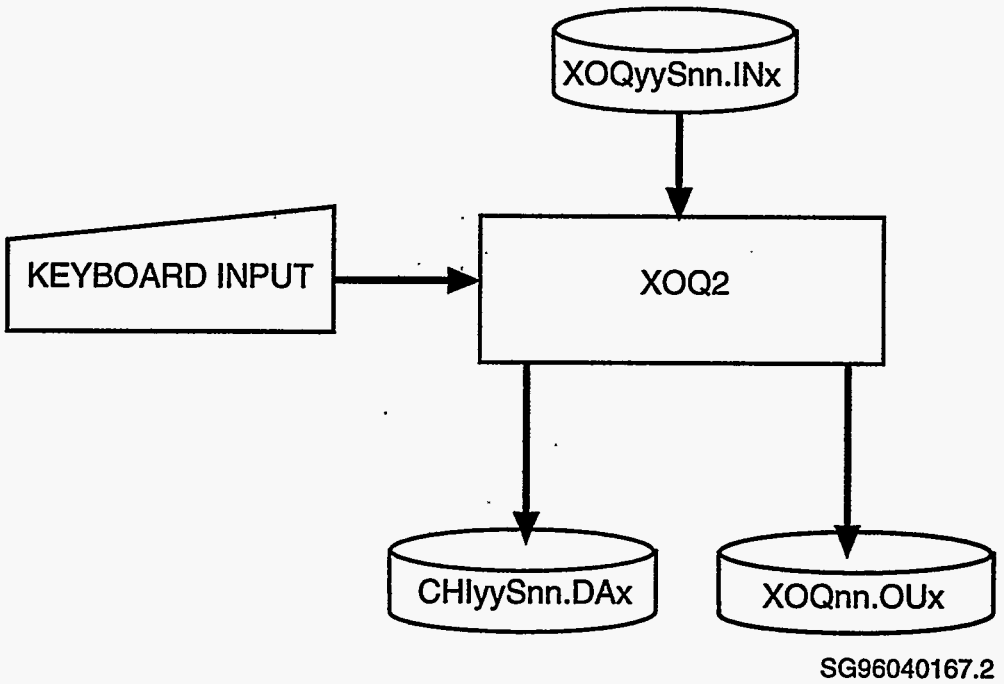

Figure 1.4 XOQ2 flow

Table 2.1 Radionuclides considered

No.	Nuclide	Decay constant (1/sec)	No.	Nuclide	Decay constant (1/sec)
1	H-3	1.78E-09	43	Nb-97	1.57E-04
2	Be-10	1.37E-14	44	Mo-99+D	2.92E-06
3	C-14	3.83E-12	45	Tc-99M	3.19E-05
4	N-13	1.16E-03	46	Ru-103+D	2.02E-07
5	F-18	1.05E-04	47	Ru-106+D	2.17E-08
6	Na-22	8.44E-09	48	Ag-110M+D	3.19E-08
7	Na-24	1.28E-05	49	Cd-115M	1.80E-07
8	Ar-41	1.05E-04	50	Cd-115	3.60E-06
9	Sc-46	9.58E-08	51	Sn-125+D	8.31E-07
10	Cr-51	2.89E-07	52	Sb-124	1.33E-07
11	Mn-54	2.57E-08	53	Sb-125+D	8.06E-09
12	Mn-56	7.47E-05	54	Te-132+D	2.47E-06
13	Fe-55	8.14E-09	55	Te-133M+D	2.09E-04
14	Fe-59	1.80E-07	56	I-131+D	9.97E-07
15	Co-57	2.97E-08	57	I-132	8.42E-05
16	Co-58	1.12E-07	58	I-133+D	9.25E-06
17	Co-60	4.17E-09	59	I-134	2.20E-04
18	Ni-57	5.35E-06	60	I-135+D	2.92E-05
19	Ni-63	2.20E-10	61	Xe-131M	6.69E-07
20	Ni-65	7.64E-05	62	Xe-133M	3.61E-06
21	Cu-64	1.52E-05	63	Xe-133	1.52E-06
22	Zn-65	3.31E-08	64	Xe-135M	7.56E-04
23	Zn-69M+D	1.39E-05	65	Xe-135	2.10E-05
24	As-76	7.32E-06	66	Xe-137	3.01E-03
25	Br-82	5.44E-06	67	Xe-138+D	8.14E-04

Table 2.1 (Continued)

No.	Nuclide	Decay constant (1/sec)	No.	Nuclide	Decay constant (1/sec)
26	Kr-83M	1.04E-04	68	Cs-134	1.07E-08
27	Kr-85M	4.31E-05	69	Cs-136	6.17E-07
28	Kr-85	2.05E-09	70	Cs-137+D	7.31E-10
29	Kr-87	1.52E-04	71	Cs-138	3.58E-04
30	Kr-88+D	6.89E-05	72	Cs-139+D	1.24E-03
31	Kr-89	3.64E-03	73	Ba-139	1.39E-04
32	Rb-88	6.53E-04	74	Ba-140+D	6.28E-07
33	Rb-89+D	7.61E-04	75	La-140	4.78E-06
34	Sr-89+D	1.59E-07	76	La-141	4.97E-05
35	Sr-90+D	7.58E-10	77	Ce-141	2.47E-07
36	Sr-91+D	2.03E-05	78	Ce-144+D	2.83E-08
37	Sr-92+D	7.11E-05	79	Eu-152	1.69E-09
38	Y-90	3.01E-06	80	Eu-154	2.55E-09
39	Y-91M+D	2.32E-04	81	W-187	8.06E-06
40	Zr-95+D	1.22E-07	82	Th-232+D	1.57E-18
41	Zr-97+D	1.14E-05	83	Np-239	3.42E-06
42	Nb-95	2.29E-07			

2.2 Site-Specific Data Files

The site-specific data files are those files that hold data specific to each site. These files include the population distribution, atmospheric dispersion factors, radionuclide releases, and other miscellaneous data for each plant site. All files of this category except the miscellaneous site-specific data file (SSD.DAT) have the site number (nn) attached to their name for identification purposes. Those files which are updated annually have the year (yy) included in their name. All site-specific input files are written in sequential text (ASCII) format.

2.2.1 Population Distribution--POPyySnn.DAT

The POPyySnn.DAT files are made up of the population distribution around the sites and the population exposed to contaminated drinking water for river and lake sites. The first line of the file is the customary header containing file QA information. The second line contains the drinking water population, if applicable.

The population distribution is made up of the number of persons residing in each of the 160 sectors in a decennial census year: 1970, 1980, etc. These sectors are the areas defined by the 22-1/2 degree boundaries of the 16 compass points and 10 radial intervals from 2 to 80 kilometers from the site. See Figure 2.1 and Table 2.2. The population distributions for the 1980 decennial year were developed by the NRC Siting Analysis Branch from data obtained from the Bureau of the Census. See Listing D.10 for an example of these files.

Table 2.2 Radii intervals and midpoints for airborne dose calculations (km)

Interval	Midpoint
2 - 3	2.5
3 - 4	3.5
4 - 6	5
6 - 9	7.5
9 - 14	11.5
14 - 20	17
20 - 30	25
30 - 40	35
40 - 60	50
60 - 80	70

Note: Intervals are approximately logarithmically proportioned between 2 and 80 km.

2.2.2 Atmospheric Transport Factors--CHIyySnn.DAx

The CHIyySnn.DAx files contain the atmospheric transport factors which are made up of four sets of 160 factors - one for each sector defined above for the population. These four sets of factors are generated from the NRC computer program XOQ2 (a version of a PC version of XOQDOQ [Sagendorf et al. 1982] converted by Joyce W. Morton of Morton and Potter, Technical Consultants) using site climatological joint frequency data supplied by the licensee for the year of release. The first three sets of 160 factors are the atmospheric dilution factors (s/m^3) for three categories of radionuclide depending on their decay half-life and depletion rate from the cloud. The fourth set of factors is the relative deposition (reciprocal $meter^2$) of particles and iodines and is used in estimating the doses from terrestrial food consumption and ground irradiation.

Meteorological (joint frequency) data for the release year are generated from information submitted by the licensees for ground, elevated, and mixed-mode releases for a site. In some cases, more than one joint frequency distribution are used, depending on the height of release and availability.

For population doses, atmospheric transport factors are calculated for 16 compass points and for 10 radii from 2 to 80 km (see Table 2.2). For individual Appendix I doses, semi-infinite plume transport factors were estimated at locations of the site boundary, closest residence, closest garden, and closest pasture. Here, "closest" is the location of maximum dose as stipulated by the licensee. Ingestion doses from leafy vegetables and other vegetables were calculated for the garden location; ingestion doses from milk (cow or goat) and meat were calculated for the pasture location. If no milk pathway was stipulated by the licensee, a default pasture location 5 miles from the site or at a "beef pasture" is used.

The XOQ2 program generates four sets of atmospheric transport factors:

- average annual atmospheric dilution factors that are not corrected for cloud depletion or radioactive decay
- dilution factors that are only corrected for decay assuming a 2.26-day half-life
- dilution factors that are corrected for depletion and decay assuming an 8-day half-life
- relative deposition per unit area.

These factors are used to estimate the dose from semi-infinite airborne releases using methods similar to the NRC GASPAR program (Eckerman et al. 1980, Strenge et al. 1987). The assumptions used in the calculation of these transport factors are as follows:

- release heights used depended on type of release: ground, elevated, or mixed mode
- release heights corrected for plume rise or building wake effects where applicable
- semi-infinite cloud model with sector-average, Gaussian-plume dispersion
- no correction for terrain height variation or recirculation.

For sites with tall stacks, the site boundary gamma and residential total-body doses from direct irradiation from noble gases contained in the plume are also estimated using AIRGAMMA, which implements the finite-plume model described in Regulatory Guide 1.109, p. 5, and Appendix F (NRC 1977a). For the final dose estimate, the maximum dose is selected from the two methods of calculation. Listing D.11 shows the makeup of a typical CHIyySnn.DAx file.

2.2.3 Annual Releases

The RELyySnn.DAT files contain the waterborne and airborne releases from each site. The second line of the file contains the site number, site name, and four parameters. These are the population factor (unitless), liquid dilution stream flow rate (liter/year), energy output for the year (megawatt-hours), and number of units per site. The population factor is used to account for the increase in population in non-decennial census years when complete updates of the POPyySnn.DAT files are not available. These factors may be calculated on a state basis from data contained in the annual series, *Statistical Abstract of the United States 19yy*, put out by the Bureau of the Census. When the population files are updated, this factor is set to unity. The dilution-stream flows are found in the annual reports of *Radioactive*

Materials Released from Nuclear Power Plants, issued each year by the NRC as the NUREG/CR-2907 series of reports. The annual energy generation values are also derived from this series as well as the annual effluent releases of radionuclides.

The remainder of this file is a list of the radionuclides released to both the air and water from the site during the year. Three lists of air releases are given, depending on the mode of release: ground, elevated, or mixed mode. Table 2.1 lists all of the radionuclides considered and Listing D.12 shows the makeup of a typical RELyySnn.DAT file. Note that the "+D" after some of the nuclides listed in the table indicates that the decay energy of the daughter is included with that of the parent. Thus, whenever a parent nuclide release is specified, the result of the dose calculation will be as though an additional equilibrium amount of daughter nuclide is specified. This practice is recognized and supported by the NRC in Regulatory Guide 1.109. The utilities report some releases as combination parent/daughter pairs, such as Y/Sr-90, Zr/Nb-95, Cs/Ba-137, Ba/La-140, I/Xe-133, and Pr/Ce-144. The release from pairs is assumed to be evenly divided between the two nuclides when entered into the release lists. Also, all nuclides that are given in the NRC effluent release reports as a "less than" (<) basis are entered into the file at their maximum value given.[1]

When site-specific data are supplied by the licensee, nuclide-dependent recirculation factors and bioaccumulation factors are included for fish and invertebrates. Either one set (combining fish and invertebrates) or two sets of factors are supported, with the second set applying to the maximum individual when his diet would be different than that of the general population. If no second set is given, the first set applies both to the population and individual.

2.2.4 XOQ2 Input--XOQyySnn.INx

These files, XOQyySnn.INx, contain the input parameters for the XOQ2 program. They contain the joint frequency distribution, receptor locations, and parameters associated with either ground, elevated, or mixed mode releases. A listing of an example file is shown in Appendix D.13.

2.2.5 Miscellaneous Parameters--SSD.DAT

The file SSD.DAT contains the miscellaneous site-specific parameters. It is a sequential file made up of a record for each site. Each of these records contains 22 fields of character string data, which are described in Table 2.3. Each field is separated by at least one space. These parameters are mainly derived from the licensee Environmental Statements (ES) and Offsite Dose Calculation Manuals (ODCM) pertaining to each specific site. Sites are added to this file when their effluents are first reported in Radioactive Materials Released from Nuclear Power Plants, NUREG/CR-2907 (NRC 1993). Listing D.8 shows this file.

Fields 1 through 6 are self-explanatory. Field 7 contains the mixing ratio used for estimating the committed dose to the population from the consumption of drinking water contaminated by reactor effluents. For river sites, complete mixing (CMX) in the river flow is usually specified. For lake sites, mixing ratios are taken from dilution factors given in the site ES or ODCM. Here, mixing ratio is the reciprocal of the "dilution factor" given in the licensee ODCM. Sometimes, individual factors need to be weighted by a population taking water from various intakes and averaged to obtain an effective mixing ratio for the total population exposed. For all sites situated on salt water, no drinking-water dose is estimated. Field 8 is the fraction of the population exposed to liquid effluents.

Fields 9 and 10 contain the values for annual fish catch or consumption and mixing ratio. Three types of values can be placed in these fields: 1) the total annual fish catch for the region, 2) the average annual consumption rate as found in

[1]Not included in dose were very short-lived isotopes, such as Kr-90, -91, -93, -94, Xe-139, -140, -141, -143, and Rb-88m. Those were not likely to be produced; decay energies of daughter products were accounted for in the dose factor of the parent.

Table 2.3 Format of SSD.DAT file record

Field number	Description
1	Site number
2	Site name
3	State (not used)
4	Salinity (salt or fresh water)
5	River, lake, estuary, or bay code
6	River flow rate (cfs)
Population parameters	
7	Mixing ratio for population drinking water
8	Exposure factor
9	Annual fish catch rate for population (kg)
10	Mixing ratio for population fish catch
11	Annual invertebrate catch rate for population (kg)
12	Mixing ratio for invertebrate catch for population
Maximum Individual parameters	
13	Mixing ratio for individual drinking water
14	Mixing ratio for individual fish catch
15	Mixing ratio for individual invertebrate catch
16	Mixing ratio for individual shoreline
Production and animal husbandry factors	
17	Site production factor
18	Grazing factor for milk path
19	Grass/feed fraction
State production of food produced annually within an 50-mile radius	
20	Vegetables (kg)
21	Milk (L)
22	Meat (kg)

Table 2.5. Generic annual consumptions and occupancy factors used for the maximally exposed individual[a]

Item	Infant	Child	Teen	Adult
Annual consumptions				
Leafy vegetables (kg)	0	26	42	64
Produce and other vegetables and grain (kg)	0	520	630	520
Milk (L)	330	330	400	310
Meat and poultry (kg)	0	41	65	110
Fish (kg)[b]	0	6.9	16	21
Invertebrates (kg)	0	1.7	3.8	5
Drinking water (L)	330	510	510	730
Inhalation (m^3)	1400	3700	8000	8000
Shielding/occupancy factors				
Air submersion and ground irradiation factor	0.7	0.7	0.7	0.7
Shoreline recreation (hr/yr)	0	14	67	12
Garden produce fraction ingested	0.76	0.76	0.76	0.76

(a) Regulatory Guide 1.109 (NRC 1977a).
(b) Both fresh and salt water.

Table 2.6. Holdup times between harvest and consumption of foods[a]

	Holdup time (days)	
Food	**Population**	**Individual**
Leafy vegetables	-	1
Fruits, grains, and vegetables	14	60
Milk[b]	4	2
Meat[b]	20	20
Aquatic foods (fish and invertebrates)	7	1
Drinking water	1	0.5

(a) Regulatory Guide 1.109 (NRC 1977a).
(b) Value given is time after milking or slaughter. For the portion of the time animals were fed stored feed, an additional 90 days was added to the holdup time.

Table 2.7 Energy coefficients for six energy groups[a]

Energy (MeV)	Linear (mass) attenuation (1/m)	Linear energy absorption (1/m)
0.15	0.0173	0.00323
0.4	0.0123	0.00381
0.75	0.0095	0.00378
1.25	0.0074	0.00340
1.75	0.0062	0.00315
2.25	0.0054	0.00290

(a) Shleien and Terpilak 1984, p. 127.

Table 2.8 Shoreline Geometry Factors[a]

Water Body	Factor
Canal	0.1
River or estuary	0.2
Lake	0.3
Ocean or bay	0.5
Tidal basin	1

(a) Regulatory Guide 1.109 (NRC 1977a).

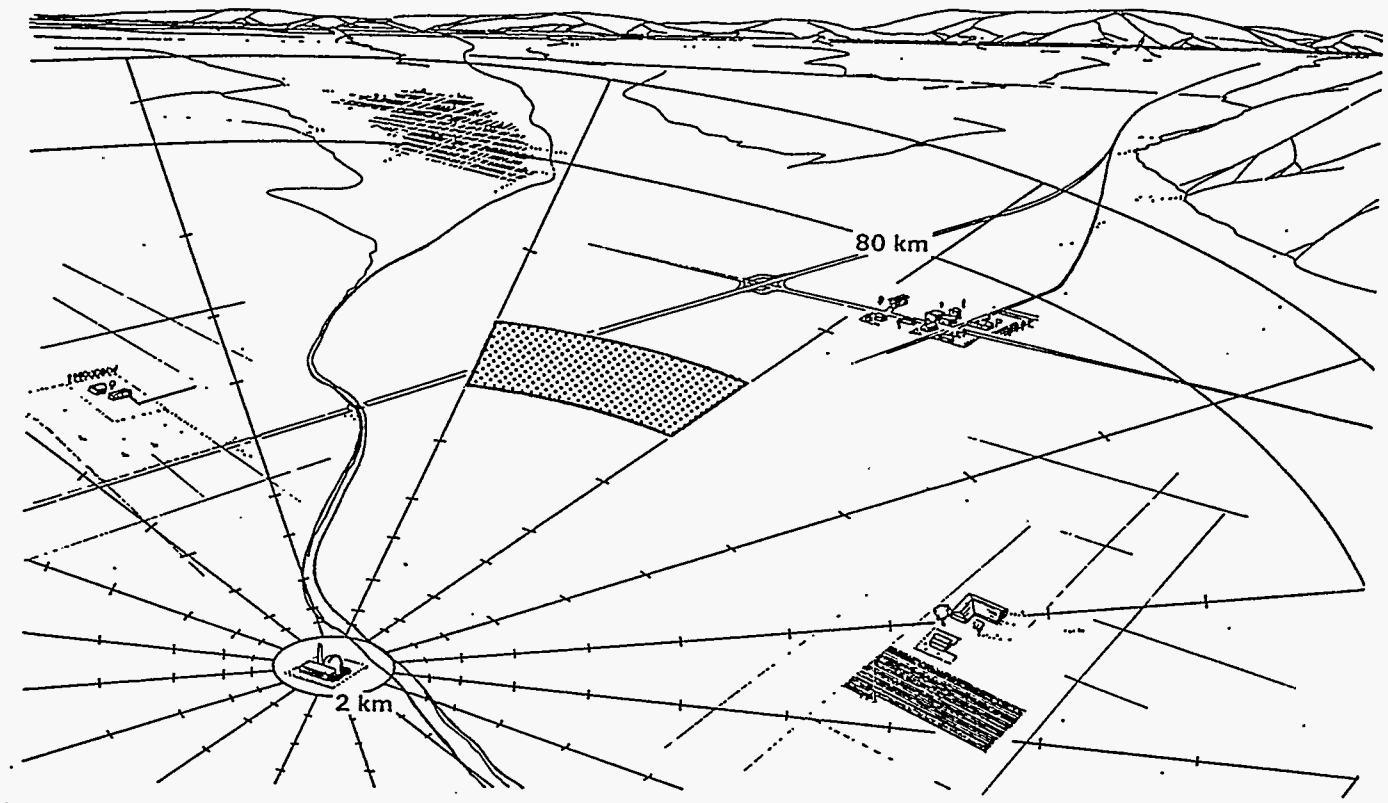

Figure 2.1 Airborne pathway

3 Programs

This section describes the programs used to calculate the population and maximum individual dose commitments. In addition, utility programs for enhancing the efficiency and quality of the work (Table 1.4) are discussed. Listings for each program are to be found in Appendixes A and B. Sample runs of the programs are given in some cases. Figures 1.1 through 1.3 show the data flow for the primary programs.

3.1 Primary Programs

The primary programs are CPRDA.EXE, CPRDL.EXE, and AIRGAMMA.EXE. These programs are run as compiled programs directly from the operating system, usually via batch files. The programs are written in Microsoft Basic PDS 7.1. The dose equations are displayed in bold type.

3.1.1 CPRDA - Airborne Pathway

This program is used to estimate collective and individual dose commitments received by persons residing within the region and derived from the annual releases of radionuclides to the atmosphere by a commercial nuclear power plant. The pathways from release to man are air submersion, ground irradiation from soil contaminated with one year's release, inhalation, and ingestion of vegetables and animal products (milk and meat).

3.1.1.1 Models

The models used in the CPRDA program are those generally approved and supported by the NRC and are found in their various publications (NRC 1977a, Sagendorf et al. 1982, Strenge et al. 1982). The equations for the models are given below using the symbols used in the code.

The symbol $\sum_{k,j,i}$ represents the summation over all nuclides (i) considered, 160 segments (j), and 4 population age groups (k).

Air Gamma and Beta

The air gamma and air beta doses are calculated for an individual assuming a semi-infinite plume model. Thus, for tall-stack releases, this model may yield results somewhat low for gamma doses. The program AIRGAMMA described in Section 3.1.3 uses a finite-cloud algorithm to better estimate tall-stack gamma doses. The air dose rates from gamma and beta radiation from radionuclide I, to an individual at location j (usually, the site boundary, j = 1) is given by:

$$\mathbf{HGAMMA_{i,j} = 31{,}700\ QREL_i\ XQ_{1,j}\ DFAIR_{i,1}\ mrad/yr} \quad (3\text{-}1)$$

$$\mathbf{HBETA_{i,j} = 31{,}700\ QREL_i\ XQ_{1,j}\ DFAIR_{i,2}\ mrad/yr} \quad (3\text{-}2)$$

where $31{,}700$ = conversion factor (10^{12} pCi/Ci) x (3.17×10^{-8} yr/s)
$QREL_i$ = annual release of activity of nuclide I, Ci/yr
$XQ_{1,j}$ = annual average dilution factor for individual at location j (usually, 1) for material that has no decay and is undepleted, s/m^3
$DFAIR_{i,m}$ = dose rate commitment factor for gamma (m=1) and beta (m=2), mrad/yr per pCi/m^3 (see Listing D.5).

Air Submersion

The dose rate from air submersion in the plume to the population of age group k, living in segment j, from nuclide I is given by the following relation:

$$HA_{k,j,i} = 31.7\ POP_j\ FAGE_k\ QREL_i\ CHIQ_{1,j}\ K2\ DF_{k,i,1}\ FOCCUP \text{ man-rem/yr} \quad (3\text{-}3)$$

where 31.7 = conversion factor (10^{12} pCi/Ci) x (3.17 x 10^{-8} yr/s) x (0.001 rem/mrem)
POP_j = population of segment j (1 to 160), numbers of people
$FAGE_k$ = age group fraction k, dimensionless (see Table 2.4)
$CHIQ_{1,j}$ = dilution factor for population in segment j (1 to 160) not corrected for decay or cloud depletion, s/m^3
K2 = EXP { $LAMDA_i$ ln[$CHIQ_{2,j}$ / $CHIQ_{1,j}$] / LAMDA2 }, decay-only adjustment factor for noble gases and iodines
$CHIQ_{2,j}$ = dilution factor for population in segment j (1 to 160), corrected for decay only, s/m^3
$LAMDA_i$ = radiological decay constant for the ith nuclide, s^{-1}
LAMDA2 = 3.55 x 10^{-6}, noble gas reference decay constant (2.26 days half-life)] [ln(2)/(2.26 x 24 x 60 x 60)], s^{-1}
$DF_{k,i,1}$ = dose rate factor for age group k, nuclide I, and pathway 1 (air submersion), mrem/hr per pCi/m^3
FOCCUP = shielding or occupancy factor x 8766 hr/yr, hr/yr (see Table 2.4).

The dose rate factor $DF_{k,i,1}$ is selected from the applicable population group file (Listings D.1 through D.4). The factor K2 corrects the undecayed dilution factor, $CHIQ_{1,j}$, for decay, as in the NRC code GASPAR (Eckerman et al. 1980).

For the total air-submersion dose rate for all age groups, segments, and noble gases, the individual air submersion doses are summed:

$$\text{Total air submersion dose} = \sum_{k,j,i} HA_{k,j,i} \text{ man-rem/yr} \quad (3\text{-}4)$$

Only noble gases are considered in the air-submersion dose, to be consistent with the NRC GASPAR program.

The dose rate to the total body from submersion in the plume of an individual of age group k, at location j, from nuclide I is given by the following relation:

$$HAMI_{k,j,i} = 31{,}700\ QREL_i\ XQ_{1,j}\ K2\ DF_{k,i,j}\ FSHIELD \text{ mrem/yr} \quad (3\text{-}5)$$

where $XQ_{1,j}$ = dilution factor for individual at location j, as previously defined for equations 3-1 and 3-2, s/m^3
K2 = EXP { $LAMDA_i$ ln[$XQ_{2,j}$ / $XQ_{1,j}$] / LAMDA2 }, decay-only adjustment factor for noble gases and iodines
$XQ_{2,j}$ = dilution factor for individual at location j corrected for decay only, s/m^3
FSHIELD = shielding factor for maximum individual x 8766 hr/yr, hr/yr (see Table 2.5).

Note that for individual doses, the index j denotes the location of the receptor: (1) site boundary, (2) residence, (3) garden, or (4) pasture for milk and meat animals.

Ground Irradiation

The dose commitment from ground irradiation to the population of age group k, living in segment j, from nuclide I deposited on the ground over a one-year period is given by:

$$HG_{k,j,i} = 31.7\ QREL_i\ D1\ DOQ_j\ K4\ FAGE_k\ DF_{k,i,2}\ FOCCUP \text{ man-rem/yr} \quad (3\text{-}6)$$

where D1 = $[1 - \exp(-LAMDA_i\ TB)] / LAMDA_i$, soil-buildup factor, Ci s/Ci, where TB, the period of buildup, is 1 yr (3.156×10^7 s)
DOQ_j = deposition factor for segment j, m^{-2}
K4 = $EXP\{[(LAMDA_i - LAMDA8)/LAMDA2]\ ln[CHIQ_{2,j}/CHIQ_{1,j}]\}$, decay- and depletion-adjustment factor for particles and iodines, dimensionless
LAMDA8 = 1.003×10^{-6} s^{-1}, iodine reference half-life (8-day half-life), [ln(2)/(8 x 24 x 60 x 60)]
$DF_{k,i,2}$ = dose rate commitment factor for age group k, nuclide I, and pathway 2 (ground irradiation), mrem/hr per pCi/m^3.

The factor D1 accounts for the buildup over time TB of radionuclides in the soil and K4 corrects the deposition factor DOQ_j for decay. Here, as in the air submersion model, a half-year shielding/occupancy factor is assumed.

The dose from ground irradiation to an individual of age group k, at location j, from nuclide I, is given by the relation:

$$HGMI_{k,j,I} = 31{,}700\ QREL_i\ D1\ DQ_j\ K4\ DF_{k,i,2}\ FSHIELD \text{ mrem/yr} \quad (3\text{-}7)$$

where Dq_j is the deposition factor for individual location j, in m^{-2}.

Here, locations 3 and 4 are the garden and animal pasture, respectively.

Inhalation

The dose commitment from inhalation over one year of air contaminated with site radioactive airborne emissions to organ o, of the population of age group k, living in segment j, from nuclide I is given by the following relation:

$$HB_{o,k,j,i} = 31.7\ QREL_i\ \Omega_j\ POP_j\ FAGE_k\ RCONS_{k,4}\ DF_{o,k,i,3} \text{ man-rem} \quad (3\text{-}8)$$

where 31.7 = conversion factors (10^{12} pCi/Ci) x (3.168×10^{-8} yr/s) x (0.001 rem/mrem)
$RCONS_{k,4}$ = annual inhalation rate for average individual in age group k, m^3 (see Table 2.4)
$DF_{o,k,i,3}$ = dose commitment factor for organ o, age group k, nuclide I, and pathway 3 (inhalation), mrem/pCi
Ω_j = dilution factor defined for each class of nuclide for segment j, specified below, s/m^3:

H-3 and C-14

$$\Omega_j = CHIQ_{1,J}$$

Noble Gases

$$\Omega_j = CHIQ_{1,J}\ K2$$

Iodines

$$\Omega_j = CHIQ_{1,J}\ K2 + CHIQ_{3,J}\ K4$$

Particles

$$\Omega_j = CHIQ_{3,J}\ K4ta$$

The "K factors" (K2 and K4) previously defined account approximately for the decay and depletion of the various types of materials during the transit time of the plume to the receptor.

The dose commitment from annual inhalation to an organ o, of an individual of age group k, location j, and nuclide I is given by the following relation:

$$HBMI_{o,k,j,i} = 31{,}700\ QREL_i\ \Omega_j\ RCONS_{k,8}\ DF_{o,k,i,3}\ \text{mrem} \tag{3-9}$$

where $RCONS_{k,8}$ = annual inhalation rate for maximum individual in age group k, m^3 (see Table 2.5)
Ω_j = dilution factors similar to those defined for equations 3-8, but using dilution factors, $XQ_{m,j}$ and K factors defined for the individual at location j, s/m^3.

Ingestion

The dose commitment from ingestion over one year of food products contaminated with site radioactive airborne emissions to organ o, of the population of age group k, residing in segment j, from nuclide I, consuming food produced in any part of the 2 to 80 km region is given by the following equation:

$$HI_{o,k,j,i} = 31.7\ QREL_i\ T\ FOODS_k\ POP_j\ DF_{o,k,i,4}\ \text{man-rem} \tag{3-10}$$

where $DF_{o,k,i,4}$ is the dose commitment factor for organ o, age group k, nuclide I, and pathway 4 (ingestion), mrem/pCi.

The term *T* in the ingestion dose equation above represents either the area weighted, average, nondepleted, nondecayed atmospheric dilution factor E3 (for H-3 and C-14):

$$E3 = \sum CHIQ_{1,j}\ (Area_j/A3)\ s/m^3$$

where A3 is the area of the 2- to 80-km region, m^2, or the area weighted average depletion factor K3 (for all else) over the region, that is, $K3 = \sum DOQ_j\ (Area_j/A3)\ 1/m^2$.

The summations are over the 160 segment areas of the 2 to 80 km region.

The factor $FOODS_k$ is dependent on the amount of the three types of food eaten by the four population groups and their respective transfer factors:

$$FOODS_k = [V1\ RCONS'_{k,1} + M1\ RCONS'_{k,2} + B1\ RCONS'_{k,3}]\ FAGE_k\ m^3 \text{ or } m^2s \tag{3-11}$$

where V1, M1, and B1 are defined below and $RCONS'_{k,1..3}$ is the adjusted annual average individual consumption rate of vegetables, milk, and meat, kg or L.

The overall transfer factors are then in units of Ci/kg per Ci/m^3 for tritium and carbon-14, and Ci/kg per Ci/m^2-s for all other radionuclides:

Vegetables
$$V1 = FTRANS_{i,1,2} \tag{3-12}$$

Milk
$$M1 = FPM\ FSM\ FTRANS_{i,2,2} + [(1 - FPM) + FPM\ (1 - FSM)]\ FTRANS_{i,4,2} \tag{3-13}$$

Meat
$$B1 = FPB\ FSB\ FTRANS_{i,3,2} + [(1 - FPB) + FPB\ (1 - FSB)]\ FTRANS_{i,5,2} \tag{3-14}$$

where FPM = fraction of year milk animals are on pasture, dimensionless
FSM = fraction of year milk animals are on stored feed, dimensionless
FPB = fraction of year meat animals are on pasture, dimensionless
FSB = fraction of year meat animals are on stored feed, dimensionless.

The factors for milk and meat are dependent on the fraction of time the animal is left to graze on fresh pasture (F4 for milk cows and F6 for beef cattle) and the fraction of time on fresh pasture when stored feed is given as a supplement (F5 for milk cows and F7 for beef cattle). These factors vary by site, depending on the practices of the area.

The food transfer factors FTRANS are the ratios of activity in a unit mass of food to the deposition rate per unit area of ground, except for tritium and carbon-14 which are in units of Ci/kg per Ci/m^3. Derivations of the food transfer factors for the three food paths and the two types of animal fodder and values of parameters are given in Section 3.1.4.

To account for a reduction of the dose due to the "dilution" of the contaminated food produced in the region by uncontaminated food grown outside the region (in the case where the regional production is less than consumption), a correction was applied to the age-dependent annual consumption rates, $RCONS_{k,1...3}$:

Vegetables $$RCONS'_{k,1} = RCONS_{k,1} (RPROD_1/Z_1) V2 \text{ kg} \quad (3\text{-}15)$$

Milk $$RCONS'_{k,2} = RCONS_{k,2} (RPROD_2/Z^2) M1 \text{ L} \quad (3\text{-}16)$$

Meat $$RCONS'_{k,3} = RCONS_{k,3} (RPROD_3/Z_3) B1 \text{ kg} \quad (3\text{-}17)$$

where $RCONS_{k,1..3}$ = annual consumption rates for population group k for vegetables, milk and meat, kg/yr or L
$RPROD_{1...3}$ = annual production rates for vegetables, milk, and meat for the state in which the site is located, kg or L
$Z_{1...3}$ = population age-group weighted consumption rates for vegetables (Z), milk (Z_2), and meat (Z_3) where

$$Z_x = Z_1 \, P2 \, (RCONS_{1,1} \, FAGE_1 + RCONS_{2,1} \, FAGE_2 + RCONS_{3,1} \, FAGE_3 + RCONS_{4,1} \, FAGE_4), \text{ in kg} \quad (3\text{-}18)$$

and P2 is the total current population of the 2 to 80-km region around the site.

The dose commitment to the organ (o) of an individual of age group (k), at location (j), and nuclide (i), from consuming leafy vegetables, other produce, milk, and meat is given by the following relation:

$$HI_{o,k,j,l} = 31{,}700 \; QREL_i \; T \; (LVEG + PROD + MILK + MEAT) \; DF_{o,k,i,4} \text{ mrem} \quad (3\text{-}19)$$

where T is the dilution factor $XQ_{1,j}$ (for H-3 and C-14) or the adjusted deposition factor K4 DQ_j (for all other nuclides) for an individual at location j (s/m^3 and 1/m^2, respectively) and where the activity uptake per unit deposition flux or air concentration in Ci per Ci/m^2-s or Ci per Ci/m^3 is given by:

$$LVEG = FTRANS_{i,1,1} \; RCONS_{k,5} \quad (3\text{-}20)$$

$$PROD = FGARDEN \; FTRANS_{i,6,1} \; RCONS_{k,9} \quad (3\text{-}21)$$

$$MILK = RCONS_{k,6} \; \{FPM \; FSM \; FTRANS_{i,2,2} + [(1 - FPM) + FPM \; (1 - FSM)] \; FTRANS_{i,4,2}\} \quad (3\text{-}22)$$

$$MEAT = RCONS_{k,7} \; \{FPB \; FSB \; FTRANS_{i,3,2} + [(1 - FPB) + FPB \; (1 - FSB)] \; FTRANS_{i,5,2}\} \quad (3\text{-}23)$$

where FGARDEN is the garden produce fraction ingested, dimensionless (see Table 2.5).

3.1.1.2 Program Description

After initialization and assignment of dimensions and constants, run information is supplied to the program through the setup file, CPRD.SET, which must be in the current subdirectory. Then, the data from various input files are read into memory. The reduction in consumption is made if it is found to be greater than production to account for the need to ship in uncontaminated foods. Dose commitments are then calculated for each age group k, segment j, and radionuclide i. The doses are then summed. An output report SUMyySnn.OUx is generated as a random file containing selected input values, input file headers, and summarized dose commitments for each release mode. In addition, a file, AIRyySnn.OUx, of adult doses by nuclide and organ is generated for each release mode. A listing of the program is included as Listing A.1 in Appendix A.

3.1.1.3 Run Instructions

Prior to running CPRDA, the file CPRD.SET (Listing D.9) must be created or updated and copied to the same directory as CPRDA. The program is run interactively at the terminal by entering the command CPRDA at the system level with site number and release mode. More generally, the batch files RUNCPRD or RUNCPRDA are used (see Appendix C). For example, to calculate airborne doses for site 12 for a ground release, enter:

CPRDA 12 G

or from the batch file,

RUNCPRDA 12 G

After a few seconds, the header is displayed on the screen, giving the last date of revision. If the site has not been entered on the command line, it is requested.

The program now will run to completion as it displays its progress on the screen. The usual run time is a minute or so. No use of a printer will be required unless the supplemental debugging printout option described below is selected. The output files SUMyySnn.OUx and AIRyySnn.OUx may be printed out using the program CPRDPRNT.

3.1.1.4 QA Checking

A supplemental printout which is optional for debugging purposes and checking various input, intermediate, and result parameters may be turned on if desired. To select the optional printout, enter the nuclide number and sector number after the release mode. Thus, for the example given above, the detailed results for I-131 at the sector 160 (60 to 80 km NNW) would be:

CPRDA 12 G 56 160

3.1.1.5 Notes

During the program run, a POP file search is made for files with the year up to 99. The search routine does not support files with years greater than 1999. The search was included in the program so that POP files with various years could be read into the program.

For the maximum individual, only noble gases are included in the direct radiation from the plume to the total body at residence. Organ doses are all adult except for the thyroid, which is for an infant.

The total food production for the region within 80 km around each site was the product of the NRC state-wide productivity figure for each state and a site productivity factor. At some sites, this total production may be more or less than the total consumption, i.e., population times average individual consumption (see Table A-1 for generic consumption rates). When production was more than consumption for a site, it was assumed that all persons in the 2 to 80 km region ate contaminated food; when production was less than consumption, it was assumed that dilution would occur because uncontaminated food would be shipped into the area from outside. Thus, the calculated doses for a particular food type were reduced in proportion to the ratio of production divided by consumption, i.e., production/consumption is less than 1 (see equations 3-15 through 3-18).

The dose to persons outside the 80-km limit from food shipped out of the region, in the case of production being greater than consumption, is not included in the reports because we are concerned only with the dose within the 80-km radius.

3.1.2 CPRDL - Liquid Pathway

This program is used to estimate collective and individual dose commitments derived from releases of radionuclides into cooling water of the reactor and transferred to the regional population through the ingestion of drinking water and aquatic organisms.

3.1.2.1 Models

The models used in the CPRDL program are taken from NRC Regulatory Guide 1.109. The equations for the models for concentrations, drinking water, and aquatic foods are given below.

Concentration

The concentrations of activity in the reactor effluent are given by:

$$CONC_i = QREL_i \; RECIRC_i/FLOWPIPE \; Ci/L \qquad (3\text{-}24)$$

where $QREL_i$ = release rate of radionuclide i in liquid effluent, Ci/yr - This is the annual release reported by the licensee.
$RECIRC_i$ = recirculation factor for nuclide i, dimensionless
FLOWPIPE = plant dilution flow rate, L/yr - This is the total dilution water used during the year as reported by the licensee.

Drinking Water Ingestion

The population dose commitment from drinking water over 1 year contaminated with site waterborne effluents to the organ o, of age group k, from radionuclide i is given by the following relation:

$$HW_{o,k,i} = 10^9 \; CONC_i \; M1 \; P4 \; FAGE_k \; RCONS_{k,1} \; DF_{o,k,i,4} \; EXP(-LAMDA_i \; TdwPOP) \; man\text{-}rem \qquad (3\text{-}25)$$

where 10^9 = conversion factor, (10^{12} pCi/Ci) x (0.001 rem/mrem)
P4 = population ingesting drinking water effected by plant effluent, persons
$RCONS_{k,1}$ = annual drinking water consumption for average individual of age group k, L (see Table 2.4)
M1 = mixing ratio of plant effluent in water body at location of withdrawal, dimensionless
TdwPOP = holdup time for drinking water for population, day converted to s (see Table 2.6).

The dose commitment to an individual of age group k annually ingesting drinking water containing nuclide i is given by the relation:

$$HWMI_{o,k,i} = 10^{12}\ CONC_i\ M1MI\ RCONS_{k,6}\ DF_{o,k,i,4}\ EXP(-LAMDA_i\ TdwMI)\ mrem \quad (3\text{-}26)$$

where 10^{12} = conversion factor, 10^{12} pCi/Ci
M1MI = mixing ratio of plant effluent in water body at point of withdrawal, dimensionless
$RCONS_{k,6}$ = annual drinking water consumption for maximum individual of age group k, L (see Table 2.5)
TdwMI = holdup time for drinking water for individual, day converted to s (see Table 2.6).

Aquatic Foods

The population dose commitment from ingesting aquatic foods over one year contaminated with site waterborne effluents to the organ o, of age group k, from nuclide i is given below for fish and invertebrates.

Fish

$$Hf_{o,k,i} = CONC_i\ M2\ BIOFAC_{s,i,1}\ P2\ FAGE_k\ RCONS_{k,p}\ DF_{o,k,i,4}\ FEXPOSR\ EXP(-LAMDA_i\ T1POP)\ man\text{-}rem \quad (3\text{-}27)$$

Invertebrates

$$HV_{o,k,i} = CONC_i\ M3\ BIOFAC_{s,i,2}\ P2\ FAGE_k\ RCONS_{k,p}\ DF_{o,k,i,4}\ FEXPOSR\ EXP(-LAMDA_i\ T1POP)\ man\text{-}rem \quad (3\text{-}28)$$

where M2 and M3 = mixing ratios for fish and invertebrates respectively, dimensionless (Listing D.8)
$BIOFAC_{s,i,m}$ = bioaccumulation factors for fish (m=1) and invertebrates (m=2), for water type fresh (s=1) or salt (s=2), and nuclide i, L/kg (Listing D.6)
P2 = total population residing in the 2 to 80 km region around the site, persons
$RCONS_{k,p}$ = annual consumptions for average individual of age group k for fish (p=1) and invertebrates (p=2) derived from harvest when possible, kg (see Table 2.4)
FEXPOSR = fraction of year population exposed to aquatic food, dimensionless
T1POP = holdup time for fish and invertebrates for population, day converted to s (see Table 2.6).

The dose commitment to the organ o, age group k, to a maximum individual annually consuming aquatic foods is given by the following relations for fish and invertebrates:

Fish

$$HFMI_{o,k,i} = CONC_i\ M2MI\ BIOFAC_{s,i,1}\ RCONS_{k,p}\ DF_{o,k,i,4}\ EXP(-LAMDA_i\ T1MI)\ mrem \quad (3\text{-}29)$$

Invertebrates

$$HVMI_{o,k,i} = CONC_i\ M3MI\ BIOFAC_{s,i,2}\ RCONS_{k,p}\ DF_{o,k,i,4}\ EXP(-LAMDA_i\ T1MI)\ mrem \quad (3\text{-}30)$$

where M2MI and M3MI = mixing ratios for fish and invertebrates, respectively, at location of individual, dimensionless (Listing D.11)
T1MI = holdup time for fish and invertebrates for individual, day converted to s (see Table 2.6).

The total-body irradiation dose rate from shoreline activities to the adult individual from nuclide i is given by the following expression:

$$HSLMI_i = CONC_i \; M4MI \; FSOLD \; BUILDUP_i \; RCONS_{4,11} \; FSHORE \; DF_{i,6} \text{ mrem/yr} \quad (3\text{-}31)$$

where M4MI = mixing ratio for shoreline waters, dimensionless
FSOLD = shoreline deposition flux, Ci/m^2-s per Ci/L = 693 L/m^2-day/86400 s/day
$BUILDUP_i$ = shoreline buildup factor for nuclide i, [1 - exp(-$LAMDA_i$ T)]/$LAMDA_i$, s, where T, the buildup time, is 1 yr (3.156 x 10^7 s)
$RCONS_{4,11}$ = shoreline usage, hr/yr (see Table 2.5)
FSHORE = shoreline geometry factor, dimensionless (see Table 2.8)
$DF_{i,6}$ = adult dose rate factor for ground plane irradiation, mrem/hr per pCi/m^2 (see Listing D.1).

3.1.2.2 Program Description

After initialization and assignment of dimensions and constants, run information is supplied to the program through the setup file, CPRD.SET, which must be in the current subdirectory. Then, the data from various input files are read into memory. The program proceeds to calculate the dose commitments for the four age groups in succession for each organ, path, and nuclide. For the adult population group, an optional file of dose for each path, organ, and nuclide may be generated as a random file. The doses are finally summed and written to the standard output file SUMyySnn.OUx, along with input file headers and selected input values for run documentation. In addition, the file LIQyySnn.OUT of adult doses by nuclide, organ, for drinking water and aquatic foods is generated. A listing of the program appears as Listing A.2 in Appendix A.

Aquatic food consumption rates for populations be entered into the program in three ways depending on the type of consumption assumed for the particular site:

- generic average individual - as given in Table 2.4
- individual - as given in the ES or ODCM for the site
- total catch - as given in the ES or ODCM for the site.

The program checks to see what was entered for this consumption from the SSD.DAT file, field numbers 9 and 11 (see Section 2.2.5). The word "GENERIC" in these fields causes the program to select the generic consumption rate, as given in Table 2.4. A number is assumed to be an individual rate or a fish-catch rate. If the value is less than 100 kg/yr, it is assumed to be an individual rate; a value 100 kg/yr or greater is assumed to be the annual edible fish catch for the region of concern. This fish-catch value is converted to an individual rate by the program by dividing by the population of the region.

However, the program does one more check to see if the individual rate as found in the ES or as derived from the fish catch is greater than the age-weighted generic rate. If it is, then the generic rates (Table 2.4) are used in place of the ES values. The justification for reducing a consumption rate as found in an ES is that the generic values used are considered conservative (much higher than typical), so any greater values would be unrealistic.

3.1.2.3 Run Instructions

Prior to running CPRDL, the file CPRD.SET (Listing D.9) should be generated or updated and copied to the same directory as CPRDL.

The program is run interactively at the terminal by entering the command CPRDL at the system level with the option of entering the site number on the command line or more generally from a batch file. For example, to calculate airborne doses for site 12, enter:

CPRDL 12

or from a batch file

RUNCPRDL 12

The program will run to completion as it displays its progress on the terminal screen. The usual run time is less than a minute. As with the airborne path program, no use of the printer will be required. The output file SUMyySnn.OUx, which also holds the results of the CPRDA run, may be printed out using the utility program CPRDOUT. CPRDA should be run before CPRDL so that the SUMyySnn.OUx file for the air release mode will be created. When CPRDL is run, it searches for a SUMyySnn.OUx file. If the file is not found, it creates one for the ground release case by default. If there is no ground release, an extra SUMyySnn.OUx file will be made.

A file LIQyySnn.OUT containing dose commitments by nuclide and pathway-organ will also be generated. This file may be printed using the program CPRDPRNT, discussed in Section 3.2.4.

3.1.2.4 QA Checking

A supplemental printout, which is optional for debugging purposes and checking various input, intermediate, and result parameters, may be turned on if desired. To select the optional printout, enter the nuclide number and sector number after the release mode. Thus, for the example given above, the detailed results for I-131 would be:

CPRDL 12 56

3.1.2.5 Notes

The radionuclide concentration in the drinking water consumed by a population downstream from a site is usually estimated by assuming 100% mixing of the plant effluent with the river. For lakes, an overall dilution factor was estimated from dilution factors given in the licensee ES or ODCM for each population center along the shore (within 80 km) that consumes the contaminated lake water. These individual factors are weighted by population and averaged to obtain an effective dilution factor for the total population exposed to contaminated drinking water. For individual doses, the mixing ratio (reciprocal of the dilution factor) taken from the ODCM is used.

Wherever possible, the fish-catch data from the licensee ES or ODCM are used to estimate aquatic food consumption rates for the population living within the region. When these data are not found in the ES or ODCM, the generic values of Table 2.4 are used. For the individual Appendix I dose estimates, the generic values of Table 2.5 are used for all sites.

For population dose estimates, the average radionuclide concentration of the waters in which this food was harvested is estimated by assuming an additional dilution over the effluent flow from the reactor. For rivers, it was assumed that the fish were caught in waters in which the plant effluent is completely diluted. For lakes, an additional factor as given if the ES is used; when none is given in the ES or ODCM, a generic value of 0.01 is used. For ocean and bay sites, generic values of 0.001 and 0.002 are used for fish and invertebrates, respectively, if the ES or ODCM yielded no values for these parameters.

For individual dose estimates, the mixing ratio designated by the licensee ODCM for the site is used to determine typical water concentrations for the fish and shellfish (invertebrate) pathway.

Only a few sites reported the irrigation pathway. This pathway is evaluated for the individual only. The assumptions of NRC (1977a) were used. Site-specific values for irrigation rate, mixing ratio and growing period are taken from the licensee ODCM when available. A modified version of CPRDL is used to estimate these doses.

The shoreline recreation pathway dose is not estimated for populations because it is trivial compared with the drinking water and aquatic food pathways. However, for individual dose estimates, the shoreline path was included, even though it is not usually reported for many sites by the licensees. The mixing ratio for this path is assumed to be the same as for fish when no licensee value is reported. Occupancy factors used for this path are listed in Table 2.5.

3.1.3 AIRGAMMA - Tall Stack doses

This program is used to calculate gamma and total-body external irradiation doses from plumes emitted from tall stacks when the release mode is elevated. The beta dose is also calculated using the semi-infinite plume model. A listing of AIRGAMMA.BAS appears as Listing A.3 in Appendix A.

In addition, for comparison purposes, the program calculates the semi-infinite cloud (short stack) gamma, total-body, and skin doses. The atmospheric dispersion factors are calculated from site joint frequency data (JFD) and release parameters similar to the NRC program XOQDOQ.

3.1.3.1 Models

Finite Plume Models

AIRGAMMA calculates the noble gas air-gamma and total-body air-submersion dose from tall stacks (> 80 m) using the finite cloud model.

Gamma Dose

The air gamma dose from tall stacks is estimated using the finite cloud model given as formula (6) of Regulatory Guide 1.109-4. Either one of two dose integral (DINT) routines (Eckerman's or Hamawi's), documented in Appendix F of that Regulatory Guide, may be used. The routines give essentially the same results (the Hamawi routine yields results about 7% to 10% greater), so the Hamawi routine is normally used, since it is much faster.

The dose rate to air at a distance X and direction j from a release of radionuclide i, of energy group k, at a level H is given by the following expression:

$$DGAMELEV_{k,i} = \frac{260}{\theta\ X} \sum_{n,s} (F_{elev,j,n,s}/U_{elev,n,s})\ MUA_k\ I(ZPLUME, SIQZ_{S,X}, GMU_k, MUA_k)\ Q_{i,n,s}\ EA_{k,i}\ \text{mrad/yr} \qquad (3\text{-}32)$$

where 260 = conversion factor, 260 mrad radian m^3 dis/(Mev Ci s) (see Regulatory Guide 1.109-4)
θ = sector angle constant at $2\pi/16$ radian
X = distance to receptor, m
$F_{elev,j,n,s}$ = frequency of occurrence for an elevated release of stability category s, wind-speed class n, and direction j, dimensionless
$U_{elev,n,s}$ = mean-wind speed of class n corrected for sensor level for stability category s, m/s
MUA_k = linear energy absorption coefficient for kth energy group, 1/m (see Table 2.7)
$I(ZPLUME,SIGZ_{s,x},GMU_k,MUA_K)$ = numerical integration function as described in Appendix F of Regulatory Guide 1.109, where ZPLUME is the release height H, corrected for plume rise in m; $SIGZ_{s,x}$ is the vertical plume standard deviation in m for stability s, and distance x in m; GMU_k is the linear (mass) attenuation coefficient in 1/m; and MUA_k is the linear energy absorption coefficient in 1/m - See Table 2.7.
$Q_{i,n,s}$ = decay-corrected release rate of radionuclide i, for stability category s, and wind-speed class n, Ci/yr
$EA_{k,i}$ = gamma energy x abundance for energy group k, and nuclide i, MeV/dis (see Listing D.5 in Appendix D).

The dose rate to air at a distance X from a release of radionuclide i, and energy group i, at a ground level (H=0), $DGAMGND_{k,i}$, is given by an expression the same as above, but with Felev,j,n,s / Uelev,n,s replaced with Fgnd,j,n,s / $U_{gnd,n,s}$ for the frequency of occurrence of a ground release divided by the sensor level corrected wind speed.

The total dose rate is made up of both ground-level releases and elevated releases, depending on the selection of elevated, ground, or mixed mode. For a pure ground release, Felev would be zero, and for a pure elevated release, Fgnd would be zero. Thus, for tall stacks (> 80 m) the ground component would be zero.

The total gamma dose is made up of dose rates from both ground-level and elevated releases as defined in Equation 3-33:

$$DGAMMA = \sum_{k,i} DGAMELEV_{k,i} + DGAMGND_{k,i} \text{ mrad/yr} \quad (3\text{-}33)$$

Total Body Dose

The dose rate to the total body of an individual at a distance X and direction j from a release of radionuclide i, and energy group k, at a release height H is given by the expression:

$$DTBody = 1.11\ FShield \sum_{k,i} (DGAMELEV_{k,i} + DGAMGND_{k,i}) \exp(-MUA_k\ DENSDEPTH/DENSAIR/CMperM) \text{ mrem/yr} \quad (3\text{-}34)$$

where 1.11 = average ratio of tissue to air energy absorption coefficient, dimensionless
Fshield = shielding factor, dimensionless (see Table 2.5)
DENSDEPTH = 1 g/cm^3 tissue density x 5 cm depth, g/cm^2 (see Regulatory Guide 1.109-20)
DENSAIR = air density 0.00129 g/cm^3
CMperM = conversion factor, 100 cm/m.

Skin Dose

Although not included in the annual reports at present, the skin dose rate is included in the program. The dose to the skin of an individual at a distance X and direction j from a release of radionuclide i, and energy group k, at a level H is given by the expression:

$$DSkin = 1.11\ FShield \sum_{k,i} (DGAMELEV_{k,i} + DGAMGND_{k,i}) + 31{,}700\ Q_{i,n,s}\ CHIQ_{j,x}\ DFBETSKIN_i \text{ mrem/yr} \quad (3\text{-}35)$$

where 31,700 = conversion factor, (10^{12} pCi/Ci) x (3.17×10^{-8} yr/s)
$CHIQ_{j,x}$ = atmospheric dispersion factor for direction j and direction x, s/m^3
$DFBETSKIN_i$ = skin dose factor for nuclide i, mrad/yr per pCi/m^3 (see Listing D.5).

The dispersion factor averaged over a sector j at distance x from an elevated release point is given as

$$CHIQ_{j,x} = \frac{0.7979\ FOT_x}{X\ \theta\ SIGZ_{s,x}} \sum_{n,s} FREK_{n,s,j}\ EXP(-0.5\ ZPLUME^2/SIGZ_{s,x}^2)/U_{elev,n,s} \text{ s/m}^3 \quad (3\text{-}36)$$

where 0.7979 = conversion factor, $\sqrt{2/\pi}$
FOT_x = open terrain factor for increasing CHIQ due to recirculation effects, as described in XOQDOQ, p. A.43
$FREK_{n,s,j}$ = annual frequency of occurrence in direction j, stability category s, and wind speed class n, dimensionless

ZPLUME = release height, H, corrected for plume rise in m, as described in XOQDOQ, pp. 34-36 and A.41
$SIGZ_{s,x}$ = vertical plume standard deviation for stability s and distance x, m.

For a ground release, a wake correction factor is used so that the above relation becomes:

$$CHIQ_{j,x} = \frac{0.7979 \ FOT_x}{X \ \theta \ FWake} \sum_{n,s} FREK_{n,s,j} / U_{n,s} \ s/m^3 \quad (3\text{-}37)$$

where FWake is the wake correction for ground release, m, that is the minimum of either the relation $\sqrt{3 \ SIGZ_{s,x}}$ or $\sqrt{SIGZ_{s,x}^2 + HBLD^2/2\Pi}$, where HBLD is the height of building near a release point that is the cause of wake effects.

Semi-Infinite Cloud Models

The doses from short stacks ($\sim$ < 80 m) are derived using the semi-infinite plume model and dose factors given in Regulatory Guide 1.109. See Listing D.5 for dose factors.

Let the air concentration of nuclide i, in direction j, at distance x be given by the following relation:

$$CHI_{i,j,x} = 31{,}700 \ Q_i \ CHIQ_{j,x} \ pCi/m^3 \quad (3\text{-}38)$$

where Q_i is the release rate (not decay corrected) of radionuclide i, Ci/yr.

The air gamma, beta, total body, and skin dose rates to an individual at a distance x and direction j from the release point are given by the following relations.

Air Gamma and Beta Dose

$$DGAMMA_{j,x} = \sum_i CHI_{i,j,x} \ DFGAMAIR_i \ mrad/yr \quad (3\text{-}39)$$

where $DFGAMAIR_i$ is the air gamma dose-rate factor for nuclide i, in mrad/yr per pCi/m^3. The relation for the beta dose, DBETA, is the same except the dose factor is $DFBETAIR_i$.

Total Body Dose

$$DTBody_{j,x} = FShield \sum_i CHI_{i,j,x} \ DFBODY_i \ mrem/yr \quad (3\text{-}40)$$

where $DFBODY_i$ is the total body dose factor for nuclide i, in mrem/yr per pCi/m^3.

Skin Dose

$$DSkin_{j,x} = \sum_i CHI_{i,j,x} \ (1.11 \ FShield \ DFGAMAIR_i + DFBETAIR_i \ mrem/yr \quad (3\text{-}41)$$

where $DFBETAIR_i$ is the air beta dose factor for nuclide i, in mrad/yr per pCi/m^3.

3.1.3.2 Program Description

After initialization and assignment of constants and array dimensions, run information is supplied to the program by command line and setup file, CPRD.SET, which must be in the current subdirectory. The data from the various input files (gamma energy file, release file, generic file, and JFD file) are read into memory.

The frequency factors, $FREQ_{n,s,j}$ are calculated for each direction, stability category, and wind speed class. Then, the various doses and dispersion factor $CHIQ_{j,x}$ are calculated and the results for a specified direction and distance are sent to the printer.

3.1.3.3 Run Instructions

The program must be run after the program CPRDA because it cannot create the SUM file. AIRGAMMA searches for a SUM file and, if found, writes the results of the finite dose-rate calculations to it.

The command line consists of input of the site number, the distance to the location of interest in meters, the direction, and the release type list of the CPRD REL file for both Site Boundary and RESident. The release type should be E or M. If none given, E is the default. For example, for an elevated release to a maximal Site Boundary location at Dresden:

```
>AG 04 SB 1100 SE E
```

The program outputs the file plume-gamma and total-body dose rates to record 91 of the SUMyySnn.OUx file if one exists for the release mode selected. Thus, CPRDA must be run prior to the AIRGAMMA program.

Results of the run are printed on a single page along with command line used, headers of input files, releases, and release input parameters. Format is set up for a 125 cpi line width, which may be printed in line printer font on a HP LaserJet II or 4. See Listing E-5 for an example of the printout.

3.1.3.4 QA Checking

The JFD percents, wind speeds adjusted for release height for both ground and elevated may be printed out for stability categories and wind speed classes. Also, the average harmonic-mean speed and X/Q for ground elevated and combined for mixed mode may be printed by a call to the GOSUB QAPRINT1.

A list of parameters making up the dose integral calculation may be printed with a call to the GOSUB QAPRINT2. This is used to check the value of the dose integral, DI, for each energy group and compare with standard values, such as Figure 7.23 for 0.7-MeV gammas in *Meteorology and Atomic Energy-1968* (Slade 1968).

Results have been compared to RABFIN (X/Q and doses). All XOQ's and doses were within 4% of this program when the 1.2 finite purge factor is accounted for in the RABFIN example.

3.1.3.5 Notes

Analysis of the dispersion coefficient is similar to XOQDOQ except for the decay constant of each nuclide used in calculating the decay in transit for the semi-infinite dose calculations.

Purge releases are not supported. All releases are assumed over 1 year and released into 22.5-degree sectors. No sigma y parameters are used.

Mixed (Split-H) mode releases are supported. Entrainment coefficients are calculated.

Depletion is not used, since all releases are noble gases.

Any release under 1 meter is considered a ground release; only short stack results are valid.

The sensor level is corrected to stack height for releases > 1 m and corrected to 10 m for releases < 1 m (ground).

Wake correction is only for ground releases (height < 1 m); the analysis uses building height.

There is no plume rise when the stack internal diameter is set to zero. Downwash occurs when the velocity is set to zero and I.D. > zero.

The dispersion coefficient (X/Q) shown in the printout is not corrected for decay; however, decay is included in the doses.

The open terrain correction factor is supported as in XOQDOQ.

3.1.4 Food Transfer Factors

The food transfer factors $FTRANS_{i,j,m}$ are the rates of activity per unit mass of food divided by the deposition rate per unit ground area. The factors include the holdups between harvest (or slaughter) and consumption by average individuals for the population dose and maximum individuals for the individual Appendix I dose. The subscripts denote the nuclide (i) and food type (j), and whether for individual (m=1) or population (m=2). These factors are used in the program CPRDA and are calculated in the subroutine TERFOOD.

The food transfer factors for vegetables (leafy vegetables and produce for maximum individual doses) and animal fodder (stored feed and pasture grass) are derived from parameters given in NRC Regulatory Guide 1.109 (NRC 1977a). These factors are in units of Ci/kg per Ci/m^3 for tritium and carbon-14, and Ci/kg per Ci/m^2-s for all other nuclides. Table 3.1 lists the various factors used in the following equations.

Tritium

The non-decayed food transfer factor for tritium is derived from equation C-9 in Appendix C of Regulatory Guide 1.109 by letting the quantity Q(X/Q) be the atmospheric tritium concentration in Ci/m^3. Then, the plant concentration divided by this factor is as follows:

$$FVEG_{H\text{-}3} = FWATER\ \ FPLANT/HUMID \text{ Ci/kg per Ci/m}^3 \qquad (3\text{-}42)$$

where FWATER = fraction of plant mass that is water (fresh)
FPLANT = fraction of atmospheric tritium that is transferred to plant
HUMID = absolute humidity of air, kg/m^3.

For calculating the dose derived from eating irrigated foods, $FVEG_{H\text{-}3}$ (Ci/kg per Ci/L) is assumed to be unity. In other words, the tritium concentration in the foods is the same as that of the water.

Carbon-14

Although doses from carbon-14 are not required for the annual site assessments, the non-decayed food transfer factor is given here anyway for possible future use. The food transfer factor for carbon-14 is derived in a similar way as that for tritium. Equation C-8 of Appendix C of Regulatory Guide 1.109 gives the relationship for the plant concentration of C-14. Making similar changes in the equation, we see that the plant concentration per unit air concentration is as follows:

$$FVEG_{C\text{-}14} = FCARBON/CONCARB \text{ Ci/kg per Ci/m}^3 \quad (3\text{-}43)$$

where FCARBON = fraction of carbon in wet mass of plant
CONCARB = atmospheric carbon concentration, kg/m^3, or for irrigation water, kg/L.

The fractional equilibrium ratio, p, in Regulatory Guide 1.109 is set to unity, because any annual releases of C-14 are assumed to be continuous.

All Else

The non-decayed food transfer factors for the other radionuclides (i) are derived from the relationship given as equation C-5 in Appendix C of Regulatory Guide 1.109:

$$FVEG_i = \frac{f_r[1-\exp(-\gamma_{Ei}t_e)]}{Y_v\gamma_{Ei}} + \frac{B_{iv}[1-\exp(-\gamma_i t_b)]}{P\gamma_i} \text{ Ci/kg per Ci/m}^2\text{-s} \quad (3\text{-}44)$$

where f_r = interception fraction, i.e., the fraction of deposited activity intercepted and retained by edible portion of crop (dimensionless)
t_e = time period of above-ground crop exposure to contamination during the growing season, s
Y_v = standing crop biomass of crop at harvest, kg/m^2
B_{iv} = concentration ratio for the transfer of the element to the edible portion of a crop from dry soil, Bq/kg plant per Bq/kg soil (see Listing D.6 in Appendix D)
λ_i = effective decay constant for radionuclide i, to account for removal of radionuclide from soil, s^{-1}
λ_{Ei} = effective rate constant (s^{-1}) for removal of the radionuclide deposited on vegetation (s^{-1}), where $\lambda_{Ei} = \lambda_i + 0.693/t_w$, where t_w is the weathering half-time, s
t_b = period of long-term deposition and buildup in soil, s
P = areal density for the effective root zone in soil, kg/m^2 dry mass.

Equation 3-44 represents a concentration in the plant per unit flux to the ground of a radionuclide i. The first term on the right accounts for the buildup of radionuclides on the leaves and stems of the vegetation. The second term describes the buildup of radionuclides in the soil and transfer to the plant through its root system. The units are different than those for the tritium and C-14 factors because of the different air transport factors used. Tritium and C-14 plant concentrations are dependent on the air concentrations directly via the dispersion factor with units of s/m^2, whereas all other nuclides are dependent on air concentration via the deposition factor with units of m^{-2}.

Equations $FPAST_i$ and $FFEED_i$ for the concentrations in pasture grass and stored feed for animal consumption are the same as for equation H-3, except for t_e, t_b, Y_v, and B_{iv} parameters.

For estimating the concentration of radionuclides in vegetables and other plant produce at the time of consumption, the food transfer factor, $FTRANS_{i,j,m}$ is the product of the non-decayed factor and the exponential decay term to account for holdup:

Leafy vegetables for maximum individual

$$FTRANS_{i,1,1} = FVEG_i \exp(-\lambda_i t_{hv}) \text{ Ci/kg per Ci/m}^2\text{-s or Ci/kg per Ci/m}^3 \quad (3\text{-}45)$$

Garden produce (other vegetables) for maximum individual

$$FTRANS_{i,6,1} = FVEG_i \exp(-\lambda_i t_{hv}) \text{ Ci/kg per Ci/m}^2\text{-s or Ci/kg per Ci/m}^3 \quad (3\text{-}46)$$

Vegetables for population

$$FTRANS_{i,1,2} = FVEG_i \exp(-\lambda_i t_{hv}) \text{ Ci/kg per Ci/m}^2\text{-s or Ci/kg per Ci/m}^3 \quad (3\text{-}47)$$

where t_{hv} is the vegetable holdup time for either maximum individual or population, s.

Animal Products

Transfer factors from air to animal-product concentrations are calculated using equations 3-42, 3-43, or 3-44 to obtain the concentrations in pasture grass and stored feed (grain); they are then multiplied by the plant-to-animal factor, F_{ai}, and an exponential holdup decay factor to obtain the concentration of radionuclide in the animal product (milk or meat) at the time of consumption. The subscript m of the FTRANS factors below is 1 for the maximum individual and 2 for the population.

Concentration in animal product via pasture grass

Milk
$$FTRANS_{i,2,m} = FPAST_i \; F_{mi} \; Q \; \exp(-\lambda_i t_{hp}) \text{ Ci/kg per Ci/m}^2\text{-s or Ci/kg per Ci/m}^3 \quad (3\text{-}48)$$

Meat
$$FTRANS_{i,3,m} = FFEED_i \; F_{fi} \; Q \; \exp(-\lambda_i t_{hp}) \text{ Ci/kg per Ci/m}^2\text{-s or Ci/kg per Ci/m}^3 \quad (3\text{-}49)$$

and via stored feed

Milk
$$FTRANS_{i,4,m} = FPAST_i \; F_{mi} \; Q \; \exp(-\lambda_i t_{hg}) \text{ Ci/kg per Ci/m}^2\text{-s or Ci/kg per Ci/m}^3 \quad (3\text{-}50)$$

Meat
$$FTRANS_{i,5,m} = FFEED_i \; F_{fi} \; Q \; \exp(-\lambda_i t_{hg}) \text{ Ci/kg per Ci/m}^2\text{-s or Ci/kg per Ci/m}^3 \quad (3\text{-}51)$$

where t_{hp} = pasture holdup times, s
t_{hg} = grain holdup times, s
Q = feed or forage consumption rate of animal, kg/d
F_{mi} & F_{fi} = transfer coefficient of radionuclide i from daily intake of animal to milk or meat, pCi/L (milk) per pCi/d, or pCi/kg (meat) per pCi/d (Values for these factors are found in file GENERIC.DAT in Listing D.6 of Appendix D. For factors for goat milk, see Table 3.1.)

Table 3.1 Food transfer factor parameters[a]

HTW = 14 * SperD	Weathering Half-time, s	1.109-69
LW = LN2 / HTW	Weathering decay factor, 1/s	
TGV = 60 * SperD	Growing time for veg., s	1.109-68
TGMP = 30 * SperD	Growing time for milk-pasture, s	1.109-68
TGFP = 30 * SperD	Growing time for meat-pasture, s	1.109-68
TGMF = 90 * SperD	Growing time for milk-feed, s	BNWL-2209
TGFF = 90 * SperD	Growing time for meat-feed, s	BNWL-2209
Maximum Individual		
THV(1) = 1 * SperD	Holdup time for leafy veg., s	1.109-69
THP(1) = 60 * SperD	Holdup time for produce, s	1.109-69, GASPAR p. 2.24
THMP(1) = 2 * SperD	Holdup time for milk-human, s	1.109-68
THFP(1) = 20 * SperD	Holdup time for meat-human, s	1.109-69
THF(1) = 90 * SperD	Holdup time for feed-animal, s	1.109-69
Population		
THV(2) = 14 * SperD	Holdup time for all veg., s	1.109-69, GASPAR p. 2.24
THMP(2) = 4 * SperD	Holdup time for milk-human, s	1.109-68
THFP(2) = 20 * SperD	Holdup time for meat-human, s	1.109-69
THF(2) = 90 * SperD	Holdup time for feed-animal, s	1.109-69
YV = 2	Yield for veg. kg/m2 wet	1.109-69
YMP = .7	Yield for milk-pasture, kg/m2 wet	1.109-69
YFP = .7	Yield for meat-pasture, kg/m2 wet	1.109-69
YMF = 2	Yield for milk-feed, kg/m2 wet	1.109-58, Rev 0; GASPAR p. 2.24
YFF = 2	Yield for meat-feed, kg/m2 wet	1.109-58, Rev 0; GASPAR p. 2.24
FR = .2	Retention factor, All but iodines	1.109-68
FRI = 1	Retention factor, iodines	1.109-68
P = 240	Soil areal density, kg/m2	1.109-68
QCOW = 50	Milk Cow Fodder intake, kg/d	1.109-38
QGOAT = 6	Milk Goat Fodder intake, kg/d	1.109-38
QBEEF = 50	Beef Cow Fodder intake, kg/d	1.109-38
HUMID = .008	Absolute humidity, kg/m3	GASPAR p. 2.8
FPLANT = .5	Plant to atmosphere tritium ratio	1.109-27

Table 3.1 (Continued)

FWATER = .75	Fraction plant mass that is water	1.109-27
CONCARB = .00016	Conc. carbon in atmosphere, kg/m3	1.109-27, BNWL-SA-5523
CONCARB = .00002	Conc. carbon in irrigation water, kg/L	BNWL-SA-5523
FCARBON = .11	Fraction plant mass that is carbon	1.109-26
Goat Milk Transfer Factors, d/L		
FMGOAT(1) = .17	FMGOAT(3) = .1	Tritium and Carbon
FMGOAT(13) = .00013	FMGOAT(14) = .00013	Fe
FMGOAT(21) = .013		Cu
FMGOAT(34) = .014	FMGOAT(35) = .014	Sr
FMGOAT(36) = .014	FMGOAT(37) = .014	Sr
FMGOAT(56) = .06	FMGOAT(57) = .06	I
FMGOAT(58) = .06	FMGOAT(59) = .06 FMGOAT(60) = .06	I
FMGOAT(68) = .3	FMGOAT(69) = .3	Cs
FMGOAT(70) = .3	FMGOAT(71) = .3 FMGOAT(72) = .3	Cs

(a) The holdup times are given as days multiplied by the constant of seconds/day (SperD). Parameter values are all from Regulatory Guide 1.109, Rev. 1, unless otherwise indicated.

3.2 Utility Programs

The following programs are used in initializing, printing, and sorting some of the files input to or generated from the above programs. These utility programs are all written in Microsoft BASIC. All utility programs are compiled and linked, thus are run from the operating system. Refer to Figure 1.1 for their use in the data flow.

3.2.1 CPRDEDIT - Edit data fields of SUMyySnn.OUx files

CPRDEDIT is used to make changes in the random-formatted SUM files, usually to replace drinking water doses by irrigated food doses in record 29. The program accepts keyboard input and displays the record before and after changes. An optional printout of the modified SUM file may be selected.

Input

Command Line

This is the file specification. If neglected, the program will query for it.

Example for Yankee Rowe:

\Y91\PROGS> CPRDEDIT \Y91\OUT\SUMMARY\SUM91S38.OUM

Keyboard entry

This includes the record number, field number, and new value as desired.

Files

The input files required by the program are:

SUMyySss.OUx Summary file

This file should be in the \Yyy\OUT\SUMMARY subdirectory.

Output

Files

SUMyySss.OUx Modified summary file.

Printer

The printed output of a file is optional.

3.2.2 CPRDUMP - Print SUMyySnn.OUx Files

CPRDUMP prints selected records of the SUMyySnn.OUx files. The input to the program other than the input data file is only via the terminal. The program is shown in Listing B.2 of Appendix B. A sample of the file dump printout is given in Listing E.1 of Appendix E.

The command line consists of input of the file specification. For example, the command line for WNP-2, assuming the three output files are in F, is as follows:

> \Y91\PROGS\CPRDUMP F:SUM91S57.OUM

3.2.3 CPRDPRNT - Print Result Files

CPRDPRNT reads SUM, AIR, and LIQ files generated by the CPRDA and CPRDL programs and directs selected lines to the printer for these files. Headers of the files, input data, and result tables are printed. In addition, for the detailed AIR and LIQ files, percentages of contributing nuclides resulting in an adult total-body dose of greater than 3% of the total are listed. Reports are automatically selected from the input file name. This program is usually run from the "RUN" bat programs.

Input

Command Line

The command line consists of input of the file specification, for example, for WNP-2 assuming the three output files are in F:

> \Y91\PROGS\CPRDPRNT F:SUM91S57.OUM

> \Y91\PROGS\CPRDPRNT F:AIR91S57.OUM

> \Y91\PROGS\CPRDPRNT F:LIQ91S57.OUT

Keyboard Entry

No additional entry needed during execution.

Files

The input files required by the program are:

SUMyySss.OUx	Summary file
AIRyySss.OUx	Detailed air dose file
LIQyySss.OUT	Detailed liquid dose file

Output

Files

None.

Printer

Results in the SUM file are printed on a single page for air and water with headers of input files. Detailed results of the AIR and LIQ files are printed with doses by nuclide and organ, sums, and with percents of total. Format is set up for a 132 cpi line width, which may be printed in line printer font on a HP LaserJet II or 4. Examples of these files can be found in Appendix E.

3.2.4 RELGEN - Generate RELyySnn.DAT files

RELGEN processes a Brookhaven-generated annual release file for the light water commercial reactor sites into separate REL files for each reactor site.

Input

Command Line

The command line consists only of the name of the input file received from Brookhaven (BFN):

>RELGEN BFN

User Input

At startup, the user is queried as to what input and output drives (directories) are required. The defaults are current directory for both the input file and output files. Next, the initials of the operator and year of release are asked for. The defaults are dAb. A query then appears for whether REL files for all sites are to be generated or only a selected site. Enter "A" here for all sites or the site number if only one site needs to be run. Then, each site is run after the population factor is entered. After the last site is run, it is displayed on the screen through the SHELL and BROWSE programs (if in path). Enter Esc to exit program.

Files

The input file required by the program is the Brookhaven file of the annual reactor radionuclide releases. This annual file contains the dilution flow in L/y, energy generated in MW-hr, number of plants on site, and releases for air and liquid streams. The dilution flow is the total of all the plants on the site. The air is identified by location or type of release: ground, elevated, or mixed-mode. The input file is a text file with spaces as delimiters between data values and "****" as a delimiter between each site. The parameter types are indicated using keywords at the left-hand columns of the file.

Output

The output is the standard CPRD REL file for each site (an example file is given in Listing D.12 of Appendix D) and an additional file consisting of nuclides not on the list and other exceptions. This file is named REL.EXP and is created in the same subdirectory as the REL files.

Notes

Some sites have documented, measured site-specific data of nuclide-dependent recirculation factors or bioaccumulation factors for fish and invertebrates caught in receiving waters. For these sites,the REL file must be edited to add this data in columns after the liquid release values in order of recirculation, fish biofactor, and invertebrate biofactor. For most sites, a default recirculation factor of 1 and "Reg Guide" bioaccumulation factors are assumed.

3.2.5 SSUM - Generate Site Summary Pages

SSUM generates the Site Summary pages of the report in WordPerfect format. The program is not compiled, so it must be run from the BASIC environment (editor).

Input

Command Line

None.

Keyboard Entry

Modify file names and flags as desired in the relevant section of the program. During the run, query for site number of change made. Respond with "ALL" or "A" for all sites.

Files

The input files required by the program are:

SITEPOP.DAT	Population and city data
SUMyySss.OUx	Summary files
SUMMARY.TMP	Page format template

Output

Files

SUMyy.WP	Site Summary section in WP format .

Printer

None.

Notes

SSUM generates site summaries in order of the SITEPOP.DAT file (Listing D.7 in Appendix D). The program skips sites whose SUM file is not found and proceeds to the next site in the list. It can replace pages with updated results when a site number is entered instead of "all" at the query. Insertion of new pages is not supported. No automatic backup is provided, so if a user revises a site, there should be a separate backup. The program adds the results of multiple air releases and also considers the results of the AIRGAMMA program. The larger result of CPRDA and AIRGAMMA is taken.

3.2.6 SUMTAB - Calculate Table 4 Data

SUMTAB reads SUM files and generates a table of population and MI doses for each site. The table is in essentially Table 4 format so the values can be easily transferred by hand. The table includes both Air MI doses from both CPRDA and AIRGAMMA results. The program selects the larger value of the air gamma and residential plume MI dose for the table. The percentages of the Appendix I design values are calculated for MI paths on either a per site basis or per unit basis. The sites may be printed in either alpha order (as per order of the SITEPOP.IN file) or site number order.

Input

Command Line

The command line consists of the release year, flag for order of sites in table, and flag to calculate MI doses as per site or reactor unit.

In this example, where the first T specifies alpha order (order of sites in SITEPOP.IN file and the second the per unit MI doses:

> \Y91\PROGS\SUMTAB 91 T T

An F in the first place would print out a table in site-number order; an F in the second place would calculate the MI doses on a per site basis and take percentages of Appendix I limits accordingly.

Keyboard Entry

No additional entry is needed. However, an Optional section is provided for debugging in the Basic editor.

Files

The input files required by the program are:

SITEPOP.DAT	Population and city file
SUMyySss.OUx	Summary files

OUTPUT

Files

None.

Printer

Table of population and individual doses by site. Also, the totals are calculated and arithmetic and geometric means calculated. The format is set up for a landscape 16.5 cpi spacing, which may be printed in the line printer font on an HP LaserJet.

Notes

The program assumes that the SITEPOP.IN file is in the \Yyy\REPORT subdirectory and the SUM files are in the \Yyy\OUT\SUMMARY directory. If the setup is different than this, the program's Option section must be changed and recompiled or run from the Basic editor after changing.

4 Output Files

This section discusses the makeup and format of the files containing results of the CPRDA, CPRDL, and AIRGAMMA runs.

4.1 SUMyySnn.OUx - Output Summary File

This file is a random file to which the CPRDA, CPRDL, and AIRGAMMA programs write information on input parameters and the results of dose calculations. A SUMyySnn.OUx file is created for each site (nn) for a particular year of release (yy), and release mode (x). Each file is made up of 100 128-byte records containing character strings of up to 128 bytes. Table 4.1 describes the contents of each record. The file may be printed using the program CPRDUMP, which is described in Section 3.2.3. An example of the file can be found in Table E.1 of Appendix E.

Records 1 through 4 contain the date and time of the particular program run. Records 5 through 14 contain headers of the input files used in the calculation of the air pathway dose commitments using CPRDA. Records 15 through 26 contain similar information for the liquid dose commitment calculations using CPRDL. The parameters F2 are the fish consumption rates for the four age groups. Records 42 through 51 contain the summary of the liquid and air pathway dose commitments for the four age groups and organs considered. The factors of production divided by consumption are contained in record 52. Records 53 through 68 contain the 160 air-pathway dose commitments summed over age group and distributed the same as the population and dilution factors. Records 69 through 75 contain miscellaneous input data. Records 76 and 77 contain some intermediate parameter values. Further room for expansion of the file is maintained in records 93-99. Record 100 is reserved for any notes entered during the use of the edit program CPRDEDIT.

The summary printouts for the air and liquid dose runs are generated from the SUMyySnn.OUx files using the CPRDPRNT program described in Section 3.2.4. Both reports are one-page, using an HP LaserJet printer with the Line Printer font. The reports consist of a header giving the time the program was run, its version, and the command line string. The next section is the listing of the headers of the input files used, followed by a section on the parameter values used in the calculations. For nuclide-specific parameters, only those for nuclides of major concern are listed. For the air summaries, dilution factor sums and weighted means are given along with dilution values for the four MI locations of interest. Next are tables listing the population doses calculated and the maximum individual doses. Finally, at the bottom of the report is the summary of MI doses for the comparison with the Appendix I design values. Examples of the summary printouts may be found in Sections E.2 and E.3 of Appendix E.

Results from the AIRGAMMA runs are printed directly and are not sent to an output file. See Section 3.3.3.3 for a description of this file.

4.2 Detailed Population Dose Commitment Files

Detailed result files organized in the random file mode are generated by both the CPRDA and CPRDL programs. The records are formatted as a random file. Each dose value is coded in single precision floating point format, 4 bytes wide; the nuclide symbol takes 8 bytes. The end of each record is padded to give a record length of 60 bytes. These files are created on disk at run time to be accessed at a later time through the use of report generating program, CPRDPRNT.

4.2.1 AIRyySnn.OUx - Detailed Airborne Population Dose Commitments

This file is generated by the CPRDA program to give a more detailed assessment of the nuclides contributing most to the airborne population dose commitments. The first record of each file contains the header and the succeeding records contain the doses for each of the six organs for each nuclide released. This file may be printed with the CPRDPRNT program, discussed in Section 3.2.4.

4.2.2 LIQyySnn.OUT - Detailed Waterborne Population Dose Commitments

This file, which is similar to the above described file, is generated by the CPRDL program. It provides a detailed assessment of the waterborne population dose commitments. The first record of the file contains the informational header record. The succeeding records contain five adult organ doses for drinking water and five for aquatic food consumption. This file may be printed with the CPRDPRNT program, which is discussed in Section 3.2.4.

Table 4.1 SUMYYSnn.OUx file contents

Rec. No.	Contents
1	Date and time of CPRDA run
2	Date and time of CPRDL run
3	Not used
4	Not used
5	Site specific data file (SSDMOD.DAT) header for air calculations
6	Population input file (POPYYSnn.DAT) header for air calculations
7	Air dilution file (CHIYYSnn.DAx) header for air calculations
8	Recovery information for met data for air calculations
9	Release file (RELYYSnn.DAT) header for air calculations
10	Generic data file (GENERIC.DAT) header for air calculations
11	Infant dose factor file (INFANT.DAT) header for air calculations
12	Child dose factor file (CHILD.DAT) header for air calculations
13	Teen dose factor file (TEEN.DAT) header for air calculations
14	Adult dose factor file (ADULT.DAT) header for air calculations
15	Site specific data file (SSDMOD.DAT) header for liquid calculations
16	Population distribution input file (POPYYSnn.DAT) header for liquid calculations
17	Release file (RELYYSnn.DAT) header for liquid calculations
18	Generic data file (GENERIC.DAT) header for liquid calculations
19	Infant dose factor (INFANT.DAT) header for liquid calculations
20	Infant average fish and invert. consumption rates, kg/yr
21	Child dose factor (CHILD.DAT) header for liquid calculations
22	Child average fish and invert. consumption rates, kg/yr
23	Teen dose factor (TEEN.DAT) header for liquid calculations
24	Teen average fish and invert. consumption rates, kg/yr
25	Adult dose factor (ADULT.DAT) header for liquid calculations
26	Adult average fish and invert. consumption rates, kg/yr
27	Drinking water population
28	Not used
29	Appendix I liquid doses (mrem), percents, and critical organ summary
30	Site Boundary distance (km), direction, and dilution factors (s/m^3 & m^{-2}) for air calculations
31	Residence " "
32	Garden " "
33	Pasture " "
34	Infant air indiv. organ doses (GI, thyroid, bone, liver, and lung) for inhalation, vegetables, and milk and meat, mrem
35	Child " "
36	Teen " "
37	Adult " "
38	Drinking water mixing ratio and indiv. doses to t. body, GI, thyroid, bone, and liver, mrem
39	Fish " "
40	Invert " "
41	Shoreline " "

Table 4.1 (Continued)

Rec. No.	Contents
42	Infant liquid population doses for t. body, GI, thyroid, bone, and lung, man-rem
43	Child " "
44	Teen " "
45	Adult " "
46	Total " "
47	Infant air population doses for t. body, GI, thyroid, bone, liver, and lung, man-rem
48	Child " "
49	Teen " "
50	Adult " "
51	Total " "
52	Production/Consumption factors for air population dose calculations
53 - 68	Air population doses by segment (160), man-rem (Not used for report)
69	Air population factor, dose parameters from site specific file, and TWHR
70	Liquid population factor, dose parameters from site specific file, TWHR, and FEXPOSR
71	Site specific MI biofactors note
72	Populations considered for drinking water and aquatic foods
73	Primary air releases, Ci/yr
74	Appendix I air doses (mrem) summary and critical organ
75	Total 2-80 km population for air population dose estimates
76	Air dilution factor sums (s/m^3 and m^{-2})
77	Area fraction and population weighted average dilution factors (s/m^3 or m^{-2}) (E3, K3, & P5)
78	Primary liquid releases, Ci/yr
79	Recirculation factors
80	Population fish bioaccumulation factors, L/kg
81	Population invertebrate bioaccumulation factors, L/kg
82	Appendix I air dose percents for gamma, beta, t. body, and total organ
83	Vegetable (and produce) transfer factor for primary air releases
84	Milk (cow or goat) translocation factor (d/L) for primary air releases
85	Meat (beef) translocation factor (d/L) for primary air releases
86	Direct noble-gas adult doses (mrem) for t. body, GI, thyroid, liver, lung
87	Inhalation iodine and particle adult doses (mrem) for t. body, GI, liver, and lung, and infant thyroid
88	Vegetable Iodine and particle adult doses (mrem) for " "
89	Milk and meat iodine and particle adult doses for " "
90	Not used
91	Site boundary air gamma and beta noble-gas doses from Air Gamma program
92	Residence t. body direct plume noble-gas dose from Air Gamma program
93 - 99	For future use
100	Notes on changes using CPRDEDIT

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Appendix A

Main Program Listings

APPENDIX A. MAIN PROGRAM LISTINGS

Listings of the main dose assessment programs described in this manual are listed in this appendix. A list of listings is given below.

A.1 CPRDA.BAS

```
' CPRDA.BAS  ****   Air dose program for CPRD Project -- MI version
'*************************************************************************
   CONST V$ = "****  CPRDA  ***  VERSION OF 17-Nov-94"
   CONST CRN$ = "Copyright (C) 1993 Battelle Memorial Institute (DA Baker, Author)"
'*************************************************************************

'       Auther:   D. A. Baker, PNL

'       Contact:  D. A. Baker, PNL, (509) 375 3809

'****************************** Abstract ***********************************

'   Program calculates population and individual dose commitments via air pathways:
'   submersion, gnd irrad., inhalation, and ingestion of veg, milk, and meat.
'   for region between 2 and 80 km around release point.  Four age groups are
'   considered, 160 sectors (J1), 83 nuclides (N1), and 14 Pathway-organs (P1)
'   Dose factors are those of Reg Guide 1.109.  Gamma and Beta air doses are also
'   calculated for individuals.

'***************************** Disclaimer **********************************

'      This program was prepared under a contract with an agency of the
'      U. S. Government.  Neither the agency, Pacific Northwest Laboratory,
'      nor the author makes any warranty or assumes any legal liability or
'      responsibility for the accuracy or usefullness of this program.

'******************************* Software **********************************

'  Compiler:           Microsoft Basic 7.1
'  Libraries:          DAB1.LIB & DAB1.QLB
'  Supporting Modules: None

'*********************** Update History ************************************

'   First written for CSCX basic

'   Next revised for Data General Machine

'   MODIFIED BY R. A. PELOQUIN TO RUN ON THE EAS ALTOS, BNW   9-MAR-82
'   WRITTEN IN BASIC-80 FOR BASCOM COMPILER BY DA BAKER & RA PELOQUIN, BNW.
'   IBM PC VERSION WRITTEN IN BASICA. 26-FEB-84.
'   Qbasic Compiler version completed  26 July 88

' 19 APR 89  First time run without errors from environment using CPRD.QLB.
' 30 MAY 89  Corrected FindFile and expanded Message
' 31 May 90  Added individual dose capability through sub MIDOSE.
' 14 Nov 90  Added MISCMOD2 module
' 26 NOV 90  Added TERFOOD SUBroutine
'  5 Feb 91  Releases read in using PARSE2 SUB
'  8 Jul 91  Added produce to MI. Revised FTRANS calculation
' 13 Jul 91  Modifed input setup file for new format. Fixed detailed
'            output file for format 1.  New command line format.
' 18 Jul 91  Selects pop file starting at 1980 and ending in 1999.
' 12 Aug 91  Added APPENDIXI sub.
' 29 Aug 91  Added goat factors and logic for calculating goat milk dose.
' 11 Nov 91  Added App I percents to sub.  Changed P5 to be pop weighted avg x/q
' 21 Feb 92  Revised comm line input format for G E M types and Rel read.
' 24 Feb 92  Further GEM revisions.
'  5 Mar 92  For F2 calculation in subs MIDOSE and POPDOSE prevented divide by zero.
' 16 Mar 92  Revised format of SSD file.  Now standard dAb format.
' 13 Apr 92  Minor cahanges.  FORMAT function added.
' 21 Apr 92  Correction of FR in SUB TERFOOD.
' 22 Apr 92  Final parameter check with RG 1.109. Minor changes.
'  5 May 92  Put D$ definition right after command line input.
' 28 May 92  Output organ doses by age to records 34 - 37 of Summary file.
' 23 Mar 93  Added K4 to ingestion of food products deposition concentration in MI & POP dose subs.
' 18 Jan 94  Modification of LL$ line in POPDose.
'  5 Apr 94  Reformat Image1$ in APPENDIXI for 3 sig figures.
' 17 Nov 94  Cleanup

'************************* Command Line Input ******************************

'    Site-number  Rel-type  [ Nuclide-number  Sector-number ]

'    EX.    CPRDA 5  G  25  160

'    Tests:    69 1  27 25  (Kr-85m)    &    69 1  56 6  (I-131)

'_____________________________________________________________________
```

```
'***************************** Files ****************************************
'           ------- Description -------     Type      No.    Name Variable
'   Input:  Setup file                      text      #1       SETFILE$
'           Site specific params            text      #1       IN.SITE$
'           Population distribution         text      #1       IN.POP$
'           Dilution factors                text      #1       IN.CHI$
'           Release file                    text      #1       IN.REL$
'   Output: Dose summary file               random    #3       OUT.SUMMARY$
'           Dose detail file                random    #2       OUT.DETAIL$
'************************ Internal Standard Units ***************************
'               Activity        pCi         input Ci/y release rate
'               Air Conc.       pCi/m3
'               Distance        km
'               Dose            mrem
'               Pop dose        man-rem
'               Time            s
'************************** Initialization **********************************
   DEFSNG A-Z

   DECLARE SUB APPENDIXI (H!())
   DECLARE SUB FINDFILE (FILE$, ENV$, FLG%)                              ' DAB1
   DECLARE FUNCTION FORM$ (V!)
   DECLARE SUB GETLINE (FILENUM%, COMSYMBOL$, LINE$)                     ' DAB1
   DECLARE SUB MIDOSE (K AS INTEGER)

   DECLARE SUB PARSE2 (COMSTRING$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())  ' DQB1
   DECLARE SUB POPDOSE (K AS INTEGER)
   DECLARE SUB PUTLINE (FILENUM%, RECNUM%, LINE$, RECLEN%)
   DECLARE FUNCTION ROUNDOFF! (V!, SIGFIG%)
   DECLARE SUB TERFOOD ()
   DECLARE FUNCTION TIMESTAMP$ ()                                        ' DAB1

'$INCLUDE: 'FORMAT.BI'

'----------------------- Program Constants ---------------------------------

   CONST FALSE = 0, TRUE = NOT FALSE

   CONST N1% = 83                          ' Nuclides
   CONST J1% = 160                         ' Sectors
   CONST P1% = 14                          ' Pathway-Organs

   CONST COMSYMBOL$ = "!'{¦*"
   CONST LN2 = .693147                     ' LOG(2)
   CONST SperD = 86400                     ' Sec/day
   CONST DperY = 365.25                    ' Day/y
   CONST SperY = SperD * DperY             ' Sec/y
   CONST HperY = 24 * DperY                ' Hours/y

   CONST MaxPopYear = 99                   ' Maximum year of pop file
   CONST MAXRECS% = 100                    ' OUT.SUMMARY$ no. of records
   CONST RLEN% = 128                       ' OUT.SUMMARY$ rec length including cr & lf
   CONST ENV$ = "CPRD"                     ' Environment string containing path to input files
   CONST SETFILE$ = "NEWCPRD.SET"          ' Setup file with new format
   SPCE$ = CHR$(32)                        ' Space

'---------- Parameters

   CONST TBUILDUP = 1 * SperY              ' Deposition Duration, s (1 y)
   CONST ECF = .5                          ' Iodine correction factor. RG 1.109-26
   CONST FOCCUP = .5 * HperY              ' Occupancy/Shield. factor for sub and gnd,  h/y  (pop)  RG 1.109-68
   CONST FSHIELD = .7 * HperY              ' Shielding factor for MI, h/y   RG 1.109-68
   CONST FGARDEN = .76                     ' Produce Garden factor for MI   RG 1.109-68

'  ** GRASS/FEED Fraction when animal on fresh pasture. FS in RG 1.109-28

   CONST FSM = 1, FSB = 1

   CONST LAMDA2 = LN2 / 2.26 / SperD       ' 2.26 day reference decay constant ,  1/s
   CONST LAMDA8 = LN2 / 8 / SperD          ' 8 day reference decay constant    ,  1/s

'------------------------- Random file record types -------------------------

   TYPE OUTRECTYPE
     REC AS STRING * RLEN
   END TYPE

   TYPE TITLES
     LL AS STRING * 60
   END TYPE
```

```
TYPE FILETYPE
  NUKE AS STRING * 8
  H1 AS SINGLE
  H2 AS SINGLE
  H3 AS SINGLE
  H4 AS SINGLE
  H5 AS SINGLE
  H6 AS SINGLE
  DUM AS STRING * 28
END TYPE

TYPE ALTFILETYPE
  SEC AS INTEGER
  NUK AS INTEGER
  H1 AS SINGLE
  H2 AS SINGLE
  H3 AS SINGLE
  H4 AS SINGLE
  H5 AS SINGLE
  H6 AS SINGLE
  H7 AS SINGLE
  H8 AS SINGLE
  H9 AS SINGLE
  H10 AS SINGLE
  H11 AS SINGLE
  H12 AS SINGLE
  H13 AS SINGLE
  H14 AS SINGLE
END TYPE

'------------------------ Global Parameter declarations --------------------

  DIM SHARED A(J1%) AS SINGLE              ' T Body doses by sector      (man-rem)
  DIM SHARED ARGS$(25)                     ' Parsed line arguments
  DIM SHARED B(J1%, 4) AS SINGLE           ' T Body doses by sector & age group (man-rem)
  DIM SHARED CHIQ1(J1%) AS SINGLE          ' Dil Factors: no decay, undep. (s/m3)
  DIM SHARED CHIQ2(J1%) AS SINGLE          '       "  2.26 d decay, undep. (s/m3)
  DIM SHARED CHIQ3(J1%) AS SINGLE          '       "  8 d decay, depleted  (s/m3)
  DIM SHARED DIREC$(4)                     ' Direction
  DIM SHARED DIST$(4)                      ' Distance to receptor
  DIM SHARED DF(N1%, P1%) AS SINGLE        ' Dose factors
  DIM SHARED DFAIR(N1%, 2) AS SINGLE       ' Air dose factors
  DIM SHARED DOQ(J1%) AS SINGLE            ' Relative deposition factors   (m-2)
  DIM SHARED DQ(4) AS SINGLE               ' DOQ for ind. dose             (m-2)

  DIM SHARED FAGE(4) AS SINGLE             ' Age group fractions

  DIM SHARED FTRANS(N1%, 6, 2) AS SINGLE   ' Food trans factors           (m2-s/kg)

  DIM SHARED HMI(4, P1% + 2, 4) AS SINGLE  ' Individual doses             (mrem)
  DIM SHARED HBOD(4) AS SINGLE             ' T Body dose                   (man-rem)
  DIM SHARED HBONE(4) AS SINGLE            ' Bone dose                      (man-rem)
  DIM SHARED HGI(4) AS SINGLE              ' G I dose                      (man-rem)
  DIM SHARED HLIV(4) AS SINGLE             ' Liver dose                    (man-rem)
  DIM SHARED HLUNG(4) AS SINGLE            ' Lung dose                     (man-rem)
  DIM SHARED HPO(14) AS SINGLE             ' Sum of doses over nuke & path (man-rem)
  DIM SHARED HTHY(4) AS SINGLE             ' Thyroid dose                  (man-rem)

  DIM SHARED LAMDA(N1%) AS SINGLE          ' Decay rates                   (s-1)
  DIM SHARED LOCATION$(4)                  ' MI locations title
  DIM SHARED NLOCS AS INTEGER              ' MI Locations
  DIM SHARED NUCNUM(N1%) AS SINGLE         ' Nuclide number
  DIM SHARED NUKE$(N1%)                    ' Nuclide symbol
  DIM SHARED POP(J1%) AS SINGLE            ' Population by sector
  DIM SHARED PROD(3) AS SINGLE             ' State 50-mi production of veg, milk, meat
  DIM SHARED QREL(N1%) AS SINGLE           ' Release rate                    (Ci/y)
  DIM SHARED RCONS(4, 9) AS SINGLE         ' Usage rates              (kg or m3/y)

  DIM SHARED BODY(N1%) AS SINGLE           ' T. Body dose over all sectors & paths (man-rem)
  DIM SHARED GUT(N1%) AS SINGLE            ' GI LLI
  DIM SHARED THY(N1%) AS SINGLE            ' Thyroid
  DIM SHARED BONE(N1%) AS SINGLE           ' Bone
  DIM SHARED LIVER(N1%) AS SINGLE          ' Liver
  DIM SHARED LUNG(N1%) AS SINGLE           ' Lung

  DIM SHARED S(11) AS SINGLE               ' Segment radial boundaries
  DIM SHARED U(J1%) AS SINGLE              ' Temp. array for sector values
  DIM SHARED XQ1(4) AS SINGLE              ' XOQ for ind. dose
  DIM SHARED XQ2(4) AS SINGLE              ' XOQ for ind. dose
  DIM SHARED XQ3(4) AS SINGLE              ' XOQ for ind. dose
  DIM SHARED Z(4) AS SINGLE                ' Avg. regional consump. by food type (kg/y)

  DIM SHARED OUT.FLAG%, OUT.DETAIL$

  DIM SHARED CPRDOUT AS OUTRECTYPE
  DIM SHARED TITLE AS TITLES
  DIM SHARED DOSES AS FILETYPE
  DIM SHARED ALTDOSES AS ALTFILETYPE
```

```
'---------------------------- Local declarations ----------------------------

   DIM I AS INTEGER
   DIM J AS INTEGER
   DIM K AS INTEGER

   DIM RELTYPE AS STRING * 1                          ' Release type G E M
   DIM BV(N1%), FM(N1%), FF(N1%), FMGOAT(N1%)         ' Food transfer factors
   DIM HDI(6), HINHAL(6), HVP(6), HMM(6)
   DIM AGE$(4), ORGAN$(6)

   SITE$ = SPACE$(23)

'_____________________________________________________________________________
```

```
'-------------------------- FN Functions ---------------------------------

 DEF FNBUILDUP (L, T)  '------------ Buildup factor ----------------------

'     L = Effective decay constant
'     T = Time period of buildup in consistant units

    IF L * T > .01 THEN
       FNBUILDUP = (1 - EXP(-L * T)) / L
    ELSE
       FNBUILDUP = T
    END IF
   END DEF  '_____________________________________________________________

 DEF FNEXPN (Z)      '------  Exponential of negative argument --------------
    IF Z > 80 THEN
       FNEXPN = 0
    ELSE
       FNEXPN = EXP(-Z)
    END IF
   END DEF '_____________________________________________________________

'_____________________________________________________________________

   GOSUB IMAGES

'-------------------------- Data Statements ------------------------------

   READ PR$, PMI$, PME$
   DATA "PRODUCE : ","MILK : ","MEAT : "

'------ Age group fractions and usages for veg, milk, meat, & inhalation ------
'------------------  Reg. Guide 1.109 p. 39 & 40

   FOR K = 1 TO 4
     READ AGE$(K), FAGE(K), RCONS(K, 1), RCONS(K, 2), RCONS(K, 3), RCONS(K, 4)
     READ RCONS(K, 5), RCONS(K, 6), RCONS(K, 7), RCONS(K, 8), RCONS(K, 9)
   NEXT

'                          ------- Avg -----    ----------- Max -----------
'                          v   m    m  inhal    v   m    m  inhal  Produce
   DATA "Infant", 0.0144,   0, 170,  0, 1400,    0, 330,  0, 1400,    0
   DATA "Child ", 0.16,   200, 170, 37, 3700,   26, 330, 41, 3700,    520
   DATA "Teen  ", 0.117,  240, 200, 59, 8000,   42, 400, 65, 8000,    630
   DATA "Adult ", 0.709,  190, 110, 95, 8000,   64, 310, 110, 8000,   520
'                          1   2    3   4       5   6    7   8       9

   FOR J = 1 TO 6
     READ ORGAN$(J)
   NEXT

   DATA "Total-Body", "GI-LLI", "Thyroid", "Bone", "Liver", "Lung"

   FOR I = 1 TO 11
     READ S(I)                    ' Segment radial boundaries
   NEXT

   DATA 2, 3, 4, 6, 9, 14, 20, 30, 40, 60, 80

'------  Air dose factors: Ref. GASPAR p. 3.29  mrad/yr per pCi/m3 RG 1.109 p. 21

   READ DFAIR(8, 1), DFAIR(8, 2)                  ' Ar-41  -- Gamma , Beta

   DATA 9.3E-3, 3.28E-3

     FOR I = 26 TO 31
        READ DFAIR(I, 1), DFAIR(I, 2)             ' Kr
     NEXT

   DATA 1.93E-5, 2.88E-4, 1.23E-3, 1.97E-3
   DATA 1.72E-5, 1.95E-3, 6.17E-3, 1.03E-2
   DATA 1.52E-2, 2.93E-3, 1.73E-2, 1.06E-2

     FOR I = 61 TO 67
        READ DFAIR(I, 1), DFAIR(I, 2)             ' Xe
     NEXT

   DATA 1.56E-4, 1.11E-3, 3.27E-4, 1.48E-3
   DATA 3.53E-4, 1.05E-3, 3.36E-3, 7.39E-4
   DATA 1.92E-3, 2.46E-3, 1.51E-3, 1.27E-2
   DATA 9.21E-3, 4.75E-3

   RESTORE

''   FOR I = 1 TO 4: FOR J = 1 TO 8: PRINT RCONS(I, J); : NEXT: PRINT : NEXT: STOP

'*************************** Command Line Input *******************************
```

```
COLOR 14, 1:  CLS
PRINT V$: PRINT : PRINT
C$ = COMMAND$
IF LEN(C$) THEN
   CALL PARSE2(C$, 10, SPCE$, NUMARGS%, ARGS$())
   SITENUM$ = ARGS$(1)                          ' Site number
   RELTYPE$ = LEFT$(ARGS$(2), 1)                ' Release type: G E or M
   I7% = VAL(ARGS$(3))                          ' Optional nuclide number
   J7% = VAL(ARGS$(4))                          ' Optional sector number
ELSE
   BEEP: CLS : PRINT
   PRINT "  Program needs command line input to run:":   PRINT
   PRINT "    CPRDA SiteNumber RelType   [ NucNumber SecNumber ]": PRINT
   PRINT "  Ex.  CPRDA 35 G            (Normal for Surry -- Gnd release)"
   PRINT "       CPRDA 35 G  56 6      (For optional I-131 printout for 6th sector)"
   PRINT : END
END IF

IF LEN(SITENUM$) = 1 THEN SITENUM$ = "0" + SITENUM$
SITENUM% = VAL(SITENUM$)

'*********************  Input SETUP File  ***********************************

CALL FINDFILE(SETFILE$, ENV$, FLG%)
IF FLG% = FALSE THEN GOSUB MESSG1
OPEN SETFILE$ FOR INPUT AS #1

LINE INPUT #1, DUM$                             ' Header

DO UNTIL EOF(1)
  CALL GETLINE(1, COMSYMBOL$, L$)
  CALL PARSE2(L$, 6, SPCE$, NUM%, ARGS$())
  IF INSTR(ARGS$(1), "EOF") THEN EXIT DO

    SELECT CASE LEFT$(ARGS$(1), 3)
      CASE "YEA"
         Y$ = ARGS$(2)                           ' Release year yy
      CASE "DOS"
         IN.INFANT$ = ARGS$(2) + ARGS$(3)
         IN.CHILD$ = ARGS$(2) + ARGS$(4)
         IN.TEEN$ = ARGS$(2) + ARGS$(5)
         IN.ADULT$ = ARGS$(2) + ARGS$(6)
      CASE "GAM"
        '  Files not used
      CASE "JFD"
        '  Files not used
      CASE "GEN"
         IN.GENERIC$ = ARGS$(2) + ARGS$(3)
      CASE "SIT"
         IN.SITE$ = ARGS$(2) + ARGS$(3)
      CASE "POP"
          MID$(ARGS$(3), 7, 2) = SITENUM$
          IN.POP$ = ARGS$(2) + ARGS$(3)
      CASE "REL"
          MID$(ARGS$(3), 4, 2) = Y$
          MID$(ARGS$(3), 7, 2) = SITENUM$
          IN.REL$ = ARGS$(2) + ARGS$(3)
      CASE "CHI"
          MID$(ARGS$(3), 4, 2) = Y$
          MID$(ARGS$(3), 7, 2) = SITENUM$
          MID$(ARGS$(3), 12, 1) = RELTYPE$
          IN.CHI$ = ARGS$(2) + ARGS$(3)
      CASE "SUM"
          MID$(ARGS$(3), 4, 2) = Y$
          MID$(ARGS$(3), 7, 2) = SITENUM$
          MID$(ARGS$(3), 12, 1) = RELTYPE$
          OUT.SUMMARY$ = ARGS$(2) + ARGS$(3)
      CASE "AIR"
          MID$(ARGS$(3), 4, 2) = Y$
          MID$(ARGS$(3), 7, 2) = SITENUM$
          MID$(ARGS$(3), 12, 1) = RELTYPE$
          OUT.DETAIL$ = ARGS$(2) + ARGS$(3)
      CASE "LIQ"
          ' Not used
      CASE ELSE
        CLS :  BEEP: LOCATE 10, 15
        PRINT "Keyword "; ARGS$(1); " in user file not understood --"
        PRINT "         Check your spelling.":  END
    END SELECT

  LOOP
  CLOSE #1

  OUT.FLAG% = 1     ' Standard detailed output file for pop doses.
'                     Nuclide & organs summed over sectors and %.

'************************ Check for CHI File of input REL type ***************
'------ If no CHI file found with specified reltype, program ends.
```

```
   FILE$ = IN.CHI$
   CALL FINDFILE(FILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN
     BEEP: PRINT "File "; FILE$; " not found -- returning to system."
     END
   END IF

'************************** Open SUM File ************************************

   FILE$ = OUT.SUMMARY$
   OPEN FILE$ FOR RANDOM AS #3 LEN = RLEN

'---------  Initialize file if no records
   IF LOF(3) = 0 THEN
     FOR I = 1 TO MAXRECS
       CPRDOUT.REC = SPACE$(RLEN):   PUT #3, I, CPRDOUT
     NEXT
   END IF

'**************************  Input SSD File record  ***************************

   FILE$ = IN.SITE$
   CALL FINDFILE(FILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1 LEN = 2048

   LINE INPUT #1, L$:   CALL PUTLINE(3, 5, L$, RLEN)     ' Header
   PRINT L$
   DO UNTIL EOF(1)
     CALL GETLINE(1, COMSYMBOL$, LINE$)
     CALL PARSE2(LINE$, 22, SPCE$, NUM%, ARGS$())
     IF INSTR(ARGS$(1), "EOF") THEN EXIT DO
     IF SITENUM% = VAL(ARGS$(1)) THEN EXIT DO
   LOOP
   IF SITENUM% <> VAL(ARGS$(1)) THEN
      CLS :   LOCATE 3, 5
      PRINT "Site Number "; SITENUM%; " not in file "; FILE$; ".  Check File and Try Again.": END
   END IF
   CLOSE #1

   LSET SITE$ = ARGS$(1)                          ' Site number
   MID$(SITE$, 4) = ARGS$(2)                      ' Add site
   MID$(SITE$, 22) = ARGS$(3)                     ' Add state
   V2 = VAL(ARGS$(17))                            ' Productivity factor of region
   FPM = VAL(ARGS$(18))                           ' Fraction yr milk cows on pasture
   FPB = VAL(ARGS$(19))                           ' Fraction yr meat animals on pasture
   PROD(1) = VAL(ARGS$(20))                       ' State 50-mi production for veg, kg
   PROD(2) = VAL(ARGS$(21))                       ' State 50-mi production for milk, L
   PROD(3) = VAL(ARGS$(22))                       ' State 50-mi production for meat, kg

'**************************  Screen Initialization  ***************************

   CLS : COLOR 11, 3: PRINT SPACE$(80); :  LOCATE 1, 1
   PRINT TAB(12);"Executing CPRDA for ";
   COLOR 14, 3:  PRINT SITE$:  PRINT :  COLOR 14, 1

'**************************  Input IN.POP$ file  ******************************

   FILE$ = IN.POP$

   FLG% = FALSE: I = VAL(MID$(FILE$, LEN(FILE$) - 8, 2)) - 1
' Search for file from 1980 to MaxPopYear (99)
   DO UNTIL FLG% > 0 OR I > MaxPopYear       ' The MaxPopYear is final year of search
     I = I + 1
     MID$(FILE$, LEN(FILE$) - 8, 2) = LTRIM$(STR$(I))
     F$ = FILE$
     CALL FINDFILE(F$, ENV$, FLG%)
   LOOP

   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1 LEN = 1024

   LINE INPUT #1, L$:  CALL PUTLINE(3, 6, L$, RLEN)       ' Header

   GOSUB SECTORIN                                         ' Read pop data
   CLOSE #1

   POPSUM = 0
   FOR J = 1 TO J1%: POP(J) = U(J): POPSUM = POPSUM + U(J):     NEXT   ' TOTAL POP

   PRINT IN.POP$; " FILE READ IN * * * *     POPSUM ="; POPSUM

'**************************  Input IN.CHI$ file  ******************************

   E4 = 0:    E5 = 0:    E6 = 0:    K1 = 0
   FILE$ = IN.CHI$
   CALL FINDFILE(FILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1 LEN = 4096
```

```
   LINE INPUT #1, L$:  CALL PUTLINE(3, 7, L$, RLEN)      ' Header
   LINE INPUT #1, L$:  CALL PUTLINE(3, 8, L$, RLEN)      ' Recovery & Note line

   GOSUB SECTORIN                                        ' Read in no decay CHI data
   FOR J = 1 TO J1%:  CHIQ1(J) = U(J):    E4 = E4 + CHIQ1(J):    NEXT
   '    CSE1J# = VAL(RIGHT$(X$,LEN(X$)-101))

   GOSUB SECTORIN                                        ' 2.26 d decay
   FOR J = 1 TO J1%: CHIQ2(J) = U(J): E5 = E5 + CHIQ2(J):    NEXT

   GOSUB SECTORIN                                        ' 8 d decay
   FOR J = 1 TO J1%: CHIQ3(J) = U(J): E6 = E6 + CHIQ3(J):    NEXT

   GOSUB SECTORIN                                        ' Relative deposition
   FOR J = 1 TO J1%: DOQ(J) = U(J): K1 = K1 + DOQ(J):   NEXT

   IF NOT EOF(1) THEN
     GOSUB MICHI                                         ' Individual locations & CHIQs
   ELSE
     PRINT "No MI locations found in CHI file -- proceeding ..."
   END IF

   IF NLOCS > 4 THEN BEEP:   PRINT "More than 4 locations in CHI file -- Check file":   END

   CLOSE #1
   PRINT IN.CHI$; " FILE READ IN * * * *  "

   PRINT USING "##.#^^^^  ##.#^^^^  ##.#^^^^  ##.#^^^^"; E4; E5; E6; K1

'******************************  Input IN.REL$ File  ****************************

   FILE$ = IN.REL$
   CALL FINDFILE(FILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1 LEN = 1024

   LINE INPUT #1, X$                                     ' Header
   CALL PUTLINE(3, 9, X$, RLEN)
   INPUT #1, DUM$, R$, POPFACTOR, DUM, MWH               ' Second line with data
   TWH = MWH * .000001                                   ' Convert to TerraWatt-hrs

   LINE INPUT #1, L$:    LINE INPUT #1, L$               ' Titles - may not need if comment symbols usec

   DO UNTIL EOF(1)
      CALL GETLINE(1, COMSYMBOL$, LINE$)
      CALL PARSE2(LINE$, 8, SPCE$, NUMARGS%, ARGS$())
        I = VAL(ARGS$(1))
        NUCNUM(I) = I
        NUKE$(I) = SPCE$ + ARGS$(2)                      ' Nuclide symbol
        SELECT CASE RELTYPE$
          CASE "G"
            QREL(I) = VAL(ARGS$(3))                      ' Ground release (Ci/y)
          CASE "E"
            QREL(I) = VAL(ARGS$(4))                      ' Elevated release (Ci/y)
          CASE "M"
            QREL(I) = VAL(ARGS$(5))                      ' Mixed Mode release (Ci/y)
        END SELECT
   LOOP

   CLOSE 1
   PRINT IN.REL$; " FILE READ IN * * * *  Release Type: "; RELTYPE$

'************************  Input IN.GENERIC$ file  ******************************

   FILE$ = IN.GENERIC$
   CALL FINDFILE(FILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1 LEN = 2048
   LINE INPUT #1, L$:  CALL PUTLINE(3, 10, L$, RLEN)     ' Header
   LINE INPUT #1, L$
   LINE INPUT #1, L$

   FOR I = 1 TO N1%
     LINE INPUT #1, L$
        LAMDA(I) = VAL(MID$(L$, 14, 10))                 ' Decay rates  , 1/S
        BV(I) = VAL(MID$(L$, 27, 9))                     ' Bv
        FM(I) = VAL(MID$(L$, 37, 9))                     ' FM
        FF(I) = VAL(MID$(L$, 46, 9))                     ' FF
   NEXT I

   CLOSE 1
   PRINT IN.GENERIC$; "  FILE READ IN * * * *"
   PRINT

'*************  Calculate Food transfer factors FTRANS() for Pop and MI *********

   CALL TERFOOD

'**********************  Apply iodine correction factor  ************************
```

```
   FOR I = 56 TO 60:  QREL(I) = QREL(I) * ECF:  NEXT
'******************  Correct populations for current year  *********************

   FOR J = 1 TO J1%:   POP(J) = POPFACTOR * POP(J):    NEXT          ' Sector
   POPSUM = POPSUM * POPFACTOR                                       ' Total

'***********  Calculate area & pop-weighted avg. transport factors  ***********

   E3 = 0:    K3 = 0:    P5 = 0
   A3 = S(11) * S(11) - S(1) * S(1)                        ' Area of region, m2
   FOR J = 0 TO J1% - 10 STEP 10
      FOR I = 1 TO 10
         A2 = (S(I + 1) * S(I + 1) - S(I) * S(I)) / 16     ' Segment area, m2
         E3 = E3 + CHIQ1(J + I) * A2 / A3                  ' Area fraction weighted avg. CHIQ1(), s/m3,
                                                           '   for H & C food consumption
         K3 = K3 + DOQ(J + I) * A2 / A3                    ' Area fraction weighted avg. DOQ(), 1/m2,
                                                           '   for all else food cons.
         P5 = P5 + POP(J + I) * CHIQ1(J + I) / POPSUM      ' Pop. weighted avg. CHIQ1(), s/m3,  -- Not used
      NEXT I
   NEXT J

   LL$ = STR$(E3) + ";" + STR$(K3) + ";" + STR$(P5)
   CALL PUTLINE(3, 77, LL$, RLEN)

' ********************  Modify consumption if > production  for Pop  *********

   FOR I = 1 TO 3
'----  Age weighted total consumption
      Z(I) = (RCONS(1, I) * FAGE(1) + RCONS(2, I) * FAGE(2) + RCONS(3, I) * FAGE(3) + RCONS(4, I) * FAGE(4))
* POPSUM

'----  Don't modify when reginal production > consumption
      IF Z(I) > V2 * PROD(I) THEN
        FOR K = 1 TO 4
           RCONS(K, I) = RCONS(K, I) * V2 * PROD(I) / Z(I)    '  Modified consumption by prod / Cons factor
        NEXT
      END IF

   NEXT
'******************  Calculate doses for the four age groups  ********************

   FOR K = 1 TO 4

     SELECT CASE K
       CASE 1
         L1$ = IN.INFANT$
         GOSUB DFACTORS                                    ' Read in Infant dose factors
       CASE 2
         L1$ = IN.CHILD$
         GOSUB DFACTORS                                    ' Read in Child dose factors
       CASE 3
         L1$ = IN.TEEN$
         GOSUB DFACTORS                                    ' Read in Teen dose factors
       CASE 4
         L1$ = IN.ADULT$
         GOSUB DFACTORS                                    ' Read in Adult dose factors
     END SELECT

     CALL MIDOSE(K)                                        ' Individual Dose calculation for thyroid
     CALL POPDOSE(K)                                       ' Pop Dose calculation for all ages
     PRINT

   NEXT K
'**************  Output total T. Body air doses for each sector ****************

   ERASE A
   FOR J = 1 TO J1%
     FOR K = 1 TO 4
       A(J) = A(J) + B(J, K)          ' Sum age groups for each sector for T. Body
     NEXT K
   NEXT J

   K = 0
   FOR J = 0 TO J1% - 10 STEP 10
     K = K + 1
     PRINT #3, SPACE$(RLEN); :  PUT #3, 52 + K
     PRINT #3, USING " ## "; K;
     FOR I = 1 TO 10
       PRINT #3, USING "##.##^^^^"; A(J + I);
     NEXT
     PUT #3, 52 + K

   NEXT J
' ********************  GENERATE REPORT TABLES
```

```
   T1 = 0: T2 = 0: T3 = 0: T4 = 0: T5 = 0: T6 = 0
   FOR K = 1 TO 4
      SELECT CASE K
        CASE 1
           L1$ = "INFANT"
        CASE 2
           L1$ = "CHILD"
        CASE 3
           L1$ = "TEEN"
        CASE 4
           L1$ = "ADULT"
      END SELECT

      PRINT #3, SPACE$(RLEN); :  PUT #3, 46 + K
      PRINT #3, USING I3$; L1$; HBOD(K); HGI(K); HTHY(K); HBONE(K); HLIV(K); HLUNG(K);
      PUT #3, 46 + K

'------------  Sum doses over age groups

      T1 = T1 + HBOD(K)
      T2 = T2 + HGI(K)
      T3 = T3 + HTHY(K)
      T4 = T4 + HBONE(K)
      T5 = T5 + HLIV(K)
      T6 = T6 + HLUNG(K)
    NEXT K

    PRINT #3, SPACE$(RLEN); :  PUT #3, 51
    PRINT #3, USING I4$; T1; T2; T3; T4; T5; T6;
    PUT #3, 51

    F1$ = FORM$(V2 * PROD(1) / Z(1))
    F2$ = FORM$(V2 * PROD(2) / Z(2))
    F3$ = FORM$(V2 * PROD(3) / Z(3))
    LL$ = PR$ + F1$ + "        " + PMI$ + F2$ + "         " + PME$ + F3$
    CALL PUTLINE(3, 52, LL$, RLEN)

'------------------  Put records 30-33 -- Dilution factors

    FOR J = 1 TO NLOCS
      PRINT #3, SPACE$(RLEN); :  PUT #3, 29 + J
      PRINT #3, USING I2$; LOCATION$(J); DIST$(J); DIREC$(J);
      PRINT #3, USING I21$; XQ1(J); XQ2(J); XQ3(J); DQ(J);
      PUT #3, 29 + J
    NEXT

'-----------------  Put records 34-37 -- Organ doses: GI thru Lung for inhal, veg, & pasture for App I report

    I5$ = " 0.0E+00"
    FOR K = 1 TO 4
      LL$ = FormatS$(HMI(K, 4, 2), I5$) + FormatS$(HMI(K, 5, 2), I5$) + FormatS$(HMI(K, 6, 2), I5$)
      LL$ = LL$ + FormatS$(HMI(K, 7, 2), I5$) + FormatS$(HMI(K, 8, 2), I5$)
      LL$ = LL$ + FormatS$(HMI(K, 10, 3), I5$) + FormatS$(HMI(K, 11, 3), I5$) + FormatS$(HMI(K, 12, 3), I5$)
      LL$ = LL$ + FormatS$(HMI(K, 13, 3), I5$) + FormatS$(HMI(K, 14, 3), I5$)
      LL$ = LL$ + FormatS$(HMI(K, 10, 4), I5$) + FormatS$(HMI(K, 11, 4), I5$) + FormatS$(HMI(K, 12, 4), I5$)
      LL$ = LL$ + FormatS$(HMI(K, 13, 4), I5$) + FormatS$(HMI(K, 14, 4), I5$)
      CALL PUTLINE(3, 33 + K, LL$, RLEN)
    NEXT
    LL$ = "":   I5$ = ""

'-----------------  MI doses for adult

       CALL APPENDIXI(HMI())

'---- Scenario Organ (1-6) Doses for MI --- Adult (4) except infant (1) thyroid (3) --

'----  Direct Irradiation at Residence(2) --- Not used
'          Air Sub          Ground
' Only air sub from nobles used for total body

   HDI(1) = HMI(4, 1, 2)                          ' Does not include ground !!!

   HDI(2) = HMI(4, 1, 2) + HMI(4, 2, 2)
   HDI(3) = HMI(1, 1, 2) + HMI(1, 2, 2)
   HDI(4) = HMI(4, 1, 2) + HMI(4, 2, 2)
   HDI(5) = HMI(4, 1, 2) + HMI(4, 2, 2)
   HDI(6) = HMI(4, 1, 2) + HMI(4, 2, 2)

'----  Inhalation at Residence(2)
   HINHAL(1) = HMI(4, 3, 2)                       ' Adult, Inhal-Body, Residence
   HINHAL(2) = HMI(4, 4, 2)                       ' Adult, Inhal-GI, Residence
   HINHAL(3) = HMI(1, 5, 2)                       ' Infant, Inhal-Thy, Residence
   HINHAL(4) = HMI(4, 6, 2)                       ' Adult, Inhal-Bone, Residence
   HINHAL(5) = HMI(4, 7, 2)                       ' Adult, Inhal-Lung, Residence
   HINHAL(6) = HMI(4, 8, 2)                       ' Adult, Inhal-Liver, Residence

'----  Ingestion of L. Veg and Produce at Garden(3)
   HVP(1) = HMI(4, 9, 3)
   HVP(2) = HMI(4, 10, 3)
```

```
    HVP(3) = HMI(1, 11, 3)
    HVP(4) = HMI(4, 12, 3)
    HVP(5) = HMI(4, 13, 3)
    HVP(6) = HMI(4, 14, 3)

'----  Ingestion of Milk & Meat at Pasture(4)
    HMM(1) = HMI(4, 9, 4)
    HMM(2) = HMI(4, 10, 4)
    HMM(3) = HMI(1, 11, 4)
    HMM(4) = HMI(4, 12, 4)
    HMM(5) = HMI(4, 13, 4)
    HMM(6) = HMI(4, 14, 4)

'******************  Write Air path parameters to summary file  *****************

    D$ = "CPRDA was last run: " + TIMESTAMP$ + "  from " + RIGHT$(V$, 21)
    D$ = D$ + "  with Command Line: " + RTRIM$(C$) + "   Site: " + SITE$
    CALL PUTLINE(3, 1, D$, RLEN)

    PRINT #3, SPACE$(RLEN); :  PUT #3, 76
    PRINT #3, USING "E4=##.##^^^^   E5=##.##^^^^   E6=##.##^^^^   K1=##.##^^^^"; E4; E5; E6; K1;
    PUT #3, 76

    LL1$ = STR$(POPFACTOR) + " " + STR$(V2) + " " + STR$(FPM) + " " + STR$(FPB) + " "
    LL2$ = STR$(PROD(1)) + " " + STR$(PROD(2)) + " " + STR$(PROD(3)) + "  " + STR$(TWH)
    LL$ = LL1$ + LL2$
    CALL PUTLINE(3, 69, LL$, RLEN)
    LL$ = STR$(POPSUM)
    CALL PUTLINE(3, 75, LL$, RLEN)

'---------  Put records 86-89 -- Adult organs: T. Body, thru Lung, except infant thyroid.

    PRINT #3, SPACE$(RLEN); :  PUT #3, 86    '---- Direct
    PRINT #3, USING I3$; "D. Irrad."; HDI(1); HDI(2); HDI(3); HDI(4); HDI(5); HDI(6);
    PUT #3, 86

    PRINT #3, SPACE$(RLEN); :  PUT #3, 87    '---- Inhalation
    PRINT #3, USING I3$; "Inhal"; HINHAL(1); HINHAL(2); HINHAL(3); HINHAL(4); HINHAL(5); HINHAL(6);
    PUT #3, 87

    PRINT #3, SPACE$(RLEN); :  PUT #3, 88    '---- Veg
    PRINT #3, USING I3$; "V&P"; HVP(1); HVP(2); HVP(3); HVP(4); HVP(5); HVP(6);
    PUT #3, 88

    PRINT #3, SPACE$(RLEN); :  PUT #3, 89    '---- Pasture
    PRINT #3, USING I3$; "M&M"; HMM(1); HMM(2); HMM(3); HMM(4); HMM(5); HMM(6);
    PUT #3, 89

    PRINT #3, SPACE$(RLEN); :    PUT #3, 73   '---- Releases
    PRINT #3, USING "##.#^^^^ "; QREL(1); QREL(3); QREL(8); QREL(17); QREL(30); QREL(56); QREL(63); QREL(65);
    PUT #3, 73

    PRINT #3, SPACE$(RLEN); :    PUT #3, 83   '---- Veg transfer
    PRINT #3, USING "##.#^^^^ "; BV(1); BV(3); BV(8); BV(17); BV(30); BV(56); BV(63); BV(65);
    PUT #3, 83

    PRINT #3, SPACE$(RLEN); :    PUT #3, 84   '---- Milk transfer
    PRINT #3, USING "##.#^^^^ "; FM(1); FM(3); FM(8); FM(17); FM(30); FM(56); FM(63); FM(65);
    PUT #3, 84

    PRINT #3, SPACE$(RLEN); :    PUT #3, 85   '---- Meat transfer
    PRINT #3, USING "##.#^^^^ "; FF(1); FF(3); FF(8); FF(17); FF(30); FF(56); FF(63); FF(65);
    PUT #3, 85


    CLOSE :   PRINT :  PLAY "L16O3EC"
    PRINT "FILES FOR ", MID$(R$, 1, 30); " COMPLETED * * * * * * * * * * * * * * *"
    PRINT :  PRINT CRN$  :  PRINT
  END

'****************************  Gosubroutines  ***********************************

IMAGES: '  ********************  Image sub  ***************************************

    I0$ = "##.##^^^^"
    I9$ = " ##.##^^^^"
    I2$ = "\          \ \ \ \ \ \"
    I21$ = "##.##^^^^ ##.##^^^^ ##.##^^^^ ##.##^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^"
    I22$ = "##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^"
    I3$ = "\         \ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^"
    I4$ = "TOTAL       ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^ ##.#^^^^"
RETURN

DFACTORS:  '*********************  DF file input  *********************

    FILE$ = L1$
    CALL FINDFILE(FILE$, ENV$, FLG%)
    IF FLG% = FALSE THEN GOSUB MESSG1
    OPEN FILE$ FOR INPUT AS #1 LEN = 4096
```

```
    LINE INPUT #1, L$:    CALL PUTLINE(3, 10 + K, L$, RLEN)  ' Header
    LINE INPUT #1, L$
    LINE INPUT #1, L$
    LINE INPUT #1, L$
    LINE INPUT #1, L$

    FOR I = 1 TO N1%
      LINE INPUT #1, L$
      IF QREL(I) THEN
         DF(I, 1) = VAL(MID$(L$, 9, 8))
         DF(I, 2) = VAL(MID$(L$, 17, 8))

         FOR J = 3 TO P1%
            Z1 = J * 9 - 2: Z2 = J * 9 + 6: Z3 = Z2 - Z1 + 1
            DF(I, J) = VAL(MID$(L$, Z1, Z3))
         NEXT J
      END IF
    NEXT I

    CLOSE #1
    PRINT FILE$; " File read in * * * *  Computing * * *"

 RETURN

 SECTORIN:  '***************  160 Sector File Read  ********************

      Z3 = 11
      LINE INPUT #1, X$
      FOR J = 0 TO J1% - 10 STEP 10
        LINE INPUT #1, L$
        FOR II% = 1 TO 10
          Z1 = II% * 12 - 3
          U(J + II%) = VAL(MID$(L$, Z1, Z3))
        NEXT II%
      NEXT J

 RETURN

 MICHI:   '*********************  Individual dose parameters  ******************

      LINE INPUT #1, X$
      IF INSTR(UCASE$(X$), "SPECIFIC") > 0 THEN
         LINE INPUT #1, X$:  LINE INPUT #1, X$
         I = 0
         DO UNTIL EOF(1)
            LINE INPUT #1, X$
            IF INSTR(LEFT$(X$, 10), "EOF") THEN EXIT DO     ' Exit on EOF on last line
            IF LEN(X$) > 2 THEN  ELSE EXIT DO               ' Exit on blank line
            I = I + 1

            LOCATION$(I) = MID$(X$, 11, 26)
            DIREC$(I) = MID$(X$, 34, 5)
            DIST$(I) = MID$(X$, 53, 6)
            XQ1(I) = VAL(MID$(X$, 64, 10))
            XQ2(I) = VAL(MID$(X$, 80, 10))
            XQ3(I) = VAL(MID$(X$, 96, 10))
            DQ(I) = VAL(MID$(X$, 112, 10))
         LOOP
         NLOCS = I
      END IF

  RETURN

 '*********************************  Messages  **********************************

 MESSG1:
    BEEP: CLS :   LOCATE 10, 15
    COLOR 4, 3
    PRINT "<<<<<<<<<<<< FATAL ERROR >>>>>>>>>>>> ": PRINT : PRINT
    COLOR 7, 0
    PRINT "           FILE  ": FILE$; "  NOT FOUND !!!!!": PRINT
    PRINT "           Copy file to either current subdirectory or"
    PRINT "           Subdirectory indicated by environment string (CPRD)."
    PRINT "           For POP file 1999 is max year supported by program !!!"
    PRINT : PRINT : PRINT : CLOSE : END
 RETURN

 '************************  End of main program  *****************************
```

```
'*************************************************************************
SUB APPENDIXI (HMI())                                          '  5 Apr 94
'-------------------------------------------------------------------------

'  Dose commitments for Appendix I for printout file

'      HMI(agegroup, pathorgan, location)  Max Indiv. dose          INPUT
'      See SUB MIDOSE for HMI generation

'-------------------------------------------------------------------------

   SHARED AGE$(), ORGAN$()

'-------------------------------------------------------------------------

   CONST HGAMAPPI = 10                  ' mrad/y  RG 1.109-9
   CONST HBETAPPI = 20                  ' mrad/y          -9
   CONST HTBODAPPI = 5                  ' mrem/y          -9
   CONST HORGAPPI = 15                  ' mrem/y          -10

   IMAGE1$ = "AppI-Air-Doses ##.##^^^^ ##.##^^^^ ##.##^^^^  ##.##^^^^ ##.##^^^^ ##.##^^^^ ##.##^^^^ \     \ \
   \"
   IMAGE2$ = "AppI-Air-%     ###.##%   ###.##%   ###.##%                                        ##.##%"

'  Direct dose from Nobles to air and total Body ----------------------------

   HAIRGAMMA = HMI(4, 15, 1)       ' At site boundary
   HAIRBETA = HMI(4, 16, 1)        ' At site boundary
   HTOTALBOD = HMI(4, 1, 2)        ' At Residence (adult)

'  Inhalation and ingestion dose from iodine and particles --------------------
'   at residence, garden (veg/prod) and pasture (milk/meat).
'  Max total found for an age group K and organ J.

   HTMAX = 0
   FOR K = 1 TO 4
     FOR J = 1 TO 6                ' Total body counted as organ  !!!!!!!!!!!!!!!
                                   ' Set J = 2 TO 6 for not including T Body

       HTOT = HMI(K, J + 2, 2) + HMI(K, J + 8, 3) + HMI(K, J + 8, 4)
       IF HTOT > HTMAX THEN
         HTMAX = HTOT              ' Max iodine and particle dose
         KMAX% = K:   JMAX% = J
       END IF
     NEXT
   NEXT

   HINHAL = HMI(KMAX%, JMAX% + 2, 2)     ' Inhalation  at residence
   HVP = HMI(KMAX%, JMAX% + 8, 3)        ' Veg/Produce at garden
   HMM = HMI(KMAX%, JMAX% + 8, 4)        ' Milk/meat at pasture
   ORGAN$ = ORGAN$(JMAX%)                ' Max. organ
   AGE$ = AGE$(KMAX%)                    ' Max age group

'   PRINT HINHAL; HVP; HMM; HTMAX, AGE$, ORGAN$

   PRINT #3, SPACE$(RLEN); : PUT #3, 74
   PRINT #3, USING IMAGE1$; HAIRGAMMA; HAIRBETA; HTOTALBOD; HINHAL; HVP; HMM; HTMAX; AGE$; ORGAN$;
   PUT #3, 74

'--------------  Percents of App. I Design Objective

   PGAM = HAIRGAMMA / HGAMAPPI * 100
   PBET = HAIRBETA / HBETAPPI * 100
   PTBOD = HTOTALBOD / HTBODAPPI * 100
   PORG = HTMAX / HORGAPPI * 100

   PRINT #3, SPACE$(RLEN); : PUT #3, 82
   PRINT #3, USING IMAGE2$; PGAM; PBET; PTBOD; PORG;
   PUT #3, 82

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  APPENDIXI
```

```
'_____________________________________________________________________________
FUNCTION FORM$ (X!)          '                                        8 Mar 92
'_____________________________________________________________________________

'  Rounds using ROUNDOFF function and formats for report using FORMAT function
'  Functions must be declared in main program.

'_____________________________________________________________________________


'-----------------------------------------------------------------------------

   SIGFIG% = 2
   MINI! = .01
   MAX! = 999999!

   N! = ROUNDOFF!(X!, SIGFIG%)


   SELECT CASE N!
     CASE IS < MINI!
        M$ = FormatS$(N!, "0.0E+00;;0.0")
     CASE IS < 1
       M$ = "0" + LTRIM$(STR$(N!))
     CASE IS < MAX!
       M$ = FormatS$(N!, "###,##0.#")
     CASE ELSE
       M$ = FormatS$(N!, "0.0E+00")
   END SELECT

   FORM$ = M$

END FUNCTION  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> FORM$
```

```
'*****************************************************************************
SUB MIDOSE (K AS INTEGER) STATIC                    '   16 Nov 94
'       Dose calculation & file generation
'                K = Age group index                INPUT
'_____________________________________________________________________________
  SHARED SITENUM$, FPM, FPB, I7%
  STATIC F2, K2, K4, P4
  DIM I AS INTEGER
  DIM J AS INTEGER
'_____________________________________________________________________________

   FOR J = 1 TO NLOCS  '-------------------- Loop over Locations
      IF XQ1(J) > 0 THEN
        F2 = LOG(XQ2(J) / XQ1(J)) / LAMDA2      ' 2.26- Day decay
      END IF
      P4 = 1E+12 / SperY                        ' (pCi/Ci y/s)
      FOR I = 1 TO N1%   '------------------ Loop over nuclides
         IF QREL(I) = 0 THEN GOTO SKIPNUKE
'---- Air Transport Correction Factors --------------
         K2 = EXP(LAMDA(I) * F2)                ' Decay only adjustment factor for nobles & iodines
         K4 = EXP((LAMDA(I) - LAMDA8) * F2)     ' Decay & deposition adjustment factor for particles & iodines
         SELECT CASE J
           CASE 1                   ' Site Boundary
             IF K = 4 THEN                      ' Gamma and Beta
               HGAMMA = P4 * QREL(I) * XQ1(J) * DFAIR(I, 1)
               HBETA = P4 * QREL(I) * XQ1(J) * DFAIR(I, 2)
             END IF
           CASE 2                   ' Residence
             GOSUB AIRSUB
             GOSUB INHALATION
             GOSUB GROUND
           CASE 3                   ' Garden -- Veg only & Ground
             VEG = FTRANS(I, 1, 1)                  ' L. Veg                                    ' Veg. , m2
s/kg
             PRODUCE = FTRANS(I, 6, 1) * FGARDEN    ' Produce
             M1 = 0:   B1 = 0                       ' No milk or meat
             GOSUB INGESTION
           CASE 4                   ' Pasture -- Milk & Meat only
             VEG = 0:  PRODUCE = 0                  ' No veg. or produce
             M1 = FPM * FSM * FTRANS(I, 2, 1) + ((1 - FPM) + FPM * (1 - FSM)) * FTRANS(I, 4, 1)   ' Milk , m2
s/L
             B1 = FPB * FSB * FTRANS(I, 3, 1) + ((1 - FPB) + FPB * (1 - FSB)) * FTRANS(I, 5, 1)   ' Meat , m2
s/kg
             GOSUB INGESTION
         END SELECT

' --------- Sum doses over nuclide for Age group K and Location J  ----------
         HMI(K, 1, J) = HMI(K, 1, J) + A1                   ' Air sub, mrem
         HMI(K, 2, J) = HMI(K, 2, J) + G1                   ' Ground, mrem

         HMI(K, 3, J) = HMI(K, 3, J) + H1                   ' INH-BODY  , mrem
         HMI(K, 4, J) = HMI(K, 4, J) + H2                   ' INH-GI
         HMI(K, 5, J) = HMI(K, 5, J) + H3                   ' INH-THY
         HMI(K, 6, J) = HMI(K, 6, J) + H4                   ' INH-BONE
         HMI(K, 7, J) = HMI(K, 7, J) + H5                   ' INH-LIVER
         HMI(K, 8, J) = HMI(K, 8, J) + H6                   ' INH-LUNG

         HMI(K, 9, J) = HMI(K, 9, J) + I1                   ' ING-BODY , mrem
         HMI(K, 10, J) = HMI(K, 10, J) + I2                 ' ING-GI
         HMI(K, 11, J) = HMI(K, 11, J) + I3                 ' ING-THY
         HMI(K, 12, J) = HMI(K, 12, J) + I4                 ' ING-BONE
         HMI(K, 13, J) = HMI(K, 13, J) + I5                 ' ING-LIVER
```

```
        HMI(K, 14, J) = HMI(K, 14, J) + I6                          ' ING-LUNG

        HMI(K, 15, J) = HMI(K, 15, J) + HGAMMA                      ' Air gamma, mrad
        HMI(K, 16, J) = HMI(K, 16, J) + HBETA                       ' Air beta, mrad

'-----  Debug printout of parameters for the I8 nuclide   --------
'       Skipped when I7 is zero.

'         I7% = 56     ' I-131
'         I7% = 65     ' XE-135

        IF I = I7% THEN
          WIDTH LPRINT 133
          LPRINT "CPRDA  MI Parameters -------  ";
          LPRINT "SITE: "; SITENUM$; "   RUNTIME: "; TIMESTAMP$; "   J="; J; "  K="; K; "  I="; I; "   ";
LOCATION$(J)
          LPRINT
          LPRINT "  XQ1      XQ2      XQ3      DQ       K2       K4      LAMBDA   D1     FTRANS1   2       3
4       5       6       QREL()"
          LPRINT USING "##.#^^^^"; XQ1(J); XQ2(J); XQ3(J); DQ(J); K2;
          LPRINT USING "##.#^^^^"; K4; LAMDA(I); D1; FTRANS(I, 1, 1); FTRANS(I, 2, 1); FTRANS(I, 3, 1);
FTRANS(I, 4, 1); FTRANS(I, 5, 1); FTRANS(I, 6, 1); QREL(I)
          LPRINT
          LPRINT "  RCONS5   6       7       8       9       P4      Veg   Produce  M1      B1      I9     CIng
   FPM      FPB      FSM      FSB"
          LPRINT USING "##.#^^^^"; RCONS(K, 5); RCONS(K, 6); RCONS(K, 7); RCONS(K, 8); RCONS(K, 9);
          LPRINT USING "##.#^^^^"; P4; VEG; PRODUCE; M1; B1; I9; CIng; FPM; FPB; FSM; FSB
          LPRINT
          LPRINT "   A1       G1       H1       H2       H3       H4       H5       H6       I1       I2       I3
I4       I5       I6       Gamma    Beta"
          LPRINT USING "##.#^^^^"; A1; G1; H1; H2; H3; H4; H5; H6; I1; I2; I3; I4; I5; I6; HGAMMA; HBETA
          LPRINT STRING$(132, "-"): LPRINT
          IF J = 4 THEN LPRINT
        END IF

SKIPNUKE:
      NEXT I

'--------- Clear dose values for next location

      A1 = 0: G1 = 0: H1 = 0: H2 = 0: H3 = 0: H4 = 0: H5 = 0: H6 = 0
      I1 = 0: I2 = 0: I3 = 0: I4 = 0: I5 = 0: I6 = 0: HGAMMA = 0: HBETA = 0

    NEXT J

    PRINT "MI COMPLETED --- ";

EXIT SUB

'************************* Gosubs *****************************************

AIRSUB:  '------- Air submersion dose, mrem, A1, calculated only from nobles

        SELECT CASE I

           CASE 8, 26 TO 31, 61 TO 67
              A1 = P4 * QREL(I) * XQ1(J) * K2 * DF(I, 1) * FSHIELD          ' Nobles, mrem, EAB

           CASE ELSE
              A1 = 0                                                        ' All else

        END SELECT

  RETURN

GROUND:  '------- Ground irradiation dose, mrem, G1   Garden

        D1 = FNBUILDUP(LAMDA(I), TBUILDUP)                                  ' s
        G1 = P4 * QREL(I) * DQ(J) * K4 * D1 * DF(I, 2) * FSHIELD            ' mrem

  RETURN

INHALATION:  '------- Inhalation dose, H1 - H6, mrem

        SELECT CASE I

           CASE 1, 3
             CInh = P4 * QREL(I) * RCONS(K, 8) * XQ1(J)                     ' H3 & C14, pCi

           CASE 8, 26 TO 31, 61 TO 67
             CInh = P4 * QREL(I) * RCONS(K, 8) * XQ1(J) * K2                ' Nobles

           CASE 56 TO 60
             CInh = P4 * QREL(I) * RCONS(K, 8) * (XQ1(J) * K2 + XQ3(J) * K4)   ' Iodines

           CASE ELSE
             CInh = P4 * QREL(I) * RCONS(K, 8) * XQ3(J) * K4                ' Particles & all else
```

```
        END SELECT

        H1 = CInh * DF(I, 3)                                          ' BODY, mrem
        H2 = CInh * DF(I, 4)                                          ' GI
        H3 = CInh * DF(I, 5)                                          ' THY
        H4 = CInh * DF(I, 6)                                          ' BONE
        H5 = CInh * DF(I, 7)                                          ' LIVER
        H6 = CInh * DF(I, 8)                                          ' LUNG

  RETURN

INGESTION:  '------- Ingestion dose, I1 - I6, mrem

'                Veg                  Produce              Milk              Meat
        I9 = VEG * RCONS(K, 5) + PRODUCE * RCONS(K, 9) + M1 * RCONS(K, 6) + B1 * RCONS(K, 7)    ' m2 s/y  or
m3/y

        IF I = 1 OR I = 3 THEN
          CIng = P4 * QREL(I) * I9 * XQ1(J)                           ' H-3 & C-14
        ELSE
          CIng = P4 * QREL(I) * I9 * K4 * DQ(J)                       ' All other
        END IF

        I1 = CIng * DF(I, 9)                                          ' BODY, mrem
        I2 = CIng * DF(I, 10)                                         ' GI
        I3 = CIng * DF(I, 11)                                         ' THY
        I4 = CIng * DF(I, 12)                                         ' BONE
        I5 = CIng * DF(I, 13)                                         ' LIVER
        I6 = CIng * DF(I, 14)                                         ' LUNG

   RETURN

END SUB   '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  MIDOSE
```

```
'-------------------------------------------------------------------------
SUB POPDOSE (K AS INTEGER) STATIC                          ' 16 Nov 94
'
'-------------------------------------------------------------------------
'           Population dose calculation
'
'                   K = Age group index                 INPUT
'
'-------------------------------------------------------------------------
  SHARED J7%, I7%, SITENUM$, A3, E3, K3, FPM, FPB, SITE$

  STATIC F2, K2, K4, P4

  DIM I AS INTEGER
  DIM J AS INTEGER
'
'-------------------------------------------------------------------------
   IF K = 4 THEN
      IF OUT.FLAG% < 4 THEN

'------  Open detailed dose file for output

         OPEN OUT.DETAIL$ FOR RANDOM AS #2 LEN = LEN(TITLE)
         RECLEN% = LEN(TITLE)
         LL$ = OUT.DETAIL$ + " ADULT AIR-DOSE FOR SITE: " + LEFT$(SITE$, 21)
         TITLE.LL = LEFT$(LL$, RECLEN%):    PUT #2, 1, TITLE
         LL$ = "Run of: " + TIMESTAMP$ + " from " + MID$(V$,17)

         TITLE.LL = LEFT$(LL$, RECLEN%):   PUT #2, 2, TITLE
         PRINT :  PRINT :  PRINT "FILES FOR "; OUT.DETAIL$; " OPENED * * * * ";

      END IF
   END IF

   ROW = CSRLIN:    COL = POS(0)
   LOCATE 1, 74:    PRINT "      "          ' Initialize sector no. display
   FOR J = 1 TO J1%
      IF POP(J) = 0 THEN GOTO SKIPSECTOR

      LOCATE 1, 67:   COLOR 3, 1:  PRINT " Sector =";    ' Display sector no.
      COLOR 12, 1: PRINT J: COLOR 14, 1

      ERASE HPO                                          ' Initialise sums array

      IF CHIQ1(J) > 0 THEN
        F2 = LOG(CHIQ2(J) / CHIQ1(J)) / LAMDA2           ' 2.26- Day decay
      END IF
      P4 = POP(J) * FAGE(K) / SperY * 1E+09              ' man y/s (pCi/Ci * rem/mrem)

      FOR I = 1 TO N1%
         IF QREL(I) = 0 THEN GOTO SKIPNUKE2

'---- Air Transport Correction Factors --------------

         K2 = EXP(LAMDA(I) * F2)              ' Decay only adjustment factor for nobles & iodines
         K4 = EXP((LAMDA(I) - LAMDA8) * F2)   ' Decay & deposition adjustment factor for particles & iodines

'------- Air submersion dose, A1, calculated only from nobles

         SELECT CASE I
            CASE 8, 26 TO 31, 61 TO 67
               A1 = P4 * QREL(I) * CHIQ1(J) * K2 * DF(I, 1) * FOCCUP          ' Nobles, man-rem
            CASE ELSE
               A1 = 0                                                         ' All else
         END SELECT

'------- Ground irradiation dose, G1

         D1 = FNBUILDUP(LAMDA(I), TBUILDUP)                                   ' s
         G1 = P4 * QREL(I) * DOQ(J) * K4 * D1 * DF(I, 2) * FOCCUP             ' man-rem

'------- Inhalation dose, H1 - H6


         SELECT CASE I
            CASE 1, 3
               CInh = P4 * QREL(I) * RCONS(K, 4) * CHIQ1(J)                   ' H3 & C14 , man pCi rem/mrem
            CASE 8, 26 TO 31, 61 TO 67
               CInh = P4 * QREL(I) * RCONS(K, 4) * CHIQ1(J) * K2              ' Nobles
            CASE 56 TO 60
               CInh = P4 * QREL(I) * RCONS(K, 4) * (CHIQ1(J) * K2 + CHIQ3(J) * K4)   ' Iodines
            CASE ELSE
               CInh = P4 * QREL(I) * RCONS(K, 4) * CHIQ3(J) * K4              ' Particles & all else
         END SELECT

         H1 = CInh * DF(I, 3)                                                 ' INH-BODY, man-rem
         H2 = CInh * DF(I, 4)                                                 ' INH-GI
         H3 = CInh * DF(I, 5)                                                 ' INH-THY
```

```
        H4 = CInh * DF(I, 6)                                                    ' INH-BONE
        H5 = CInh * DF(I, 7)                                                    ' INH-LIVER
        H6 = CInh * DF(I, 8)                                                    ' INH-LUNG

'------- Ingestion dose, I1 - I6

        V1 = FTRANS(I, 1, 2)                                                    ' Veg. , m2 s/kg
RG 1.109-27
        M1 = FPM * FSM * FTRANS(I, 2, 2) + ((1 - FPM) + FPM * (1 - FSM)) * FTRANS(I, 4, 2)    ' Milk , m2 s/L
   "    -27
        B1 = FPB * FSB * FTRANS(I, 3, 2) + ((1 - FPB) + FPB * (1 - FSB)) * FTRANS(I, 5, 2)    ' Meat , m2 s/kg
  "     -27

        I9 = V1 * RCONS(K, 1) + M1 * RCONS(K, 2) + B1 * RCONS(K, 3)     ' m2-s/y  or  m3/y

        IF I = 1 OR I = 3 THEN
          CIng = P4 * QREL(I) * I9 * E3                                         ' man pCi rem/mrem  for H-3 & C-14
        ELSE
          CIng = P4 * QREL(I) * I9 * K3 * K4                                    ' man pCi rem/mrem  for all else
        END IF

        I1 = CIng * DF(I, 9)                                                    ' ING-BODY, man-rem
        I2 = CIng * DF(I, 10)                                                   ' ING-GI
        I3 = CIng * DF(I, 11)                                                   ' ING-THY
        I4 = CIng * DF(I, 12)                                                   ' ING-BONE
        I5 = CIng * DF(I, 13)                                                   ' ING-LIVER
        I6 = CIng * DF(I, 14)                                                   ' ING-LUNG

' ------------------------  Sum doses over nuclides  ------------------------

        HPO(1) = HPO(1) + A1
        HPO(2) = HPO(2) + G1
        HPO(3) = HPO(3) + H1
        HPO(4) = HPO(4) + H2
        HPO(5) = HPO(5) + H3
        HPO(6) = HPO(6) + H4
        HPO(7) = HPO(7) + H5
        HPO(8) = HPO(8) + H6

        HPO(9) = HPO(9) + I1
        HPO(10) = HPO(10) + I2
        HPO(11) = HPO(11) + I3
        HPO(12) = HPO(12) + I4
        HPO(13) = HPO(13) + I5
        HPO(14) = HPO(14) + I6

'-----  Debug printout of parameters for the I7 nuclide and J7 sector  --------
'       Skipped when J7 & I7 are zero.  J7 & I7 are declared in file SETFILE$

'         J7% = 6             ' (POP=434)
'         I7% = 56            ' I-131

        IF J = J7% AND I = I7% THEN
          WIDTH LPRINT 132
          LPRINT "CPRDA  POP Parameters -------  ";
          LPRINT "SITE: "; SITENUM$; "   RUNTIME: "; TIMESTAMP$; "    K="; K; "   J="; J; "   I="; I
          LPRINT
          LPRINT "  A3      E3      K3      POP     CHIQ1   CHIQ2   CHIQ3   DOQ     K2      K4      LAMDA
D1";
          LPRINT "    FTRANS1   2       3"
          LPRINT USING "##.#^^^^"; A3; E3; K3; POP(J); CHIQ1(J); CHIQ2(J); CHIQ3(J); DOQ(J); K2;
          LPRINT USING "##.#^^^^"; K4; LAMDA(I); D1; FTRANS(I, 1, 2); FTRANS(I, 2, 2); FTRANS(I, 3, 2)
          LPRINT
          LPRINT "  QREL    FAGE    RCONS1   2       3       4       FPM     FPB     FSM     FSB"
          LPRINT USING "##.#^^^^"; QREL(I); FAGE(K); RCONS(K, 1); RCONS(K, 2); RCONS(K, 3); RCONS(K, 4); FPM;
FPB; FSM; FSB
          LPRINT
          LPRINT "  P4      V1      M1      B1      I9      CIn     Z(1)    Z(2)    Z(3)"
          LPRINT USING "##.#^^^^"; P4; V1; M1; B1; I9; CIng; Z(1); Z(2); Z(3)
          LPRINT
          LPRINT "  A1      G1      H1      H2      H3      H4      H5      H6      I1      I2      I3
I4";
          LPRINT "     I5      I6"
          LPRINT USING "##.#^^^^"; A1; G1; H1; H2; H3; H4; H5; H6; I1; I2; I3; I4; I5; I6
          LPRINT STRING$(132, "*"):  LPRINT
          IF K = 4 THEN
            LPRINT CHR$(13); CHR$(12);  ' Return  & Form feed
          END IF
        END IF

'-----------------------  File generation  ---------------------------------

        IF K = 4 THEN
           SELECT CASE OUT.FLAG%
             CASE 1                                             ' Sum over sectors
               BODY(I) = BODY(I) + A1 + G1 + H1 + I1
               GUT(I) = GUT(I) + A1 + G1 + H2 + I2
               THY(I) = THY(I) + A1 + G1 + H3 + I3
               BONE(I) = BONE(I) + A1 + G1 + H4 + I4
```

```
                LIVER(I) = LIVER(I) + A1 + G1 + H5 + I5
                LUNG(I) = LUNG(I) + A1 + G1 + H6 + I6
              CASE 2, 3
                IF I = NUK% OR NUK% = 0 THEN              ' Print for only selected nuke or
                   ALTDOSES.SEC = J                       '  for all nukes by sector
                   ALTDOSES.NUK = I
                   ALTDOSES.H1 = A1
                   ALTDOSES.H2 = G1
                   ALTDOSES.H3 = H1
                   ALTDOSES.H4 = H2
                   ALTDOSES.H5 = H3
                   ALTDOSES.H6 = H4
                   ALTDOSES.H7 = H5
                   ALTDOSES.H8 = H6
                   ALTDOSES.H9 = I1
                   ALTDOSES.H10 = I2
                   ALTDOSES.H11 = I3
                   ALTDOSES.H12 = I4
                   ALTDOSES.H13 = I5
                   ALTDOSES.H14 = I6
                   PUT #2, , ALTDOSES
                END IF
            END SELECT
         END IF

SKIPNUKE2:
       NEXT I

       IF (OUT.FLAG% = 2 OR OUT.FLAG% = 3) AND K = 4 THEN
          ALTDOSES.SEC = J:    ALTDOSES.NUK = 999
          PUT #2, , ALTDOSES
       END IF

'***  Sum paths for histogram ( Body dose vs. sector for each age group )  ****

       B(J, K) = HPO(1) + HPO(2) + HPO(3) + HPO(9)

'-----------  Sum sectors for tables  ( Organ dose vs. age group )  -----------

       HBOD(K) = HBOD(K) + HPO(1) + HPO(2) + HPO(3) + HPO(9)        ' BODY
       HGI(K) = HGI(K) + HPO(4) + HPO(10) + HPO(1) + HPO(2)         ' G.I.
       HTHY(K) = HTHY(K) + HPO(5) + HPO(11) + HPO(1) + HPO(2)       ' THY
       HBONE(K) = HBONE(K) + HPO(6) + HPO(12) + HPO(1) + HPO(2)     ' BONE
       HLIV(K) = HLIV(K) + HPO(7) + HPO(13) + HPO(1) + HPO(2)       ' LIVER
       HLUNG(K) = HLUNG(K) + HPO(8) + HPO(14) + HPO(1) + HPO(2)     ' LUNG

SKIPSECTOR:

     NEXT J

     LOCATE ROW, COL:   SOUND 5500, 1
     PRINT "POP COMPLETED --- "

     IF OUT.FLAG% = 1 AND K = 4 THEN

       FOR I = 1 TO N1%
         IF QREL(I) THEN
           DOSES.NUKE = MID$(NUKE$(I), 2, 8)
           DOSES.H1 = BODY(I)
           DOSES.H2 = GUT(I)
           DOSES.H3 = THY(I)
           DOSES.H4 = BONE(I)
           DOSES.H5 = LIVER(I)
           DOSES.H6 = LUNG(I)
           PUT #2, , DOSES
         END IF
       NEXT I
      CLOSE #2
     END IF

END SUB   '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> POPDOSE
```

```
'------------------------------------------------------------ 6 Jul 90----------
SUB PUTLINE (FILENUM%, RN%, LL$, RECLEN%) STATIC
'
'    Puts line LL$ of length RECLEN to random file
'
'     FILENUM% = File number                          INPUT
'     RN%      = Record Number                        INPUT
'     LL$      = Character string                     INPUT
'     RECLEN%  = Length of record                     INPUT
'

      CPRDOUT.REC = SPACE$(RECLEN%)
      IF LEN(LL$) > 0 THEN LSET CPRDOUT.REC = LL$
      PUT FILENUM%, RN%, CPRDOUT

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  PUTLINE
```

```
'*******************************************************************************
SUB TERFOOD                                          ' Last change:  22 Apr 92
'-------------------------------------------------------------------------------

'    Calculates food transfers for veg; and milk and meat
'    from pasture and stored feed (grain). Also Produce for MI
'    Note parameters checked against RG 1.109 & GASPAR II on 22 APR 92
'-------------------------------------------------------------------------------

   DIM THV(2), THMP(2), THFP(2), THF(2), THP(2)

   DIM I AS INTEGER
   DIM J AS INTEGER

   SHARED BV(), FM(), FF(), FMGOAT(), LOCATION$(), SITE$

'-------------------------------------------------------------------------------

'---------  Parameter values -- All from Reg. Guide 1.109 Rev 1 unless otherwise indicated

   HTW = 14 * SperD          ' Weathering Half-time, s                 1.109-69
   LW = LN2 / HTW            ' Weathering decay factor, 1/s

   TGV = 60 * SperD          ' Growing time for veg, s                 1.109-68
   TGMP = 30 * SperD         ' Growing time for milk-pasture, s        1.109-68
   TGFP = 30 * SperD         ' Growing time for meat-pasture, s        1.109-68
   TGMF = 90 * SperD         ' Growing time for milk-feed, s           BNWL-2209 (FOOD)
   TGFF = 90 * SperD         ' Growing time for meat-feed, s           BNWL-2209 (FOOD)

'******  MI
   THV(1) = 1 * SperD        ' Holdup time for leafy veg, s            1.109-69
   THP(1) = 60 * SperD       ' Holdup time for produce, s              1.109-69, GASPAR p. 2.24
   THMP(1) = 2 * SperD       ' Holdup time for milk-human, s           1.109-68
   THFP(1) = 20 * SperD      ' Holdup time for meat-human, s           1.109-69
   THF(1) = 90 * SperD       ' Holdup time for feed-animal, s          1.109-69

'******* POP
   THV(2) = 14 * SperD       ' Holdup time for all veg, s              1.109-69, GASPAR p. 2.24
   THMP(2) = 4 * SperD       ' Holdup time for milk-human, s           1.109-68
   THFP(2) = 20 * SperD      ' Holdup time for meat-human, s           1.109-69
   THF(2) = 90 * SperD       ' Holdup time for feed-animal, s          1.109-69

   YV = 2                    ' Yield for veg, kg/m2 wet                1.109-69
   YMP = .7                  ' Yield for milk-pasture, kg/m2 wet       1.109-69
   YFP = .7                  ' Yield for meat-pasture, kg/m2 wet       1.109-69
   YMF = 2                   ' Yield for milk-feed, kg/m2 wet          1.109-58, Rev 0; GASPAR p. 2.24
   YFF = 2                   ' Yield for meat-feed, kg/m2 wet          1.109-58, Rev 0; GASPAR p. 2.24

   FR = .2                   ' Retention factor, All but iodines, -    1.109-68
   FRI = 1                   ' Retention factor, Iodines, -            1.109-68
   P = 240                   ' Soil areal density, kg/m2               1.109-68
   QCOW = 50                 ' Milk Cow Fodder intake, kg/d            1.109-38
   QGOAT = 6                 ' Milk Goat Fodder intake, kg/d           1.109-38
   QBEEF = 50                ' Beef Cow Fodder intake, kg/d            1.109-38

   HUMID = .008              ' Absolute humidity, kg/m3                GASPAR p. 2.8
   FPLANT = .5               ' Plant to atmosphere tritium ratio, -    1.109-27
   FWATER = .75              ' Fraction plant mass that is water, -    1.109-27

   CONCARB = .00016          ' Conc. carbon in atmosphere, kg/m3       1.109-27
   FCARBON = .11             ' Fraction plant mass that is carbon, -   1.109-26

'------------ Goat Milk Transfer Factors, d/L  --  RG 1.109-38  -----------------

   FMGOAT(1) = .17:      FMGOAT(3) = .1                              ' Tritium & Carbon
   FMGOAT(13) = .00013:  FMGOAT(14) = .00013                         ' Fe
   FMGOAT(21) = .013                                                 ' Cu
   FMGOAT(34) = .014:    FMGOAT(35) = .014                           ' Sr
   FMGOAT(36) = .014:    FMGOAT(37) = .014                           ' Sr
   FMGOAT(56) = .06:     FMGOAT(57) = .06                            ' I
   FMGOAT(58) = .06:     FMGOAT(59) = .06:   FMGOAT(60) = .06        ' I
   FMGOAT(68) = .3:      FMGOAT(69) = .3                             ' Cs
   FMGOAT(70) = .3:      FMGOAT(71) = .3:    FMGOAT(72) = .3         ' Cs

'-------------------------------------------------------------------------------

   FOR I = 1 TO N1
     IF QREL(I) THEN

       SELECT CASE I

         CASE 1    ' H-3

           FVEG = FWATER * FPLANT / HUMID          ' pCi/kg per pCi/m3
           FPRODUCE = FVEG
           FMPAST = FVEG
           FMFEED = FVEG
```

```
            FFPAST = FVEG
            FFFEED = FVEG

          CASE 3    ' C-14

            FVEG = FCARBON / CONCARB                    ' pCi/kg per pCi/m3   RG 1.109-26
            FPRODUCE = FVEG
            FMPAST = FVEG
            FMFEED = FVEG
            FFPAST = FVEG
            FFFEED = FVEG

          CASE ELSE

            IF I > 55 AND I < 61 THEN
              F = FRI                                   ' Iodines only
            ELSE
              F = FR                                    ' All else
            END IF

'       Veg

            CVLEAF = F * FNBUILDUP((LAMDA(I) + LW), TGV) / YV
            CVSOIL = BV(I) * FNBUILDUP(LAMDA(I), TBUILDUP) / P
            FVEG = CVLEAF + CVSOIL                                  ' m2-s/kg

'       Milk
'       --- Pasture ----------------
            CVLEAF = F * FNBUILDUP((LAMDA(I) + LW), TGMP) / YMP
            CVSOIL = BV(I) * FNBUILDUP(LAMDA(I), TBUILDUP) / P
            FMPAST = CVLEAF + CVSOIL                                ' m2-s/kg

'       --- Stored Feed ----------
            CVLEAF = F * FNBUILDUP((LAMDA(I) + LW), TGMF) / YMF
            CVSOIL = BV(I) * FNBUILDUP(LAMDA(I), TBUILDUP) / P
            FMFEED = CVLEAF + CVSOIL                                ' m2-s/kg

'       Meat (Beef)
'       --- Pasture ------------
            CVLEAF = F * FNBUILDUP((LAMDA(I) + LW), TGFP) / YFP
            CVSOIL = BV(I) * FNBUILDUP(LAMDA(I), TBUILDUP) / P
            FFPAST = CVLEAF + CVSOIL                                ' m2-s/kg

'       --- Stored Feed ------------
            CVLEAF = F * FNBUILDUP((LAMDA(I) + LW), TGFF) / YFF
            CVSOIL = BV(I) * FNBUILDUP(LAMDA(I), TBUILDUP) / P
            FFFEED = CVLEAF + CVSOIL                                ' m2-s/kg

        END SELECT

'--------  Select Milk animal parameters  --------------

        IF INSTR(UCASE$(LOCATION$(4)), "G") THEN
          Q = QGOAT
          IF FMGOAT(I) > 0 THEN FM(I) = FMGOAT(I)
        ELSE
          Q = QCOW
        END IF

'---- Transfer factors in units of pCi/kg per pCi/m2-s except H & C which are pCi/kg per pci/m3
'       for MI (J=1) and POP (J=2) holdups

        FOR J = 1 TO 2
          FTRANS(I, 1, J) = FVEG * FNEXPN(LAMDA(I) * THV(J))                                    ' Vegetables
          FTRANS(I, 6, J) = FVEG * FNEXPN(LAMDA(I) * THP(J))                                    ' Produce
          FTRANS(I, 2, J) = FMPAST * FM(I) * Q * FNEXPN(LAMDA(I) * THMP(J))                     ' Cow or Goat,
pasture
          FTRANS(I, 3, J) = FFPAST * FF(I) * QBEEF * FNEXPN(LAMDA(I) * THFP(J))                ' Beef Cattle,
pasture
          FTRANS(I, 4, J) = FMFEED * FM(I) * Q * FNEXPN(LAMDA(I) * (THF(J) + THMP(J)))         ' Cow or Goat,
stored feed
          FTRANS(I, 5, J) = FFFEED * FF(I) * QBEEF * FNEXPN(LAMDA(I) * (THF(J) + THFP(J)))     ' Beef Cattle,
stored feed
'                                  d/kg    kg/d
        NEXT

'       IF I = 70 THEN
'         WIDTH LPRINT 132
'         LPRINT SITE$, NUKE$(I): LPRINT
'         LPRINT "CVLEAF  "; F; LAMDA(I); LW; TGV; FNBUILDUP(LAMDA(I) + LW, TGV); YV, CVLEAF
'         LPRINT : LPRINT
'         LPRINT "CVSOIL  "; BV(I); TBUILDUP; FNBUILDUP(LAMDA(I), TBUILDUP); P, CVSOIL
'         LPRINT : LPRINT
```

```
'       LPRINT "FTRANS1 "; CVLEAF; CVSOIL; FVEG; THV(2); FNEXPN(LAMDA(I) * THV(2)), FTRANS(I, 1, 2)
'       SHELL "FF"
'       STOP
'     END IF

'     WIDTH LPRINT 132
'     IF I = 1 THEN LPRINT "QA Parameter Printout for "; SITE$, LOCATION$(4), TIMESTAMP$:  LPRINT
'     LPRINT " NUKE     BV       FM       FF      FTRANS1   2        3        4        5        1        2";
'     LPRINT "       3       4       5"
'     LPRINT USING "\      \"; NUKE$(I);
'     LPRINT USING "##.#^^^^"; BV(I); FM(I); FF(I); FTRANS(I, 1, 1); FTRANS(I, 2, 1); FTRANS(I, 3, 1);
'     LPRINT USING "##.#^^^^"; FTRANS(I, 4, 1); FTRANS(I, 5, 1); FTRANS(I, 1, 2);
'     LPRINT USING "##.#^^^^"; FTRANS(I, 2, 2); FTRANS(I, 3, 2); FTRANS(I, 4, 2); FTRANS(I, 5, 2);

    END IF

  NEXT

END SUB       '>>>>>>>>>>>>>>>>>> End CPRDA >>>>>>>>>>>>>>>>>>>>>>>>>> TERFOOD
```

```
' CPRDL.BAS   ****    Liquid dose program for CPRD Project  ---  MI version

'************************* Version ***********************************************
  CONST V$ = "****  CPRDL  ***  VERSION OF 12-Jan-95"
  CONST CRN$ = "Copyright (C)  1995  Battelle Memorial Institute (DA Baker, Author)
'*********************************************************************************

'       Author:   D. A. Baker, PNL

'       Contact:  D. A. Baker, PNL, (509) 375 3809

'***************************** Abstract ************************************

'   Program calculates population dose commitments via liquid pathways:
'   drinking water and aquatic foods.  Four age groups are considered,
'   83 nuclides (N1), and 5 organs (P1).  Dose factors are those of Reg Guide 1.109.
'   In addition MI doses are estimated for the above paths plus shoreline.
'   No irrigated terrestrial foods are considered.

'***************************** Disclaimer **********************************

'      This program was prepared under a contract with an agency of the
'      U. S. Government.  Neither the agency, Pacific Northwest Laboratory,
'      nor the author makes any warranty or assumes any legal liability or
'      responsibility for the accuracy or usefullness of this program.

'****************************** Software ***********************************

'  Compiler:            Microsoft Basic 7.1
'  Libraries:           DAB1.LIB & DAB1.QLB
'  Supporting Modules:  None

'*********************** Update History ************************************

' 20 APR 89  Run to completion
' 25 APR 89  Corrections made
' 30 MAY 89  FindFile corrected and message improved.
'  1 JUN 90  MI dose addition.
' 14 Nov 90  MISCMOD2 module addition and MI QA printout
'  5 Feb 91  Release input modified to use PARSE2 sub
' 30 Jun 91  Modified Dilution calculation added debug printout for POPDOSE
' 13 Jul 91  Modified Input setip file for new CPRD.SET format.
'            Set detailed file flag to 1 to always get file.
' 18 Jul 91  Selects pop file from 1980 to 1999.
'  9 Aug 91  Setup file processing change.
' 11 Nov 91  Added App I doses & % of design objective.
' 21 Feb 92  Revised Rel read for G E M releases in file.
' 24 Feb 92  Further GEM revisions.
' 16 Mar 92  Revised POP dilution calculation using pipflow as basis and using
'            CMX to indicate Complete MiXing in stream.  Added FEXPOSR parameter.
' 22 Apr 92  Final parameter check with RG 1.109. Added MI holdup for fish.
' 13 May 92  RECIRC() added to concentration calculation.  Inadvertently left out!
'  9 Jun 92  Added site-specific biofactors for fish & invert input thru REL file.
' 10 Aug 92  Added print out of doses by age, path, and organ for QA printout
' 23 Mar 93  Added site to run line for summary file. Added copyright notice.
' 18 Jan 94  Minor changes to formatting App I doses.
'  5 Apr 94  Reformatted IMAGE1$ and IMAGE2$ in APPENDIXI for 3 sig figures.
' 10 Nov 94  Added support for Specific MI biofactors.
' 12 Jan 95  Set MI drinking water holdup from 1 to .5 day.

'********************** Command Line Input *********************************

'               Site number  [ Nuclide number for MI parameter printout ]

'   Ex.         CPRDL 5 26

'_____________________________________________________________________________
```

```
'****************************** Files ***************************************
'            ------- Description -------     Type      No.    Name Variable
'   Input:   Setup file                      text      #1       SETFILE$
'            Site specific params            text      #1       IN.SITE$
'            Population distribution         text      #1       IN.POP$
'            Release file                    text      #1       IN.REL$
'   Output:  Dose summary file               random    #2       OUT.SUMMARY$
'            Dose detail file                random    #1       OUT.DETAIL$
'************************ Internal Standard Units ***************************
'               Activity        pCi        input Ci/y release rate
'               Water Conc.     pCi/L
'               Dose            mrem
'               Water vol       L
'               Water flow      L/y        input CFS for river; L/y for pipe
'               Time            s
'************************** Initialization ******************************
   DEFSNG A-Z

   DECLARE SUB APPENDIXI (H!())
   DECLARE SUB FINDFILE (FILE$, ENV$, FLG%)                                  ' DAB1
   DECLARE SUB GETLINE (FILENUM%, COMSYMBOL$, LINE$)                         ' DAB1
   DECLARE SUB MIDOSE (K AS INTEGER)
   DECLARE SUB PARSE2 (COMSTRING$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())      ' DAB1

   DECLARE SUB POPDOSE (K AS INTEGER)
   DECLARE SUB PUTLINE (FILENUM%, RECNUM%, LINE$, RECLEN%)
   DECLARE FUNCTION EXIST% (FILE$)                                           ' DAB1
   DECLARE FUNCTION TIMESTAMP$ ()                                            ' DAB1

'$INCLUDE: 'FORMAT.BI'

'----------------------- Program Constants ---------------------------------
   CONST FALSE = 0, TRUE = NOT FALSE

   CONST N1% = 83                          ' Nuclides
   CONST J1% = 160                         ' Sectors
   CONST P1% = 5                           ' Organs

   CONST COMSYMBOL$ = "!'{!*"
   CONST SperY = 3.1558E+07                ' s/y
   CONST SperD = 86400                     ' s/d
   CONST LperFT3 = 28.32                   ' L/ft3
   CONST mREMperREM = 1000                 ' mrem/rem
   CONST pCIperCI = 1E+12                  ' pCi/Ci

   CONST MAXRECS% = 100                    ' OUT.SUMMARY$ no. of records
   CONST RLEN% = 128                       ' OUT.SUMMARY$ rec length including cr & lf
   CONST ENV$ = "CPRD"                     ' Environment string containing path to input files
   CONST SETFILE$ = "NEWCPRD.SET"          ' Setup file (New format)
   SPCE$ = CHR$(32)                        ' Space

'------------------ Parameters

   CONST TdwPOP = 1 * SperD                ' D. Water holdup for pop in sec (24 hr) RG 1.109-69
   CONST TdwMI = .5 * SperD                ' D. Water holdup for MI in sec (12 hr)  RG 1.109-69
   CONST T1POP = 7 * SperD                 ' Pop Fish & invert holdup in sec (7 d)     "    -69
   CONST T1MI = 1 * SperD                  ' MI Fish & invert holdup in sec (1 d)      "    -69
   CONST T8 = 1 * SperY                    ' Shore deposition duration in sec ( 1 y)  This Study
   CONST FSOLD = 100 * .693 / SperD        ' Soldat shoreline depo. flux (L/m2-s)   RG 1.109-14

'------------------------- Random file record types -------------------------

   TYPE OUTRECTYPE
     REC AS STRING * RLEN
   END TYPE

   TYPE TITLES
     LL AS STRING * 60
   END TYPE

   TYPE FILETYPE
     NUKE AS STRING * 8
     H1 AS SINGLE
     H2 AS SINGLE
     H3 AS SINGLE
     H4 AS SINGLE
     H5 AS SINGLE
     H6 AS SINGLE
     H7 AS SINGLE
     H8 AS SINGLE
```

```
    H9 AS SINGLE
    H10 AS SINGLE
    DUM AS STRING * 12
  END TYPE

'------------------------  Global Parameter declarations  --------------------

  DIM SHARED BIOFAC(N1, 4) AS SINGLE      ' Bioaccum Factors (nuke, biota)
  DIM SHARED CONCMI(N1) AS SINGLE         ' MI Water Concentration    (pCi/L)
  DIM SHARED CONCPOP(N1) AS SINGLE        ' POP Water Concentration    (pCi/L)
  DIM SHARED DF(N1, P1 + 1) AS SINGLE     ' Dose Factors
  DIM SHARED RCONS(4, 11) AS SINGLE       ' Generic consumption rates  (kg/y)
  DIM SHARED FAGE(4) AS SINGLE            ' Age group fractions

  DIM SHARED HBOD(4) AS SINGLE            ' T Body doses  by age group
  DIM SHARED HBONE(4) AS SINGLE           ' Bone doses    by age group
  DIM SHARED HGI(4) AS SINGLE             ' G I doses     by age group
  DIM SHARED HTHY(4) AS SINGLE            ' Thyroid doses by age group
  DIM SHARED HLIV(4) AS SINGLE            ' Liver doses   by age group

  DIM SHARED HMI(4, 20) AS SINGLE         ' Doses by age group and path-organ
  DIM SHARED HOP(P1, 4) AS SINGLE         ' Doses by organ and pathway
  DIM SHARED HPO(10) AS SINGLE            ' Doses by path-organ
  DIM SHARED LAMDA(N1) AS SINGLE          ' Decay rates                (s-1)
  DIM SHARED NUKE$(N1)                    ' Nuclide symbol
  DIM SHARED QREL(N1) AS SINGLE           ' Release rate               (Ci/y)
  DIM SHARED RECIRC(N1) AS SINGLE         ' Recirculation factor       (-)

  DIM SHARED POPSUM, POPDW, S$, SITE$, X$, Y$

  DIM SHARED OUT.FLAG%, OUT.DETAIL$

  DIM SHARED TITLE AS TITLES
  DIM SHARED CPRDOUT AS OUTRECTYPE    ' Summary output file
  DIM SHARED DOSES AS FILETYPE        ' Detailed output file

'----------------------------  Local declarations  ----------------------------

  DIM I AS INTEGER
  DIM J AS INTEGER
  DIM K AS INTEGER

  DIM ARGS$(25)                           ' Parsed line arguments
  DIM M(4)                                ' MI Mixing ratios for output file
  DIM PATH$(4)                            ' Path names
  DIM POP(J1) AS SINGLE                   ' Population by sector
  DIM AGE(4) AS STRING * 6                ' Age names
  DIM ORGAN$(5)                           ' Organ names
  DIM RELTYPE(3) AS STRING * 1            ' Release type: G E M

  SITE$ = SPACE$(23)

'---------------------------  FN Functions  -----------------------------------

  DEF FNBUILDUP (L, T)   '-----------  Shoreline buildup factor
    IF L * T > .01 THEN
       FNBUILDUP = (1 - EXP(-L * T)) / L
    ELSE
       FNBUILDUP = T
    END IF
  END DEF

  DEF FNEXPN (Z)    '--------- Exponential of negative argument -----------
     IF Z > 80 THEN
        FNEXPN = 0
     ELSE
        FNEXPN = EXP(-Z)
     END IF
   END DEF

'*********  Age group fraction and generic consumption rates  *** RG 1.109-39,40 *******
'        water, fresh fish, salt fish, fresh invert, salt invert.

  FOR I = 1 TO 4
    READ AGE$(I), FAGE(I), RCONS(I, 1), RCONS(I, 2), RCONS(I, 3), RCONS(I, 4), RCONS(I, 5)
    READ RCONS(I, 6), RCONS(I, 7), RCONS(I, 8), RCONS(I, 9), RCONS(I, 10), RCONS(I, 11)
  NEXT
'          ---------------------- pop ----------------------     ------------- mi ------------------
'          Age Grp    fage   water   f f    s f    f i    s i     water    f f   s f   f i   s i  shore
  DATA    "Infant", 0.0144, 170,    0,     0,     0,     0,      330,     0,    0,    0,    0,    0
  DATA    "Child ", 0.16,   260,    2.2,   2.2,   0.33,  0.33,   510,   6.9,  6.9,  1.7,  1.7,   14
  DATA    "Teen  ", 0.117,  260,    5.2,   5.2,   0.75,  0.75,   510,    16,   16,  3.8,  3.8,   67
  DATA    "Adult ", 0.709,  370,    6.9,   6.9,   1,     1,      730,    21,   21,    5,    5,   12
'                     1       2      3      4      5      6       7      8     9     10    11

  FOR I = 1 TO 4: READ PATH$(I):  NEXT
  DATA "D-Water", "Fish", "Invert", "Shore"

  FOR I = 1 TO 5: READ ORGAN$(I):  NEXT
```

```
   DATA "Total-Body", "GI-LLI", "Thyroid", "Bone", "Liver"

   RESTORE

'****************************  Program Start  ********************************

   GOSUB IMAGES

'************************  Command Line Input  *********************************

   COLOR 14, 1:  CLS
   PRINT V$: PRINT : PRINT
   C$ = COMMAND$
   IF LEN(C$) THEN
      CALL PARSE2(C$, 10, SPCE$, NUMARGS%, ARGS$())
      SITENUM$ = ARGS$(1)                    ' Site number
      I7% = VAL(ARGS$(2))                  ' Nuclide number
   ELSE
      BEEP: CLS : PRINT
      PRINT "   Program needs command line input to run:":   PRINT
      PRINT "    CPRDL SiteNumber [ NucNumber ]": PRINT
      PRINT "    Ex.   CPRDL 35                  (Normal for Surry)"
      PRINT "          CPRDL 35  56              (For optional I-131 printout)"
      PRINT : END
   END IF

   IF LEN(SITENUM$) = 1 THEN SITENUM$ = "0" + SITENUM$
   SITENUM% = VAL(SITENUM$)

'************************  Input SETUP file  *********************************

   CALL FINDFILE(SETFILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN SETFILE$ FOR INPUT AS #1

   LINE INPUT #1, DUM$                              ' Header

   DO UNTIL EOF(1)
     CALL GETLINE(1, COMSYMBOL$, L$)
     CALL PARSE2(L$, 6, SPCE$, NUM%, ARGS$())
     IF INSTR(ARGS$(1), "EOF") THEN EXIT DO

       SELECT CASE LEFT$(ARGS$(1), 3)
         CASE "YEA"
            Y$ = ARGS$(2)                          ' Release year  yy
         CASE "DOS"
            IN.INFANT$ = ARGS$(2) + ARGS$(3)
            IN.CHILD$ = ARGS$(2) + ARGS$(4)
            IN.TEEN$ = ARGS$(2) + ARGS$(5)
            IN.ADULT$ = ARGS$(2) + ARGS$(6)
         CASE "GAM"
          ' File not used
         CASE "JFD"
          '  Files not used
         CASE "GEN"
            IN.GENERIC$ = ARGS$(2) + ARGS$(3)
         CASE "SIT"
            IN.SITE$ = ARGS$(2) + ARGS$(3)
         CASE "POP"
            MID$(ARGS$(3), 7, 2) = SITENUM$
            IN.POP$ = ARGS$(2) + ARGS$(3)
         CASE "REL"
            MID$(ARGS$(3), 4, 2) = Y$
            MID$(ARGS$(3), 7, 2) = SITENUM$
            IN.REL$ = ARGS$(2) + ARGS$(3)
         CASE "SUM"
            MID$(ARGS$(3), 4, 2) = Y$
            MID$(ARGS$(3), 7, 2) = SITENUM$
            OUT.SUMMARY$ = ARGS$(2) + ARGS$(3)
         CASE "LIQ"
            MID$(ARGS$(3), 4, 2) = Y$
            MID$(ARGS$(3), 7, 2) = SITENUM$
            OUT.DETAIL$ = ARGS$(2) + ARGS$(3)
         CASE "AIR", "CHI"
             ' Not used
         CASE ELSE
           CLS :  BEEP: LOCATE 10, 15
           PRINT "Keyword "; ARGS$(1); " in user file not understood --"
           PRINT "        Check your spelling.":  END
       END SELECT

   LOOP

   CLOSE #1
   OUT.FLAG% = 1

'   PRINT OUT.SUMMARY$
```

```
'  IF OUT.FLAG% = FALSE THEN
'    PRINT "DO YOU WISH DETAILED RESULT FILE FOR ADULT POP DOSES (N/Y)? ";
'    WHILE Q$ = "": Q$ = INKEY$: WEND: PRINT Q$
'    IF UCASE$(Q$) = "Y" THEN OUT.FLAG% = 1 ELSE OUT.FLAG% = 2
'  END IF

'******************  Open SUM File for specified Release Type  ***************

   RELTYPE$(1) = "G":  RELTYPE$(2) = "E":  RELTYPE$(3) = "M"
   FILE$ = OUT.SUMMARY$:   FLG% = FALSE
   FOR K = 1 TO 3
     TEMP = LEN(FILE$)
     MID$(FILE$, LEN(FILE$), 1) = RELTYPE$(K)
     IF EXIST%(FILE$) THEN
       OPEN FILE$ FOR RANDOM AS #2 LEN = RLEN
       EXIT FOR
     ELSEIF K = 3 THEN
'---------  Initialize file if no records as a M file.
       PRINT "No SUM files found for this site."
       LINE INPUT " -- Do you want G file created (Y/N)?"; Q$
       IF UCASE$(Q$) <> "Y" THEN  PRINT "Ending Program ----- ": END

       MID$(FILE$, LEN(FILE$), 1) = RELTYPE$(1)
       OPEN FILE$ FOR RANDOM AS #2 LEN = RLEN
       IF LOF(2) = 0 THEN
         FOR I = 1 TO MAXRECS
           CPRDOUT.REC = SPACE$(RLEN):   PUT #2, I, CPRDOUT
         NEXT
       END IF
     END IF
   NEXT

   OUT.SUMMARY$ = FILE$

'**************************  Input SSD File record  ***************************

   FILE$ = IN.SITE$
   CALL FINDFILE(FILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1 LEN = 2048

   LINE INPUT #1, L$:   CALL PUTLINE(2, 15, L$, RLEN)    ' Header
   PRINT L$
   DO UNTIL EOF(1)
     CALL GETLINE(1, COMSYMBOL$, LINE$)
     CALL PARSE2(LINE$, 22, SPCE$, NUM%, ARGS$())
     IF INSTR(ARGS$(1), "EOF") THEN EXIT DO
     IF SITENUM% = VAL(ARGS$(1)) THEN EXIT DO
   LOOP
   IF SITENUM% <> VAL(ARGS$(1)) THEN
      CLS :   LOCATE 3, 5
      PRINT "Site Number "; SITENUM%; " not in file "; FILE$; ".  Check File and Try Again.": END
   END IF
   CLOSE #1
   PRINT ARGS$(1), ARGS$(2), ARGS$(3)

   LSET SITE$ = ARGS$(1)                              ' Site number
   MID$(SITE$, 4) = ARGS$(2)                          ' Add site
   MID$(SITE$, 22) = ARGS$(3)                         ' Add state
   S$ = ARGS$(4)                                      ' Salinity flag (F, S, B)
   W$ = ARGS$(5)                                      ' Diluent type (R, L, O, E, G)
   FLOWRIVER = VAL(ARGS$(6)) * LperFT3 * SperY        ' Average River flow converted from cfs to L/y
   M1$ = ARGS$(7)                                     ' Mixing ratio for d. water
   FEXPOSR = VAL(ARGS$(8))                            ' Pop. Fractional Exposure to aquatic foods
   X$ = ARGS$(9)                                      ' Consumption flag or rate or harvest for fish, C2
   M2$ = ARGS$(10)                                    ' Mixing ratio for fish
   Y$ = ARGS$(11)                                     ' Consumption flag or rate or harvest for invert, C3
   M3$ = ARGS$(12)                                    ' Mixing ratio for invert

 ' MI mixing ratios.

   M1MI$ = ARGS$(13)                                  ' D. Water
   M2MI$ = ARGS$(14)                                  ' Fish
   M3MI$ = ARGS$(15)                                  ' Invert
   M4MI$ = ARGS$(16)                                  ' Shoreline

   IF UCASE$(X$) = "GENERIC" THEN X$ = "G"            ' | Generic consumption
   IF UCASE$(Y$) = "GENERIC" THEN Y$ = "G"            ' | flags  for pop

'****************************  Screen Initialization  *************************

   CLS : COLOR 11, 3: PRINT SPACE$(80); :  LOCATE 1, 1
   PRINT TAB(15); "Executing CPRDL for ";
   COLOR 14, 3:  PRINT SITE$:  PRINT : COLOR 14, 1

'*****************************  Input IN.POP$ File  ***************************

   FILE$ = IN.POP$
```

```
   FLG% = FALSE: I = VAL(MID$(FILE$, LEN(FILE$) - 8, 2)) - 1
' Search for file from 1980 to 1999
   DO UNTIL FLG% > 0 OR I > 99        ' The year 99 is final year of search
     I = I + 1
     MID$(FILE$, LEN(FILE$) - 8, 2) = LTRIM$(STR$(I))
     F$ = FILE$
     CALL FINDFILE(F$, ENV$, FLG%)
   LOOP

   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1 LEN = 1024

   LINE INPUT #1, L$:  CALL PUTLINE(2, 16, L$, RLEN)              ' Main header

   Z3 = 11
   LINE INPUT #1, P$:  CALL PUTLINE(2, 27, (P$), RLEN)
   POPDW = VAL(MID$(P$, 1, 10))                                   ' Drinking water population
   FOR J = 0 TO J1 - 10 STEP 10
     LINE INPUT #1, LINE$
     FOR I = 1 TO 10
       Z1 = I * 12 - 3
       POP(J + I) = VAL(MID$(LINE$, Z1, Z3))
     NEXT I
   NEXT J

   POPSUM = 0
   FOR J = 1 TO J1:    POPSUM = POPSUM + POP(J):    NEXT

   CLOSE #1:    PRINT FILE$; " FILE READ IN * * * *  POPSUM ="; POPSUM; "     POPDW ="; POPDW

'*************************  Input IN.REL File  *********************************

   FILE$ = IN.REL$
   CALL FINDFILE(FILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1 LEN = 1024

   LINE INPUT #1, L$:  CALL PUTLINE(2, 17, L$, RLEN)          ' Header
   INPUT #1, DUM$, DUM$, POPFACTOR, FLOWPIPE, MWH             ' Flowpipe in L/y
   TWH = MWH * .000001                                        ' Convert to terrawatt-hr

   LINE INPUT #1, L$
   LINE INPUT #1, L$

   DO UNTIL EOF(1)
      CALL GETLINE(1, COMSYMBOL$, LINE$)
      CALL PARSE2(LINE$, 11, SPC$, NUMARGS%, ARGS$())
      I = VAL(ARGS$(1))                                       ' Nuclide number
      NUKE$(I) = ARGS$(2)                                     ' Nuclide symbol
      QREL(I) = VAL(ARGS$(6))                                 ' Release (Ci/y)
      RECIRC(I) = VAL(ARGS$(7))                               ' Recirculation
      IF RECIRC(I) = 0 THEN RECIRC(I) = 1                     ' Default recirc.
      IF NUMARGS% > 7 THEN
        IF NUMARGSREL% < 10 THEN NUMARGSREL% = 8              ' When no special MI biofactors, set to 8
        BIOFAC(I, 1) = VAL(ARGS$(8))                          ' Site specific POP fish biofactor
        BIOFAC(I, 2) = VAL(ARGS$(9))                          ' Site specific POP invert biofactor
      END IF
      IF NUMARGS% > 9 THEN
        NUMARGSREL% = 10
        BIOFAC(I, 3) = VAL(ARGS$(10))                         ' Site specific MI fish biofactor
        BIOFAC(I, 4) = VAL(ARGS$(11))                         ' Site specific MI invert biofactor
      END IF
   LOOP

   CLOSE #1:    PRINT FILE$; " FILE READ IN * * * *"

'---------------  Correct populations for current year

   POPDW = POPDW * POPFACTOR                  ' Current D. water pop.
   POPSUM = POPSUM * POPFACTOR                ' Current total pop.

'---------  Select Shoreline factor for the water bodies --- RG 1.109-15  -----------

   SELECT CASE UCASE$(W$)
     CASE "C"
       FSHORE = .1                  ' Canal
     CASE "R", "E"
       FSHORE = .2                  ' River & Estuary
     CASE "L"
       FSHORE = .3                  ' Lake
     CASE "O", "B"
       FSHORE = .5                  ' Ocean or Bay
     CASE ELSE
       FSHORE = 1                   ' Other -- Tidal Basin, etc.
   END SELECT

'-----------------  Select dilution flows (L/y)

'  Notes: When mixing ratios are designated CMX (Complete MiXing in stream) then river or
```

```
'        estuary flows used for dilution.  Otherwise the mixing ratio given is used with
'        the pipe flow as dilution flow.  (WC$ = "C" for canal - no river flow needed. Ex.: Haddam Neck)

   IF FLOWPIPE = 0 THEN GOSUB MESSG2

   IF (UCASE$(W$) = "R" OR UCASE$(W$) = "E") AND FLOWRIVER = 0 THEN GOSUB MESSG3

   IF INSTR(UCASE$(M1MI$), "CMX") THEN M1MI = FLOWPIPE / FLOWRIVER ELSE M1MI = VAL(M1MI$)
   IF INSTR(UCASE$(M2MI$), "CMX") THEN M2MI = FLOWPIPE / FLOWRIVER ELSE M2MI = VAL(M2MI$)
   IF INSTR(UCASE$(M3MI$), "CMX") THEN M3MI = FLOWPIPE / FLOWRIVER ELSE M3MI = VAL(M3MI$)
   IF INSTR(UCASE$(M4MI$), "CMX") THEN M4MI = FLOWPIPE / FLOWRIVER ELSE M4MI = VAL(M4MI$)

   IF INSTR(UCASE$(M1$), "CMX") THEN M1 = FLOWPIPE / FLOWRIVER ELSE M1 = VAL(M1$)
   IF INSTR(UCASE$(M2$), "CMX") THEN M2 = FLOWPIPE / FLOWRIVER ELSE M2 = VAL(M2$)
   IF INSTR(UCASE$(M3$), "CMX") THEN M3 = FLOWPIPE / FLOWRIVER ELSE M3 = VAL(M3$)

'------- Concentrations at outfall  (pCi/L)

   FOR I = 1 TO N1

     IF QREL(I) THEN
        CONCMI(I) = QREL(I) * RECIRC(I) / FLOWPIPE * pCIperCI
        CONCPOP(I) = QREL(I) * RECIRC(I) / FLOWPIPE * pCIperCI / mREMperREM   ' Accounts for dose factors being
in mrem
     END IF

   NEXT I

'*************************  Input IN.GENERIC$ file  *************************

   FILE$ = IN.GENERIC$
   CALL FINDFILE(FILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN GOSUB MESSG1
   OPEN FILE$ FOR INPUT AS #1
   LINE INPUT #1, L$:  CALL PUTLINE(2, 18, L$, RLEN)   ' Header
   LINE INPUT #1, L$
   LINE INPUT #1, L$
   FOR I = 1 TO N1
     LINE INPUT #1, LINE$
     IF QREL(I) > 0 THEN
       LAMDA(I) = VAL(MID$(LINE$, 14, 10))          ' Decay rates

'------  Use generic values when no site specific values found in REL file

       IF UCASE$(S$) = "S" THEN                          ' POP Salt biofactors
         IF BIOFAC(I, 1) = 0 THEN  BIOFAC(I, 1) = VAL(MID$(LINE$, 77, 9))     '   Fish
         IF BIOFAC(I, 2) = 0 THEN  BIOFAC(I, 2) = VAL(MID$(LINE$, 86, 9))     '   Invert
       ELSE                                          ' POP Fresh factors
         IF BIOFAC(I, 1) = 0 THEN  BIOFAC(I, 1) = VAL(MID$(LINE$, 105, 9))    '   Fish
         IF BIOFAC(I, 2) = 0 THEN  BIOFAC(I, 2) = VAL(MID$(LINE$, 114, 9))    '   Invert
       END IF
     END IF
   NEXT I

   CLOSE #1:   PRINT FILE$; "  FILE READ IN * * * *": PRINT

'****************  Write Liquid path parameters to summary file  *****************

   D$ = "CPRDL was last run: " + TIMESTAMP$ + "  from " + RIGHT$(V$, 21) + "  with Command line: " + C$ + "
Site: " + SITE$
   CALL PUTLINE(2, 2, D$, RLEN)

   LL1$ = STR$(POPFACTOR) + "  " + S$ + "  " + W$ + "  " + STR$(FLOWPIPE) + "  " + STR$(FLOWRIVER / LperFT3 /
SperY) + "  "
   LL2$ = STR$(M1) + " " + X$ + " " + STR$(M2) + "  " + Y$ + " " + STR$(M3) + "  "
   LL3$ = STR$(FSHORE) + "  " + STR$(TWH) + "  " + STR$(FEXPOSR)
   LL$ = LL1$ + LL2$ + LL3$:   CALL PUTLINE(2, 70, LL$, RLEN)

   PRINT #2, SPACE$(RLEN); :    PUT #2, 78
   PRINT #2, USING "##.#^^^^ "; QREL(1); QREL(11); QREL(13); QREL(14); QREL(16); QREL(17);
   PRINT #2, USING "##.#^^^^ "; QREL(22); QREL(35); QREL(56); QREL(68); QREL(70);
   PUT #2, 78

   PRINT #2, SPACE$(RLEN); :    PUT #2, 79
   PRINT #2, USING "##.#^^^^ "; RECIRC(1); RECIRC(11); RECIRC(13); RECIRC(14); RECIRC(16); RECIRC(17);
   PRINT #2, USING "##.#^^^^ "; RECIRC(22); RECIRC(35); RECIRC(56); RECIRC(68); RECIRC(70);
   PUT #2, 79

   PRINT #2, SPACE$(RLEN); :    PUT #2, 80
   PRINT #2, USING "##.#^^^^ "; BIOFAC(1, 1); BIOFAC(11, 1); BIOFAC(13, 1); BIOFAC(14, 1); BIOFAC(16, 1);
BIOFAC(17, 1);
   PRINT #2, USING "##.#^^^^ "; BIOFAC(22, 1); BIOFAC(35, 1); BIOFAC(56, 1); BIOFAC(68, 1); BIOFAC(70, 1);
   PUT #2, 80

   PRINT #2, SPACE$(RLEN); :    PUT #2, 81
   PRINT #2, USING "##.#^^^^ "; BIOFAC(1, 2); BIOFAC(11, 2); BIOFAC(13, 2); BIOFAC(14, 2); BIOFAC(16, 2);
BIOFAC(17, 2);
   PRINT #2, USING "##.#^^^^ "; BIOFAC(22, 2); BIOFAC(35, 2); BIOFAC(56, 2); BIOFAC(68, 2); BIOFAC(70, 2);
   PUT #2, 81
```

```
   IF NUMARGSREL% > 9 THEN
     LL$ = "Note:  Different site-specific biofactors used for POP and MI."
   ELSEIF NUMARGSREL% > 7 THEN
     LL$ = "Note:  Same site-specific biofactors used for POP and MI."
   ELSE
     LL$ = "Note:  Generic biofactors used."
   END IF
   CALL PUTLINE(2, 71, LL$, RLEN) :  PRINT LL$

'****************  Calculate doses for the four age groups  ****************

   FOR K = 1 TO 4

'------------  Select dose factor file name

     SELECT CASE K
        CASE 1
         L1$ = IN.INFANT$
        CASE 2
         L1$ = IN.CHILD$
        CASE 3
         L1$ = IN.TEEN$
        CASE 4
         L1$ = IN.ADULT$
     END SELECT

'-----------  Perform calculations

     GOSUB DFACTORS                                  ' Read in dose factors
     CALL MIDOSE(K)                                  ' MI dose calculation
     CALL POPDOSE(K)                                 ' Pop dose calculation
     PRINT

   NEXT K

'************************  Generate dose summary table  **********************

   FOR K = 1 TO 4
     SELECT CASE K
       CASE 1
         L1$ = "INFANT"
       CASE 2
         L1$ = "CHILD"
       CASE 3
         L1$ = "TEEN"
       CASE 4
         L1$ = "ADULT"
     END SELECT

     PRINT #2, SPACE$(RLEN); :    PUT #2, 41 + K
     PRINT #2, USING I1$; L1$; HBOD(K); HGI(K); HTHY(K); HBONE(K); HLIV(K);
     PUT #2, 41 + K

'----------  Sum doses over age groups

     T2 = T2 + HBOD(K)           ' T. body
     T3 = T3 + HGI(K)            ' GI
     T4 = T4 + HTHY(K)           ' Thyroid
     T5 = T5 + HBONE(K)          ' Bone
     T6 = T6 + HLIV(K)           ' Liver
   NEXT K

   PRINT #2, SPACE$(RLEN); :    PUT #2, 46
   PRINT #2, USING I5$; T2; T3; T4; T5; T6;          ' Pop totals
   PUT #2, 46

   LL$ = "TOTAL POPULATION CONSIDERED: DRINKING WATER:" + STR$(POPDW) + "     AQUATIC FOOD:" + STR$(POPSUM)
   CALL PUTLINE(2, 72, LL$, RLEN)

   M(1) = M1MI: M(2) = M2MI: M(3) = M3MI: M(4) = M4MI

   FOR J = 0 TO 3

      PRINT #2, SPACE$(RLEN); :    PUT #2, 38 + J
      K = 5 * J
      PRINT #2, USING I2$; PATH$(J + 1); M(J + 1);
      PRINT #2, USING I21$; HMI(4, K + 1); HMI(4, K + 2); HMI(4, K + 3); HMI(4, K + 4); HMI(4, K + 5);
Adult
      PUT #2, 38 + J

   NEXT J

   CALL APPENDIXI(HMI())

   IF I7% > 0 THEN
     LPRINT
     LPRINT "SITE: "; SITE$; "   RUNTIME: "; TIMESTAMP$; S$; "  "; W$: LPRINT
     LPRINT
     LPRINT "  Path        T. Body     GI LLI    Thyroid   Bone      Liver"
```

```
      LPRINT
      FOR P = 1 TO 4     ' Age group
        TTBOD = 0:  TGI = 0:  TTHY = 0:  TBONE = 0:  TLIV = 0
        LPRINT AGE$(P)
        FOR J = 0 TO 3   ' Path
          K = 5 * J
          LPRINT USING I2$; PATH$(J + 1);
          LPRINT USING I21$; HMI(P, K + 1); HMI(P, K + 2); HMI(P, K + 3); HMI(P, K + 4); HMI(P, K + 5)
          TTBOD = TTBOD + HMI(P, K + 1)
          TGI = TGI + HMI(P, K + 2)
          TTHY = TTHY + HMI(P, K + 3)
          TBONE = TBONE + HMI(P, K + 4)
          TLIV = TLIV + HMI(P, K + 5)
        NEXT
        LPRINT
        LPRINT USING I6$; TTBOD; TGI; TTHY; TBONE; TLIV
        LPRINT :  LPRINT
      NEXT
      LPRINT
    END IF

    CLOSE :  PRINT :  PLAY "L16O3EC"
    PRINT "OUTPUT FILE "; OUT.SUMMARY$; " CLOSED * * * * * * * * * * * * * * * *"
    IF OUT.FLAG% = 1 THEN PRINT OUT.DETAIL$; " CLOSED * * * *"
    PRINT : PRINT CRN$ :  PRINT
  END

'************************** Gosub routines ************************************

IMAGES:  '********** Image sub

      I1$ = " \       \    ##.#^^^^    ##.#^^^^    ##.#^^^^    ##.#^^^^    ##.#^^^^"
      I2$ = " \       \  ###.#### "
      I21$ = "  ##.#^^^^   ##.#^^^^  ##.#^^^^  ##.#^^^^  ##.#^^^^"

      I5$ = "TOTAL        ##.#^^^^    ##.#^^^^    ##.#^^^^    ##.#^^^^    ##.#^^^^"
      I6$ = "TOTAL        ##.#^^^^   ##.#^^^^  ##.#^^^^  ##.#^^^^  ##.#^^^^"
  RETURN

DFACTORS:  '************  Subroutine for DF file input  ***********************
      '
      FILE$ = L1$
      CALL FINDFILE(FILE$, ENV$, FLG%)
      IF FLG% = FALSE THEN GOSUB MESSG1
      OPEN FILE$ FOR INPUT AS #1 LEN = 2048
      LINE INPUT #1, L$:  CALL PUTLINE(2, 17 + 2 * K, L$, RLEN)     ' Header
      LINE INPUT #1, L$
      LINE INPUT #1, L$
      LINE INPUT #1, L$
      LINE INPUT #1, L$
      FOR I = 1 TO N1
        LINE INPUT #1, LINE$
        IF QREL(I) > 0 THEN
           DF(I, 6) = VAL(MID$(LINE$, 17, 7))                          ' Shore
          FOR J = 0 TO 4
            Z1 = 79 + 9 * J: Z2 = 78 + 9 * (J + 1): Z3 = Z2 - Z1 + 1
            DF(I, J + 1) = VAL(MID$(LINE$, Z1, Z3))                   ' Ingestion
          NEXT J
        END IF
      NEXT I
      CLOSE #1:    PRINT FILE$; " FILE READ IN * * * *";
  RETURN

'******************************** Messages ************************************

MESSG1:
   BEEP: CLS :   LOCATE 10, 15
   COLOR 4, 3
   PRINT "<<<<<<<<<<<< FATAL ERROR >>>>>>>>>>>> ": PRINT : PRINT
   COLOR 7, 0
   PRINT "           FILE  "; FILE$; "  NOT FOUND !!!!!": PRINT
   PRINT "           Copy file to either current subdirectory or"
   PRINT "           Subdirectory indicated by environment string (CPRD)."
   PRINT : PRINT : PRINT : CLOSE : END
RETURN

MESSG2:
   BEEP: CLS :   LOCATE 12, 1
   PRINT "  No dose calculation possible--- Pipe Flow = 0.  Program aborted"
   PRINT "  Check REL file for this site if site has liquid releases."
   PRINT : PRINT : PRINT : CLOSE : END
RETURN

MESSG3:
   BEEP: CLS :   LOCATE 12, 1
   PRINT "  No dose calculation possible--- River Flow = 0.  Program aborted."
   PRINT "  Check SSD file for this site.  Site should have river or estuary flow."
```

```
   PRINT : PRINT : PRINT : CLOSE : END
RETURN
'************************  END OF MAIN PROGRAM  ******************************
```

```
'*************************************************************************
SUB APPENDIXI (HMI())                                          '   5 Apr 94
'-------------------------------------------------------------------------

'  Dose commitments for Appendix I for printout file
'      HMI(agegroup, pathorgan)  Max Indiv. dose                  INPUT
'-------------------------------------------------------------------------

   SHARED AGE() AS STRING * 6, ORGAN$()

'-------------------------------------------------------------------------

   CONST HTBODAPPI = 3                    ' mrem/y  RG 1.109-9
   CONST HORGAPPI = 10                    ' mrem/y  RG 1.109-9

   IMAGE1$ = "AppI-Water ##.##^^^^ ##.##^^^^ ##.##^^^^  ##.##^^^^ ###.##%   ##.##^^^^ ##.##^^^^  ##.##^^^^
###.##%  \      \ \      \"
   IMAGE2$ = "AppI-Water ##.##^^^^ ##.##^^^^ ##.##^^^^  ##.##^^^^ ##.#^^^^%  ##.##^^^^ ##.##^^^^  ##.##^^^^
##.#^^^^%  \     \ \     \"

'  Direct & ingestion dose (Adult) to total Body ----------------------------

   HTBODDW = HMI(4, 1)                                 ' Drinking water
   HTBODFS = HMI(4, 6) + HMI(4, 11)                    ' Fish & Shellfish
   HTBODSH = HMI(4, 16)                                ' Shoreline

   HTBODTOT = HTBODDW + HTBODFS + HTBODSH              ' Total


'  Ingestion dose to Organ ---------------------------------------------------
'  From D. water, fish, and invert.
'  Max total found for an age group and organ.

   HTMAX = 0
   FOR K = 1 TO 4
     FOR J = 1 TO 5
       HTOT = HMI(K, J) + HMI(K, J + 5) + HMI(K, J + 10)
       IF HTOT > HTMAX THEN
         HTMAX = HTOT                                  ' Max organ dose
         KMAX% = K:   JMAX% = J
       END IF
     NEXT
   NEXT

   HDW = HMI(KMAX%, JMAX%)                             ' Drinking water
   HFS = HMI(KMAX%, JMAX% + 5) + HMI(KMAX%, JMAX% + 10)   ' Fish & invert
   ORGAN$ = ORGAN$(JMAX%)                              ' Max. organ
   AGE$ = AGE$(KMAX%)                                  ' Max age group

'   PRINT HDW; HFS; HTMAX, AGE$, ORGAN$

'---------------  Percents of App. I Design Objective

   PTBOD = HTBODTOT / HTBODAPPI * 100
   PORG = HTMAX / HORGAPPI * 100

   PRINT #2, SPACE$(RLEN); : PUT #2, 29
   IF (PTBOD < 999) AND (PORG < 999) THEN
     PRINT #2, USING IMAGE1$; HTBODDW; HTBODFS; HTBODSH; HTBODTOT; PTBOD; HDW; HFS; HTMAX; PORG; AGE$; ORGAN$;
   ELSE
     PRINT :  PRINT "Large App-I doses ...  Percents = "; PTBOD, PORG
     PRINT #2, USING IMAGE2$; HTBODDW; HTBODFS; HTBODSH; HTBODTOT; PTBOD; HDW; HFS; HTMAX; PORG; AGE$; ORGAN$;
   END IF
   PUT #2, 29

'  PRINT #2, SPACE$(RLEN); : PUT #2, 91
'  PRINT #2, USING IMAGE2$; PGAM; PBET; PTBOD; PORG;
'  PUT #2, 91

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  APPENDIXI
```

```
'-------------------------------------------------------------------------------
SUB MIDOSE (K AS INTEGER) STATIC                    '              12-Jan-95
'          MI dose calculation
'               K = Age group index                                INPUT
'_______________________________________________________________________________
  SHARED FLOWPIPE, FSHORE, I7%, W$
  SHARED M1MI, M2MI, M3MI, M4MI

  STATIC OFFSET%

  DIM I AS INTEGER, J AS INTEGER, P AS INTEGER
'_______________________________________________________________________________
   ERASE HOP           ' Reset array for doses
'-------------------------------------------------------------------------------
   FOR I = 1 TO N1
     IF QREL(I) > 0 THEN
       IF UCASE$(S$) = "S" THEN
          OFFSET% = 8    ' Salt
       ELSE
          OFFSET% = 7    ' Fresh
       END IF
'----- If no MI site specific biofactors,  then use POP factors
       IF BIOFAC(I, 3) > 0 THEN BFish = BIOFAC(I, 3) ELSE BFish = BIOFAC(I, 1)
       IF BIOFAC(I, 4) > 0 THEN BInvert = BIOFAC(I, 4) ELSE BInvert = BIOFAC(I, 2)
'----- Calculate activity ingestion and shorline exposure
       E1 = CONCMI(I) * M1MI * RCONS(K, 6) * FNEXPN(LAMDA(I) * TdwMI)                    ' D. water (pCi/y)
       E2 = CONCMI(I) * M2MI * BFish * RCONS(K, OFFSET%) * FNEXPN(LAMDA(I) * T1MI)       ' Fish    (pCi/y)
       E3 = CONCMI(I) * M3MI * BInvert * RCONS(K, OFFSET% + 2) * FNEXPN(LAMDA(I) * T1MI) ' Invert  (pCi/y)
       E4 = CONCMI(I) * M4MI * FSOLD * FNBUILDUP(LAMDA(I), T8) * RCONS(4, 11) * FSHORE   ' Shore
(pCi-h/m2)
'---- Calculate ingestion doses from each nuclide and each of 5 organs
'      plus direct shoreline dose to T. Body.
      FOR P = 1 TO P1
         HOP(P, 1) = E1 * DF(I, P)              ' D. water    (mrem)
         HOP(P, 2) = E2 * DF(I, P)              ' Fish
         HOP(P, 3) = E3 * DF(I, P)              ' Invert
      NEXT P
      HOP(1, 4) = E4 * DF(I, 6)                 ' Shore  ( T. Body only)
'----- Sum doses over nuclides for each organ & for D. water and aquatic foods
       HMI(K, 1) = HMI(K, 1) + HOP(1, 1)                    ' D. Water
       HMI(K, 2) = HMI(K, 2) + HOP(2, 1)
       HMI(K, 3) = HMI(K, 3) + HOP(3, 1)
       HMI(K, 4) = HMI(K, 4) + HOP(4, 1)
       HMI(K, 5) = HMI(K, 5) + HOP(5, 1)
       HMI(K, 6) = HMI(K, 6) + HOP(1, 2)                    ' Fish
       HMI(K, 7) = HMI(K, 7) + HOP(2, 2)
       HMI(K, 8) = HMI(K, 8) + HOP(3, 2)
       HMI(K, 9) = HMI(K, 9) + HOP(4, 2)
       HMI(K, 10) = HMI(K, 10) + HOP(5, 2)
       HMI(K, 11) = HMI(K, 11) + HOP(1, 3)                  ' Invert
       HMI(K, 12) = HMI(K, 12) + HOP(2, 3)
       HMI(K, 13) = HMI(K, 13) + HOP(3, 3)
       HMI(K, 14) = HMI(K, 14) + HOP(4, 3)
       HMI(K, 15) = HMI(K, 15) + HOP(5, 3)
       HMI(K, 16) = HMI(K, 16) + HOP(1, 4)                  ' Shore (T. Body only)
'-----  Debug printout of parameters for the I7 nuclide   --------
'       Skipped when I7 is zero.
'         I7% = 56     ' I-131
'         I7% = 17     ' Co-60
'         I7% = 70     ' CS-137
        IF I = I7% THEN
```

```
'-------------------------------------------------------------------------------
SUB PUTLINE (FILENUM%, RN%, LL$, RECLEN%) STATIC              '   5-JUL-90
'
'    Puts line LL$ of length RECLEN to random file record
'
'         FILENUM% = File number                        INPUT
'         RN%      = Record Number                      INPUT
'         LL$      = Character string                   INPUT
'         RECLEN%  = Length of record                   INPUT
'
'-------------------------------------------------------------------------------

      CPRDOUT.REC = SPACE$(RECLEN%)
      IF LEN(LL$) > 0 THEN LSET CPRDOUT.REC = LL$
      PUT FILENUM%, RN%, CPRDOUT

END SUB  '>>>>>>>>>>>>>>>  End of CPRDL  >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  PUTLINE
```

```
' ┌──────────────────────────────────────────────────────────────────────┐
' │ AIRGAMMA.BAS (AG.BAS)                                                │
' ├──────────────────────────────────────────────────────────────────────┤
' │ Program to estimate air gamma dose from chronic release of noble gases
' │ from finite plume from tall stacks using site JFD and dose integral  │
' │ of JN Hamawi.                                                        │
' │                                                                      │
' ├──────────────────────────────────────────────────────────────────────┤
' │     Author: D. A. Baker, PNL          Date  29 JUL 91                │
' │     Contact:  D. A. Baker, PNL, (509) 375 3809                       │
' │                                                                      │
' └──────────────────────────────────────────────────────────────────────┘

CONST VERDATE$ = "Air  Gamma       22-Nov-94"

' ┌──────────────────────────── Disclaimer ──────────────────────────────┐
' │ The author and his employer make neither any warranty nor representation,
' │ expressed or implied, with respect to the accuracy, completeness, or │
' │ usefulness of this program; or assume any liability with respect to  │
' │ the use of, or for damages resulting from the use of this program.   │
' │                                                                      │
' └──────────────────────────────────────────────────────────────────────┘

' ┌──────────────────── Compiler, Modules, and Libraries ────────────────┐
' │     Compiler version:  Microsoft Basic PDS 7.1                       │
' │     Modules needed:  None                                            │
' │     Libraries needed:  DAB1.LIB & DAB1.QLB                           │
' │                                                                      │
' └──────────────────────────────────────────────────────────────────────┘

' ┌──────────────────────────── Update History ──────────────────────────┐
' │ 1 Aug 91 Completed debugging program so it will run to completion. Results
' │          not confirmed.  Palisades 87 REL and 89 JFD used as test.    │
' │ 13 Aug 91                                                            │
' │ 20 Aug 91 Added DINTHAMAWI SUB                                       │
' │ 26 Aug 91 Added Sensor level corection; XOQ calculstion              │
' │ 5  Sep 91 Added Total body dose                                      │
' │ 7-9 Sep 91 Skin doses added and semi-infinite plume doses.  Parameter
' │           Rise sub revised.  Wake correction added. Dose corrections.│
' │ 10 Sep 91 Terrain height added.                                      │
' │ 11 SEP 91 Spurious minus sign in gamma dose Q decay exponential. Corrected
' │ 25 SEP 91 Added open terrain recirculation factor function.          │
' │  2 OCT 91 Added sub MIXEDMODE                                        │
' │ 18 Apr 92 Added write to SUM file.                                   │
' │ 29 Apr 92 Revised subs JFD, READJFD, FSLC                            │
' │ 30 Apr 92 Set HOURS to 8760, if 0                                    │
' │  5 May 92 Revised writes to SUM file to use 2 records: Site-Boundary & Res.
' │ 12 May 92 Corrected array ET() to function of speed AND stability.   │
' │  4 Aug 93 Optional read in of XOQ input files when indicated in setup file.
' │  7 May 94 Corrected speeds count for explicit calms for READXOQ input│
' │ 22 Nov 94 Cleanup. Corrected bug in UBAR calculation.  Did not include gnd.
' │                                                                      │
' └──────────────────────────────────────────────────────────────────────┘

'   Command line input:
'            >AG  SiteNum  Location  Distance-meters  Direction   RelType
' ex.         AG  62  SB  1200  SSW  M    or    AG  62  RES  1300  NW  E
'
```

```
'                                  Files
'
'          ---- Description -------     -- Type --  Number  -- Name --
'
'   Input: Setup file for input files        Text      1     NEWCPRD.SET
'          Abundance x Energies              Text      1     IN.GAMMA$
'          Airborne releases                 Text      1     IN.REL$
'          Generic parameters for Lambdas    Text      1     IN.GENERIC$
'          Joint Freq. Distribution (ASCRN)  Text      1     IN.JFD$
'            or XOQ input file
'
'   Output: Printer output
'           Dose summary file                Random    2     OUT.SUMMARY$
'
'                          Internal Standard Units
'
'           Length        -  meter         (m)
'           Mass          -  kilogram      (kg)
'           Time          -  second & DAY      (s) & (D)
'           Area          -  square meter  (m2)
'           Air volume    -  cubic meter   (m3)
'           Liquid volume -  liter         (L)
'           Activity      -  curie         (Ci)
'           Dose          -  rad           (rad)
'
'   Input parameters may be in foreign units, but are converted to standard
'   units on input.  Non standard units are indicated
'
'******************************  Generic Type    ******************************

   DEFSNG A-Z
   DEFINT I-K, M-N, S

'************************  FUNCTION & SUB Declarations  **********************

  DECLARE SUB ASUBCHI (PC%, H!, X!)
  DECLARE SUB CONVERT (V!, UNIT$, BLOCK$, SFLG%, ERFLG%)
  DECLARE SUB DINT (HEIGHT!, SIGMZ!, GMU!, ZK!, DI!)
  DECLARE SUB DINTHAMAWI (HEIGHT!, SIGMZ!, GMU!, ZK!, DI!)
  DECLARE SUB DOSE (HEIGHT!, ET!(), U!(), XOQ!, GAMMA!())

  DECLARE FUNCTION EXIST% (FILE$)                                          ' DAB1
  DECLARE SUB FINDFILE (FILE$, ENV$, FLG%)                                 ' DAB1
  DECLARE FUNCTION FSLC! (stability%, HRELEASE!, HWIND!, HSENSOR!)
  DECLARE SUB GETLINE (FILENUM%, COMSYMBOL$, LINE$)                        ' DAB1
  DECLARE FUNCTION MAXSNG! (A!, B!)                                        ' DAB1

  DECLARE SUB MESSAGES (MNUM%, B!, A!, A$, B$)
  DECLARE FUNCTION MINSNG! (A!, B!)                                        ' DAB1
  DECLARE SUB MIXEDMODE (WO!, U!, ET!)
  DECLARE FUNCTION OPENTERRAIN! (DISTANCE!)
  DECLARE SUB PARSE2 (COMSTRING$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())     ' DAB1

  DECLARE SUB PASQUILL (PC%, DISTANCE!, SIGZ!)
  DECLARE SUB PUTLINE (FILENUM%, RN%, LL$, RECLEN%)
  DECLARE SUB READJFD (FILENUM%, LINENUM%)
  DECLARE SUB READXOQ (FILENUM%)
  DECLARE SUB RISE (STAB%, X!, UWIND!, WO!, DIAM!, HPR!)
  DECLARE FUNCTION TIMESTAMP$ ()                                           ' DAB1
  DECLARE FUNCTION FORMAT$ (BYVAL V!, FORM$)

'*****************************************************************************

'***************************  CONST Statements  ******************************

  CONST FALSE = 0, TRUE = NOT FALSE
  CONST ONE! = 1!
  CONST ZERO% = 0
  CONST PI = 3.141593
  CONST CMperM = 100                    ' Conversion factor
  CONST MperMILE = 1609!                ' Conversion factor
  CONST SECperHR = 3600                 ' Conversion factor
  CONST HperY = 8766                    ' Conversion factor
  CONST HperD = 24!                     ' Conversion factor
  CONST SperD = 86400                   ' Conversion factor
  CONST PCIYperCIS = 31700              ' Conversion factor

  CONST DSTRING$ = "N  .NNE.NE .ENE.E  .ESE.SE .SSE.S  .SSW.SW .WSW.W  .WNW.NW .NNW"
  CONST COMSYMBOL$ = "!'C¦*"            ' Valid comment symbols for data files.

  CONST MAXNUCS = 83                    ' Program limit for nuclides
  CONST MAXSPEEDS = 15                  ' Program limit for speed classes
  CONST MAXDIRS = 16                    ' Program limit for directions
  CONST MAXSTABS = 7                    ' Program limit for stability categories
```

```
  CONST MAXEGROUPS = 6                  ' Program limit for gamma energy groups
  CONST ENV$ = "CPRD"                   ' Environmental variable -- optional
  CONST RLEN% = 128                     ' SUM file record length

  CONST FSHIELD = .7                    ' Total body shielding factor,  RG 1.109-68
  CONST DENSAIR = .00129                ' Air Density, g/cm3
  CONST DENSDEPTH = 5                   ' 1 g/cm3 tissue density x 5 cm depth (g/cm2), RG 1.109-20

  CONST SETFILE$ = "NEWCPRD.SET"        ' Setup file (New format)

  SPCE$ = CHR$(32)              ' Space as data value delimeter for parse routine

'--------------------------  Type Definitions  ------------------------------

  TYPE OUTRECTYPE
    REC AS STRING * RLEN
  END TYPE

'************************  Parameter Declarations  ******************

  DIM AE(MAXEGROUPS, MAXNUCS)           ' Abundance x Energy for energy group and nuclide, MeV
  DIM DFBETAIR(MAXNUCS)                 ' Dose factor for Beta-air,
  DIM DFBETSKIN(MAXNUCS)                ' Dose factor for Beta-skin
  DIM DFGAMAIR(MAXNUCS)                 ' Dose factor for Gamma-Air,
  DIM DFBody(MAXNUCS)                   ' Dose factor for Gamma-Total-Body,

  DIM DGAMMA(MAXEGROUPS, MAXNUCS)       ' Total air gamma dose, mrad
  DIM DGAMElev(MAXEGROUPS, MAXNUCS)     ' Elevated gamma dose, mrad
  DIM DGAMGnd(MAXEGROUPS, MAXNUCS)      ' Ground gamma dose, mrad
  DIM DGAMTALL(MAXNUCS)                 ' Tall Stack Air gamma dose, mrad/y
  DIM DBODYTALL(MAXNUCS)                ' Tall Stack Total Body, mrem/y
  DIM DSKNTALL(MAXNUCS)                 ' Tall Stack Skin dose, mrem/y

  DIM DGAMSHRT(MAXNUCS)                 ' Short Stack Air gamma dose, mrad/y
  DIM DBODSHRT(MAXNUCS)                 ' Short Stack Total Body dose, mrem/y
  DIM DBETSHRT(MAXNUCS)                 ' Short Stack Air Beta dose, mrad/y
  DIM DSKNSHRT(MAXNUCS)                 ' Short Stack Skin dose, mrem /y

  DIM ET(MAXSPEEDS, MAXSTABS)
  DIM FREQ(MAXDIRS, MAXSPEEDS, MAXSTABS)
                                        ' Frequency for direction, speed, and stability

  DIM FCALM(MAXSTABS)                   ' Frequency of calms
  DIM LAMDA(MAXNUCS)                    ' Decay constant, 1/s


  DIM GAMTISSUE(MAXNUCS)                ' Product of gamma dose and tissue absorption factor, mrad
  DIM GMU(MAXEGROUPS)                   ' Mass absorption Coef., 1/m
  DIM MUA!(MAXEGROUPS)                  ' Energy attenuation Coef., 1/m

  DIM NUKE$(MAXNUCS)                    ' Nuclide symbol
  DIM QREL(MAXNUCS)                     ' Annual Release, Ci/y
  DIM TOT(MAXSTABS)                     ' Total calms, hr or %

  DIM TOTALSTAB(MAXSTABS)               ' Hours or % for each stability class
  DIM TT1(MAXSPEEDS)                    '
  DIM TT2(MAXSTABS)                     '
  DIM TELEV(MAXSTABS), TGND(MAXSTABS)   '
  DIM U(MAXSPEEDS)                      ' Average of speed class. m/d & m/s

  DIM UMAX(MAXSPEEDS)                   ' Max. of speed class, m/d
  DIM UC(MAXSPEEDS, MAXSTABS)           ' Speeds corrected for level, m/s
  DIM UELEV(MAXSPEEDS, MAXSTABS)        ' Speeds corrected for elevated level, m/s
  DIM UGND(MAXSPEEDS, MAXSTABS)         ' Speeds corrected for ground (10m), m/s

  DIM UMIN(MAXSPEEDS)                   ' Min. of speed class, m/d
  DIM W$(20)                            ' Array of words from parsed strings

  DIM DIRECTION AS STRING * 3           ' Direction string

'-----------------  Dim Types ------------------------------------------------

  DIM SHARED CPRDOUT AS OUTRECTYPE            ' Summary output file

'************************  DATA Statements  ***********************************

'----  Linear (mass) attenuation coefficient, 1/m

   FOR K = 1 TO MAXEGROUPS:  READ GMU(K):  NEXT
   DATA 0.0173, 0.0123, 0.0095, 0.0074, 0.0062, 0.0054

'----  Linear energy absorption coefficient, 1/m

   FOR K = 1 TO MAXEGROUPS:  READ MUA!(K):  NEXT
   DATA 0.00323, 0.00381, 0.00378, 0.0034, 0.00315, 0.0029

'  Notes:  Coefficients given in the literature in units of cm2/g.  Here multiplied by
'          air density  1.29E-3 g/cm3 and 100 cm/m to give it in units of 1/m.
'          Values are for energies of .15, .4, .75, 1.25, 1.75, & 2.25 MeV
```

```
          These values taken from HP & Rad Health Handbook (1984), p. 127
'***************************  Format Strings  *********************************

'***************************** FN Functions  **********************************
   DEF FNEXPN (Z)    '--------- Exponential of negative argument ----------
      IF Z > 80 THEN
         FNEXPN = 0
      ELSE
         FNEXPN = EXP(-Z)
      END IF
   END DEF

'************************  Command line and KB Input  ************************
   COLOR 14, 1:  CLS
   D2$ = TIMESTAMP$
   PRINT VERDATE$, D2$:   PRINT

'''GOTO SKIP          '  Remove remark symbols for testing

   IF LEN(COMMAND$) THEN
      C$ = COMMAND$
      CALL PARSE2(C$, 10, SPCE$, NUMARGS%, W$())
      IF NUMARGS < 5 THEN
        CLS : PRINT :  PRINT "Enter 5 Command Line Arguments"
        GOSUB MESSG2: GOTO FINISH
      END IF
      SITENUM$ = W$(1)                          ' Site number
      LOCATION$ = W$(2)                         ' Location:  S or R
      DISTANCE$ = W$(3):  X = VAL(DISTANCE$)
      LSET DIRECTION$ = W$(4)
      RELTYPE$ = W$(5)                          ' Release type: M or E
   ELSE
      CLS : GOSUB MESSG2:   GOTO FINISH
   END IF
PRINT C$; "---"; SITENUM$
   IF LEN(SITENUM$) = 1 THEN SITENUM$ = "0" + SITENUM$
   SITENUM = VAL(SITENUM$)

'------  Enter Open terrain Flag

   PRINT :  PRINT "Do you want open-terrain correction (Y/N) (No is default)? ";
   Q$ = "":   WHILE Q$ = "":  Q$ = INKEY$:  WEND:   PRINT
   IF UCASE$(Q$) = "Y" THEN
     FLGOPENTERRAIN% = TRUE:   PRINT "Open Terrain it is!"
   END IF

SKIP:
'▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓ Test Parameters ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓
'  SITENUM$ = "05"
'  RELTYPE$ = "E"
'  DISTANCE$ = "569":   X = VAL(DISTANCE$)
'  DIRECTION$ = "NW"
'  LOCATION$ = "SB"
'▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓

'-----  Rotate Receptor direction 180 deg to point where wind blowing from

   J = INSTR(DSTRING$, DIRECTION$) \ 4 + 1    ' Receptor direction no.
   IF J < 9 THEN
      JDIREC = J + 8                          ' Wind direction no.
   ELSE
      JDIREC = J - 8
   END IF

   PRINT "Wind from "; JDIREC; " toward receptor at "; J; " "; DIRECTION$:  PRINT

'***********************  Input setup file  ********************************
   CALL FINDFILE(SETFILE$, ENV$, FLG%)
   IF FLG% = FALSE THEN FERR$ = "Setup": GOSUB MESSG1
   OPEN SETFILE$ FOR INPUT AS #1

   LINE INPUT #1, DUM$                        ' Header

   DO UNTIL EOF(1)
     CALL GETLINE(1, COMSYMBOL$, LINE$)
     CALL PARSE2(LINE$, 6, SPCE$, NUM%, W$())
     IF INSTR(W$(1), "EOF") THEN EXIT DO

       SELECT CASE LEFT$(W$(1), 3)
         CASE "YEA"
            Y$ = W$(2)                       ' Release year  yy
         CASE "DOS"
```

```
         ' Not used
      CASE "GAM"
         IN.GAMMA$ = W$(2) + W$(3)
      CASE "JFD"
         IF UCASE$(LEFT$(W$(3), 3)) = "XOQ" THEN
           FLGXOQIN% = TRUE                    ' Input file is XOQ input file
         ELSE
           FLGXOQIN% = FALSE                   ' Input is JFD input file
         END IF
         MID$(W$(3), 4, 2) = Y$
         MID$(W$(3), 7, 2) = SITENUM$
         MID$(W$(3), 12, 1) = RELTYPE$
         IN.JFD$ = W$(2) + W$(3)
      CASE "GEN"
         IN.GENERIC$ = W$(2) + W$(3)
      CASE "SIT"
            ' Not used
      CASE "POP"
            ' Not used
      CASE "REL"
         MID$(W$(3), 4, 2) = Y$:   MID$(W$(3), 7, 2) = SITENUM$
         IN.REL$ = W$(2) + W$(3)
      CASE "SUM"
         MID$(W$(3), 4, 2) = Y$
         MID$(W$(3), 7, 2) = SITENUM$
         OUT.SUMMARY$ = W$(2) + W$(3)
      CASE "LIQ"
            ' Not used
      CASE "AIR", "CHI"
            ' Not used
      CASE ELSE
        CLS :  BEEP: LOCATE 10, 15
        PRINT "Keyword "; W$(1); " in setup file not understood --"
        PRINT "         Check your spelling.":  END
    END SELECT

  LOOP

  CLOSE #1

'▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓ Temporary input files ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓

'   IN.JFD$ = "\Y90\JFDAG\JFD89S01.INE":  FLGXOQIN% = FALSE
'   IN.JFD$ = "\Y90\XOQIN\XOQ89S01.INE":  FLGXOQIN% = TRUE

'   IN.REL$ = "REL89S01.DAT"

    PRINT "JFD  "; IN.JFD$
    PRINT "REL  "; IN.REL$
    PRINT "GAM  "; IN.GAMMA$

'▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓

'*********************** Input Gamma Energy File *************************

  CALL FINDFILE(IN.GAMMA$, ENV$, FLG%)
  IF FLG% = FALSE THEN FERR$ = "Gamma Energy Input":    GOSUB MESSG1
  OPEN IN.GAMMA$ FOR INPUT AS #1

  LINE INPUT #1, GAMMAHEADER$                             ' Header

  DO UNTIL EOF(1)
    CALL GETLINE(1, COMSYMBOL$, LINE$)
    CALL PARSE2(LINE$, 12, SPCE$, NUM%, W$())
    IF INSTR("EODEOF", W$(1)) THEN EXIT DO
    FOR K = 1 TO 6
      I = VAL(W$(1))
      AE(K, I) = VAL(W$(K + 2))
    NEXT

    DFBETAIR(I) = VAL(W$(9))
    DFBETSKIN(I) = VAL(W$(10))
    DFGAMAIR(I) = VAL(W$(11))
    DFBody(I) = VAL(W$(12))

  LOOP

  CLOSE #1:   PRINT IN.GAMMA$; "  FILE READ IN * * * *"

'************************** Input Airborne Releases ***************************

  CALL FINDFILE(IN.REL$, ENV$, FLG%)
  IF FLG% = FALSE THEN FERR$ = "Releases input":  GOSUB MESSG1
  OPEN IN.REL$ FOR INPUT AS #1 LEN = 1024

  LINE INPUT #1, RELHEADER$                                        ' Header
  LINE INPUT #1, LINE$
  SITENAME$ = MID$(LINE$, 5, 20)
  LINE INPUT #1, LINE$
```

```
    LINE INPUT #1, LINE$

    DO UNTIL EOF(1)
       CALL GETLINE(1, COMSYMBOL$, LINE$)
       CALL PARSE2(LINE$, 10, SPCE$, NUMARGS%, W$())
       I = VAL(W$(1))                          ' Nuclide number
       NUKE$(I) = W$(2)                        ' Nuclide symbol
       SELECT CASE RELTYPE$
         CASE "G"
           QREL(I) = VAL(W$(3))    ' Ground Release (Ci/y)     ' Should not be used
         CASE "E"
           QREL(I) = VAL(W$(4))    ' Elevated release (Ci/y)
         CASE "M"
           QREL(I) = VAL(W$(5))    ' Mixed Mode release (Ci/y)
       END SELECT
    LOOP

    CLOSE #1:    PRINT IN.REL$; " FILE READ IN * * * *"

'************************** Input IN.GENERIC$ file **************************

    CALL FINDFILE(IN.GENERIC$, ENV$, FLG%)
    IF FLG% = FALSE THEN FERR$ = "Generic Input":  GOSUB MESSG1
    OPEN IN.GENERIC$ FOR INPUT AS #1

    LINE INPUT #1, GENERICHEADER$                                  ' Header
    LINE INPUT #1, LINE$
    LINE INPUT #1, LINE$
    FOR I = 1 TO MAXNUCS
      LINE INPUT #1, LINE$
      IF QREL(I) THEN
        NUCNAME$ = LEFT$(LINE$, 8)
        LAMDA(I) = VAL(MID$(LINE$, 14, 10))          ' Decay rates
      END IF
    NEXT I

    CLOSE #1:   PRINT IN.GENERIC$; "  FILE READ IN * * * *":  PRINT

'***************** Input JFD or XOQ File and calculate Frequencies *************

    CALL FINDFILE(IN.JFD$, ENV$, FLG%)
    IF FLG% = FALSE THEN FERR$ = "JFD input":   GOSUB MESSG1
    OPEN IN.JFD$ FOR INPUT AS #1 LEN = 1024

   JFDFILENUM% = 1
   IF FLGXOQIN% THEN
     CALL READXOQ(JFDFILENUM%)      ' Read ALL of file
     CLOSE #1:    PRINT IN.JFD$; " FILE READ IN * * * *"
   ELSE
     CALL GETLINE(JFDFILENUM%, COMSYMBOL$, HEADERJFD$)   ' Get header
     CALL READJFD(JFDFILENUM%, FALSE)      ' Read first part of file
   END IF

'                  OPTIONAL VALUE CHANGE FOR INTERACTIVE PROCESSING
'                      Normally remarked out
'    WO = 0
'    DIAM = 0    '     1.78
'    HEIGHT = 58
'    HBLD = 58
'    HTERRAIN = 0
'    FLGOPENTERRAIN% = TRUE    ' Open terrain correction factor included when TRUE

'

    FLGMM% = FALSE
    SELECT CASE RELTYPE$
      CASE "G", "E"
        IF HEIGHT < 2.5 * HBLD THEN
          PLAY "L16O3G"
          PRINT "Release height < 2.5 x Building height -- Do you want Mixed Mode (Y/N)? ";
          Q$ = "":   WHILE Q$ = "":  Q$ = INKEY$:  WEND:   PRINT
          IF UCASE$(Q$) = "Y" THEN FLGMM% = TRUE
          IF FLGMM% THEN PRINT "Mixed Mode it is -- It will take a little longer":   PRINT
        END IF
      CASE "M"
        FLGMM% = TRUE         ' Always
        PRINT "Mixed Mode takes a little longer":   PRINT
    END SELECT

'------------------------  Print data from JFD file  ----------------------

   PRINT "Sensor Level (m): "; HSENSOR
   PRINT "SPEED CLASSES="; SPEEDNUM%; "   UNITS="; SPEEDU$; "   Max(-1) or Avg(0) speeds="; FLGSPEED%
   PRINT "SPEEDS OF CLASS (m/s) :  ";
   FOR I = 1 TO SPEEDNUM%:    PRINT USING " ##.##"; UMAX(I) / SperD; : NEXT:  PRINT
   PRINT "STAB CATEGORIES="; STABCATS%; "   RECOVERY="; FREQ; "   YEARS OF DATA="; YEARS
   PRINT "CALMS: "; FCALM(1); FCALM(2); FCALM(3); FCALM(4); FCALM(5); FCALM(6); FCALM(7)

'-------------  Calculate average speeds and convert to m/s -------------------------------
```

```
  IF FLGSPEED% = TRUE THEN    ' Calculate avg. speeds from max speeds
    UMIN(1) = 0
    FOR N = 1 TO SPEEDNUM
      U(N) = (UMAX(N) + UMIN(N)) * .5
      IF N < SPEEDNUM THEN UMIN(N + 1) = UMAX(N)
    NEXT
  ELSE                        ' Speeds entered as average
    FOR N = 1 TO SPEEDNUM
      U(N) = UMAX(N)
    NEXT
  END IF

  FOR N = 1 TO SPEEDNUM
      U(N) = U(N) / SperD          ' Convert from m/d to m/s
  NEXT

'-------------------- Adjust speeds to Wind height ---------------------------

  FOR S = 1 TO STABCATS
    FOR N = 1 TO SPEEDNUM
      UGND(N, S) = U(N) * FSLC!(S, 0, 10, HSENSOR)              ' Speed at ground (10 m), m/s
      UELEV(N, S) = U(N) * FSLC!(S, HEIGHT, HWIND, HSENSOR)     ' Speed at release height, m/s

''      LPRINT S; N, U(N), FSLC!(S, 0, 10, HSENSOR), UGND(N, S)

  NEXT N, S

'----------------- Calculate Entrainment coefficients for Mixed Mode Option
'------------- ET() = 0 for all elevated release or when not selected; 1 for all ground.

  FOR S = 1 TO STABCATS
    FOR N = 1 TO SPEEDNUM
      IF FLGMM% = TRUE THEN
         CALL MIXEDMODE(WO, UELEV(N, S), ET(N, S))
      ELSE
         ET(N, S) = 0
      END IF
  NEXT N, S

'------------------------- Read in JFD values from table ---------------------

  IF FLGXOQIN% = FALSE THEN
    CALL READJFD(JFDFILENUM%, TRUE)    ' Read in JFD part of file
    CLOSE #1:    PRINT IN.JFD$; " FILE READ IN * * * *"
  END IF

'------------------- Sum freq for total Recovery  (hrs or %) -------------
'                    Includes calms

     TOTAL = 0
     FOR K = 1 TO STABCATS%
       FOR I = 1 TO SPEEDNUM%
         FOR J = 1 TO DIRNUM%
           TOTAL = TOTAL + FREQ(J, I, K)
         NEXT
       NEXT
       TOTAL = TOTAL + FCALM(K)            ' Include calms if specified explicitly
     NEXT

'--------------------------- Recovery -------------------------------------
'-----  % means percent frequency;
'-----  H means period covered in hours that is held in HOURS

   IF FREQ$ = "%" THEN
     RECOVERY = TOTAL                      ' %
   ELSE
     IF HOURS = 0 THEN HOURS = 8760        ' One year
     RECOVERY = TOTAL / HOURS * 100        ' HRS TO %
   END IF

   CONVERS = 1 / TOTAL                     ' Converts % or hours to fraction of time

'------------  Add calms to first speed class  -----------
'
'------- Determine % or hr for first speed class for kth stability for all 16 directions.

     ERASE TOT
     FOR K = 1 TO STABCATS%
       FOR J = 1 TO DIRNUM%
         TOT(K) = TOT(K) + FREQ(J, IST, K)
     NEXT J, K

'------- Distribute calms into the first speed class for each stability class on
'------- basis of directional frequency.

     FOR K = 1 TO STABCATS%
       IF TOT(K) < .0001 THEN TOT(K) = DIRNUM%  ' If nothing for stability k, then
                                                '  distribute equally in all 16 directions.
       FOR J = 1 TO DIRNUM%
```

```
        FREQ(J, 1, K) = FREQ(J, 1, K) + FREQ(J, IST, K) * (FCALM(K) / TOT(K))
    NEXT J, K

  PRINT " Total Recovery with calms = "; TOTAL
  PRINT USING " Total Recovery for year=###.# %     CONVERS=##.##^^^^"; RECOVERY; CONVERS

'------------------  Sum freq for various totals  (hr or %) -------------
'                    Includes calms

    TOTDIR = 0:  TGND = 0:  TELEV = 0
    ERASE TT1, TT2, TELEV, TGND

    FOR K = 1 TO STABCATS%
      FOR I = 1 TO SPEEDNUM%
        TOTDIR = TOTDIR + FREQ(JDIREC, I, K)                    ' Total hr or % in JDIREC
        TT1(I) = TT1(I) + FREQ(JDIREC, I, K)                    ' Total hr or % in JDIREC for speeds I
        TT2(K) = TT2(K) + FREQ(JDIREC, I, K)                    ' Total hr or % in JDIREC for stability K
        TGND = TGND + FREQ(JDIREC, I, K) * ET(I, K)             ' Total hr or % in JDIREC for ground
        TELEV = TELEV + FREQ(JDIREC, I, K) * (1 - ET(I, K))     ' Total hr or % in JDIREC for elevated
        FOR J = 1 TO DIRNUM%
          TELEV(K) = TELEV(K) + FREQ(J, I, K) * (1 - ET(I, K))  ' Total hr or %  time for elevated for stab
K
          TGND(K) = TGND(K) + FREQ(J, I, K) * ET(I, K)          ' Total hr or % time for ground for stab K
    NEXT J, I, K

'-------  Harmonic mean UBAR apportioned between ground and stack height  ------
'-------                 R prefix denotes reciprical speeds, s/m

  RSUMUBARGND! = 0:   RSUMUBARELEV! = 0

  FOR S = 1 TO STABCATS
    FOR N = 1 TO SPEEDNUM
      IF UGND(N, S) > 0 THEN RSUMUBARGND! = RSUMUBARGND! + FREQ(JDIREC, N, S) * ET(N, S) / UGND(N, S)
    ' s/m
      IF UELEV(N, S) > 0 THEN RSUMUBARELEV! = RSUMUBARELEV! + FREQ(JDIREC, N, S) * (1 - ET(N, S)) / UELEV(N,
S)   ' s/m
'       PRINT UGND(N, S); UELEV(N, S),
    NEXT N, S

  IF RSUMUBARGND! > 0 THEN UBARGND = TGND / RSUMUBARGND!            ' Harmonic mean for ground, m/s
  IF RSUMUBARELEV! > 0 THEN UBARELEV = TELEV / RSUMUBARELEV!        ' Harmonic mean for elevated, m/s

  IF UBARGND > 0 THEN RUBG = TGND / UBARGND                         ' s/m
  IF UBARELEV > 0 THEN RUBE = TELEV / UBARELEV                      ' s/m

  IF (RUBG + RUBE) > 0 THEN UBAR = TOTDIR / (RUBG + RUBE)          ' Total harmonic mean in JDIREC direction,
m/s

  PRINT "Harmonic Mean (m/s) = "; UBAR

'************************** Make calculations ***********************************

  Z = TIMER

  PRINT :  PRINT "    Dose Calculations Proceeding for "; SITENAME$; " -------"

'----------------------  Finite Cloud Calculations for Air Gamma Dose  ----------

  ERASE DGAMElev, DGAMGnd

  FOR I = 1 TO MAXNUCS

    IF QREL(I) > 0 AND (I = 8 OR (I > 25 AND I < 32) OR (I > 60 AND I < 68)) THEN    ' Nobles only

      PRINT : PRINT :  PRINT NUKE$(I); "    QREL="; QREL(I); "   LAMDA="; LAMDA(I); " 1/s"

      IF FLGMM% THEN
        PLAY "L6403B"
        PRINT : PRINT "Mixed Mode:  Proceeding with Ground calculation ----";
        CALL DOSE(0, ET(), UGND(), CHIQGND, DGAMGnd())
        MM$ = "Mixed Mode Release   "
      END IF

      PLAY "L6403A"
      PRINT : PRINT "Proceeding with Elevated calculation ----";
      HEFF = 0
      CALL DOSE(HEIGHT, ET(), UELEV(), CHIQELEV, DGAMElev())
      IF MM$ = "" THEN MM$ = "Elevated Only Release"

    END IF

  NEXT

'-----------------------  Average CHI/Q  -----------------------------------

  CHIQ = CHIQELEV + CHIQGND                         ' Average CHIQ

  PRINT :  PRINT HEIGHT, CHIQELEV, CHIQGND
```

```
'' GOSUB QAPRINT1

'------------  Finite gamma dose from both elevated & ground release  -----------
'------------  as function of energy group, K and nuclide, I

   FOR I = 1 TO MAXNUCS
     IF QREL(I) > 0 AND (I = 8 OR (I > 25 AND I < 32) OR (I > 60 AND I < 68)) THEN    ' Nobles only
       FOR K = 1 TO MAXEGROUPS
         DGAMMA(K, I) = DGAMElev(K, I) + DGAMGnd(K, I)                               ' mrad/yr
       NEXT
     END IF
   NEXT

'-----------------  Finite & Semi-Infinite Cloud Doses & Totals  -----------------

   DGAMTALLTOT = 0:   TBODYTALLTOT = 0:   DSKINTALLTOT = 0                           ' Initialize totals
   DGAMSRTOT = 0:  DBODSRTOT = 0:  DBETSRTOT = 0:  DSKNSRTOT = 0
   ERASE DGAMTALL, GAMTISSUE

   FOR I = 1 TO MAXNUCS
     IF QREL(I) > 0 AND (I = 8 OR (I > 25 AND I < 32) OR (I > 60 AND I < 68)) THEN    ' Nobles only

'---------- Total over energy groups for nuclide I  ----------------------

       FOR K = 1 TO MAXEGROUPS
         FTISSUABS = FNEXPN(MUA!(K) * DENSDEPTH / DENSAIR / CMperM)
         DGAMTALL(I) = DGAMTALL(I) + DGAMMA(K, I)                                  ' Finite Gamma dose, mrad/y
         GAMTISSUE(I) = GAMTISSUE(I) + DGAMMA(K, I) * FTISSUABS                    ' Finite Tissue dose, mrad/y
       NEXT

'---------- Air concentration at receptor X corrected for decay in transit, pCi/m3

       CHI = PCIYperCIS * QREL(I) * FNEXPN(LAMDA(I) * X / UBAR) * CHIQ             ' pCi/m3
'
'----------  Finite cloud doses

       DBODYTALL(I) = 1.11 * FSHIELD * GAMTISSUE(I)                                ' T Body 1.109-5 (8)

       DSKNTALL(I) = 1.11 * FSHIELD * DGAMTALL(I) + CHI * DFBETSKIN(I)             ' Skin 1.109-6   (9)

'       LPRINT "DSKNTALL---"; I; DSKNTALL(I); FSHIELD; DGAMTALL(I); CHI; DFBETSKIN(I)

'-----------  Semi-infinite cloud doses

       DGAMSHRT(I) = CHI * DFGAMAIR(I)                                             ' Air Gamma 1.109-5 (7)

       DBETSHRT(I) = CHI * DFBETAIR(I)                                             ' Air Beta 1.109-5 (7)

       DBODSHRT(I) = FSHIELD * CHI * DFBody(I)                                     ' T Body 1.109-6 (10)

       DSKNSHRT(I) = CHI * (1.11 * FSHIELD * DFGAMAIR(I) + DFBETSKIN(I))           ' Skin 1.109-6 (11)

'---------Totals over Nuclides ---------

' ------- Tall stack -- finite

       DGAMTALLTOT = DGAMTALLTOT + DGAMTALL(I)                                     ' Air gamma dose, mrad/y
       DBODYTALLTOT = DBODYTALLTOT + DBODYTALL(I)                                  ' Total Body dose, mrem/y
       DSKINTALLTOT = DSKINTALLTOT + DSKNTALL(I)                                   ' Skin dose, mrem/y

' ------  Short stack -- semi-inf.

       DGAMSRTOT = DGAMSRTOT + DGAMSHRT(I)                                         ' Air Gamma dose, mrad/y
       DBETSRTOT = DBETSRTOT + DBETSHRT(I)                                         ' Air Beta dose, mrad/y
       DBODSRTOT = DBODSRTOT + DBODSHRT(I)                                         ' T. Body dose, mrem/y
       DSKNSRTOT = DSKNSRTOT + DSKNSHRT(I)                                         ' Skin dose, mrem/y

     END IF
   NEXT  ' Nuclide

   PRINT :  PRINT :  PRINT USING "Total Gamma Air Dose = ##.#^^^^"; DGAMTALLTOT
   PRINT :  PRINT "Time for calculations (s): "; TIMER - Z

'------------  Output Results

   WIDTH LPRINT 132
   LPRINT :  LPRINT VERDATE$; TAB(91); "Run at "; D2$
   LPRINT :  LPRINT TAB(42); "* * * * * * * "; RTRIM$(SITENAME$); "  * * * * * * *":  LPRINT
   LPRINT "   Finite and Semi-infinite Cloud Noble-Gas Gamma, Beta, Total-Body, and Skin Annual Doses using ";
DINTEGRAL$

   LPRINT :  LPRINT "Command Line:     "; C$:   LPRINT
   LPRINT "REL Header:        "; RELHEADER$
   LPRINT "Energy/DF Header: "; GAMMAHEADER$
   LPRINT "JFD Header:        "; HEADERJFD$
   LPRINT
   LPRINT "Receptor Location:  "; STRING$(65, "_"); : LPRINT USING "  ##### m    \ \   &"; X; DIRECTION$;
LOCATION$
   LPRINT
```

```
   I$ = "Met Recovery: #### hr          Percent Recovery: ###.# %              Conversion Factor: ##.##^^^^
"
   LPRINT USING I$; TOTAL; RECOVERY; CONVERS

   I$ = "Stack Height:  ### m           Terrain Height:     ### m              Sensor Level:          ### m
"
   LPRINT USING I$; HEIGHT; HTERRAIN; HSENSOR

   I$ = "Bldg. Height:  ### m           Stack Velocity:    ##.# m/s            Inner. Diam:          ##.## m
"
   LPRINT USING I$; HBLD; WO; DIAM

   LPRINT
   I$ = "Wind Level:      ### m                  \               \   \                                  \
"
   LPRINT USING I$; HWIND; HPR$; WAKE$

   IF UBAR > 0 THEN
     I$ = "UBAR (Harmean): ##.# m/s               Transit Time:   #### s                X/Q: ##.##^^^^ s/m3
"
     LPRINT USING I$; UBAR; X / UBAR; CHIQ
   END IF

   LPRINT MM$; : IF TELEV = 0 THEN LPRINT "-- ALL Ground";
   LPRINT TAB(75); OPEN$
   LPRINT :    LPRINT STRING$(100, 196):    LPRINT
   LPRINT "                          ----Finite Plume Model ----          ----- Semi-Infinite Plume Model -----"
   LPRINT "                          ---- Tall Stack (>80m) ----          -------- Short Stack & Ground -------"
   LPRINT "                              Air     T. Body    Skin              Air       Air     T. Body    Skin
"
   LPRINT "   Nuclide     Release    Gamma                                    Gamma     Beta
"
   LPRINT "               Ci/y     mrad/y    mrem/y    mrem/y           mrad/y    mrad/y    mrem/y    mrem/y"
   LPRINT
   FOR I = 1 TO MAXNUCS
     IF QREL(I) > 0 AND (I = 8 OR (I > 25 AND I < 32) OR (I > 60 AND I < 68)) THEN    ' Nobles only
       I$ = "  \     \   ##.#^^^^  ##.#^^^^  ##.#^^^^  ##.#^^^^          ##.#^^^^  ##.#^^^^"
       LPRINT USING I$; NUKE$(I); QREL(I); DGAMTALL(I); DBODYTALL(I); DSKNTALL(I); DGAMSHRT(I); DBETSHRT(I);
       I$ = "  ##.#^^^^  ##.#^^^^"
       LPRINT USING I$; DBODSHRT(I); DSKNSHRT(I)
     END IF
   NEXT
   LPRINT
   I$ = "    TOTAL              ##.#^^^^  ##.#^^^^  ##.#^^^^          ##.#^^^^  ##.#^^^^  ##.#^^^^  ##.#^^^^"
   LPRINT USING I$; DGAMTALLTOT; DBODYTALLTOT; DSKINTALLTOT; DGAMSRTOT; DBETSRTOT; DBODSRTOT; DSKNSRTOT
   GOSUB NOTES
   LPRINT CHR$(13); CHR$(12);

'----------------  Write to SUM file -- Use Elevated before Mixed.

   FILE$ = OUT.SUMMARY$
   MID$(FILE$, LEN(FILE$), 1) = "E"
   FE$ = FILE$
   MID$(FILE$, LEN(FILE$), 1) = "M"
   FM$ = FILE$

   IF EXIST%(FE$) THEN
     OPEN FE$ FOR RANDOM AS #2 LEN = RLEN
   ELSEIF EXIST%(FM$) THEN
     OPEN FM$ FOR RANDOM AS #2 LEN = RLEN
   ELSE
     PRINT "   "; FILE$:  PRINT
     PRINT "   No Elevated or Mixed Mode summary file."
     GOTO FINISH
   END IF

   IF LEFT$(LOCATION$, 1) = "S" THEN
     L$ = "Site-Boundary-Air-Gamma-&-Beta:   " + D2$ + "   " + FORMAT$(DGAMTALLTOT, "0.00E+00")
     L$ = L$ + "   " + FORMAT$(DBETSRTOT, "0.00E+00")
     CALL PUTLINE(2, 91, L$, RLEN)
   ELSE
     L$ = "Residence-Total-Body:   " + D2$ + "   " + FORMAT$(DBODYTALLTOT, "0.00E+00")
     CALL PUTLINE(2, 92, L$, RLEN)
   END IF

GOTO FINISH: '------------  End Program

'----------------------  Gosub Routines  -----------------------------------

'*******************************  Messages  ***********************************

MESSG1:
   BEEP: CLS :   LOCATE 10, 15
   COLOR 4, 3
   PRINT "'<<<<<<<<<<<< FATAL ERROR >>>>>>>>>>>> ": PRINT : PRINT
   COLOR 7, 0
   PRINT "           "; FERR$
   PRINT "            FILE  "; FILE$; "  NOT FOUND !!!!!": PRINT
   PRINT "           Copy file to either current subdirectory or"
```

```
   PRINT "          Subdirectory indicated by environment string (CPRD)."
   PRINT : PRINT : PRINT : CLOSE : END
RETURN

MESSG2:
      BEEP:  LOCATE 10, 15
      PRINT "   Program needs command line input to run:":   PRINT
      PRINT "    AG   SiteNumber  Location  Distance(m)  Direction  [RelType]": PRINT
      PRINT "    Ex.              AG  35  SB  300  SSW  E"
RETURN

NOTES:
   LPRINT : LPRINT : LPRINT "_____________________________________"
   LPRINT "Notes:": LPRINT
   LPRINT "  Doses are as per Reg. Guide 1.109 for both finite·(Stack > 80 m) and semi-infinite plume models."
   LPRINT "  Analysis similar to XOQDOQ except decay constant of each nuclide used in calculating decay in
transit."
   LPRINT "  Mixed (Split-H) Mode releases supported.  Depletion not used, since all releases are Noble gases."
   LPRINT "  Any release under 1 meter is considered ground release; only Short-stack results are valid."
   LPRINT "  When option 1 selected, sensor level corrected to wind height.  Minimum sensor level set to 3 m."
   LPRINT "  If wind height = 0, height corrected to 10 m for releases < 10 m, otherwise height set to release
height."
   LPRINT "  Wake correction only for ground releases (height < 1 m); analysis uses bldg. height."
   LPRINT "  No plume rise when I.D. set to zero; Downwash occurs when velocity set to zero and I.D. > zero."
   LPRINT "  Dispersion coefficient (X/Q) shown above not corrected for decay.  Lid height set to 1000 m"
   LPRINT "  Optional NRC open-terrain correction factor available in interactive mode. (Max. of 4 at <-1000
m)."
RETURN

QAPRINT1:  ' Otional printout of JFD % in JDIREC and other parameters --------

   WIDTH LPRINT 132
   LPRINT VERDATE$; TAB(90); D2$: LPRINT
   FOR K = 1 TO STABCATS%
     LPRINT USING "#  ##.##"; K; TT2(K) * CONVERS * 100;              ' %
     FOR N = 1 TO SPEEDNUM%
       LPRINT USING " ##.##"; FREQ(JDIREC, N, K) * CONVERS * 100;     ' %
     NEXT N:   LPRINT
   NEXT K
     LPRINT USING "ToT##.##"; TOTDIR * CONVERS * 100;                 ' %
     FOR N = 1 TO SPEEDNUM%
       LPRINT USING " ##.##"; TT1(N) * CONVERS * 100;                 ' %
     NEXT N: LPRINT
     LPRINT "ET      ";
     FOR S = 1 TO STABCATS%
       FOR N = 1 TO SPEEDNUM%
         LPRINT USING " ##.##"; ET(N, S);
       NEXT N
       LPRINT
    NEXT
   LPRINT
   LPRINT
   FOR K = 1 TO STABCATS%
     LPRINT USING "#  UGND "; K;
     FOR N = 1 TO SPEEDNUM%
       LPRINT USING " ##.##"; UGND(N, K);
     NEXT N:   LPRINT
   NEXT K
   LPRINT
   FOR K = 1 TO STABCATS%
     LPRINT USING "#  UELEV"; K;
     FOR N = 1 TO SPEEDNUM%
       LPRINT USING " ##.##"; UELEV(N, K);
     NEXT N:   LPRINT
   NEXT K
   I$ = "TOTAL= ###.##   TOTDIR= ###.##   TGND= ###.##   TELEV= ###.##"
   LPRINT :  LPRINT USING I$; TOTAL * CONVERS * 100; TOTDIR * CONVERS * 100; TGND * CONVERS * 100; TELEV *
CONVERS * 100
   LPRINT :  LPRINT USING "Speeds (m/s)    GND, ELEV, COMBINED:   ##.##  ##.##  ##.##": UBARGND; UBARELEV; UBAR
   I$ = "CHI/Q'S (s/m3)  GND, ELEV, COMBINED:  ##.##^^^^  ##.##^^^^  ##.##^^^^    Effective Plume height (m):
####.#"
   LPRINT :  LPRINT USING I$; CHIQGND; CHIQELEV; CHIQ; HEFF:  LPRINT

''     LPRINT CHR$(13); CHR$(12);
RETURN

FINISH:

   CLOSE :   PRINT :   PLAY "L1603EC"

END  '********************  End Main Program  **********************************
```

```
'_____________________________________________________________________
SUB DINT (HS!, SIGMZ!, GMU!, ZK!, DI!)          '  1 Aug 91
'_____________________________________________________________________
'    Dose integral routine of K. Eckerman, Reg. Guide 1.109, p. 76

'       HS      Plume centerline height, m                          INPUT
'       SIGMZ   Sigma z, m                                          INPUT
'       GMU     Mass attenuation coefficient, 1/m                   INPUT
'       ZK      Buildup constant (gmu -mua)/mua                     INPUT
'       DI      Dose integral,                                      OUTPUT

'    DOSE INTEGRAL SUBROUTINE -K.F. ECKERMAN 11-24-74
'    SUBROUTINE EVALUATES THE DOSE INTEGRAL 'IT' AS DEFINED BY EQN 7.61
'    IN MET & AE-1968.  THE TWO DIMENSIONAL INTEGRATION IS EVALUATED
'    USING GAUSSIAN-LEGENDRE QUADRATURE OF ORDER 48.
'
'_____________________________________________________________________

   DEFSNG A-Z
   DEFINT I-K, M-N

'_____________________________________________________________________

     DIM X(24), W(24)

     NN = 48:  A = 2.828427125#

     X(1) = .0323801709#:  X(2) = .0970046992#: X(3) = .161222356#:    X(4) = .2247637903#
     X(5) = .2873624873#:  X(6) = .3487558862#: X(7) = .4086864819#:   X(8) = .4669029047#
     X(9) = .5231609747#:  X(10) = .577224726#: X(11) = .6288673967#: X(12) = .6778723796#
     X(13) = .7240341309#: X(14) = .7671590325#: X(15) = .807066204#: X(16) = .8435882616#
     X(17) = .8765720202#: X(18) = .9058791367#: X(19) = .9313866907#: X(20) = .9529877031#
     X(21) = .9705915925#: X(22) = .9841245837#: X(23) = .9935301722#: X(24) = .9987710072#

     W(1) = .0647376968#:  W(2) = .0644661644#:  W(3) = .0639242385#:  W(4) = .0631141922#
     W(5) = .0620394231#:  W(6) = .0607044391#:  W(7) = .0591148396#:  W(8) = .0572772921#
     W(9) = .0551995036#:  W(10) = .0528901894#: W(11) = .0503590355#: W(12) = .0476166584#
     W(13) = .0446745608#: W(14) = .0415450829#: W(15) = .038241351#: W(16) = .0347772225#
     W(17) = .0311672278#: W(18) = .0274265097#: W(19) = .0235707608#: W(20) = .0196161604#
     W(21) = .0155793157#: W(22) = .0114772345#: W(23) = .0073275539#: W(24) = .003153346#

     SUM = 0!
     B = .5 / (SIGMZ * SIGMZ)
     ZLB = HS - 4! * SIGMZ
     ZUB = HS + 4! * SIGMZ

     IF ZLB < 0 THEN ZLB = 0
     YUB = 15! / GMU
     C = .5 * (ZUB - ZLB)
     G = .5 * (ZUB + ZLB)
     E = .5 * YUB

    FOR II = 1 TO NN
      I = II - II / 2
      F = 1!
      EX = 0!

      IF II MOD 2 = 0 THEN F = -1
      ZZ = F * X(I) * C + G
      ARGU = B * (ZZ - HS) * (ZZ - HS)
      IF ARGU <= 20 THEN
        EX = EXP(-ARGU)
      END IF
      ARGU = B * (ZZ + HS) * (ZZ + HS)

      IF ARGU <= 20 THEN
        EX = EX + EXP(-ARGU)
      END IF

      IF EX > 0 THEN

        FOR KK = 1 TO NN
          K = KK - KK / 2
          F = 1!
          IF KK MOD 2 = 0 THEN F = -1
          YY = F * X(K) * E + E
          D1 = YY * YY + ZZ * ZZ
          ARGU = GMU * SQR(D1)

          IF ARGU <= 20 THEN
            BULDUP = 1 + ARGU * ZK
            EX1 = EX * EXP(-ARGU) * BULDUP * YY / D1
            SUM = SUM + W(I) * W(K) * EX1
          END IF

        NEXT
      END IF
```

```
     NEXT
    DI = SUM * C * E / (A * SIGMZ)
END SUB '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  DINT
```

```
'-------------------------------------------------------------------------
SUB DINTHAMAWI (H!, SIGZ!, MU!, ZK!, DI!)                    ' 21 Aug 91
'-------------------------------------------------------------------------
'  Dose integral routine by John N. Hamawi of Yankee Atomic Power Co.
'  Ref. Reg. Guide 1.109-78.

'       H       Plume centerline height, m                          INPUT
'       SIGZ    Sigma z, m                                          INPUT
'       MU      Mass attenuation coefficient, 1/m                   INPUT
'       ZK      Buildup constant (mu -mua)/mua                      INPUT
'       DI      Dose integral,                                      OUTPUT

'-------------------------------------------------------------------------

   DEFSNG E-Z
   DEFDBL A-D
   DEFINT I-N

   DIM CDATA(5)
   DIM E(49)
   DIM B(49)
   DIM P(49)

'-------------------------------------------------------------------------

   M = 9
   CDATA(1) = 5000#
   CDATA(2) = 10000#
   CDATA(3) = 20000#
   CDATA(4) = 50000#
   CDATA(5) = 100000#

   A0 = -.57721566#:  A1 = .99999193#:   A2 = -.24991055#
   A3 = .05519968#:   A4 = -.00976004#:  A5 = .00107857#

   B0 = .2677737343#:   B1 = 8.6347608925#:  B2 = 18.059016973#:  B3 = 8.5733287401#

   C0 = 3.9584969228#:  C1 = 21.0996530827#: C2 = 25.6329561486#: C3 = 9.5733223454#

   D = 3543.75:     D1 = 989:    D2 = 5888:  D3 = -928:  D4 = 10496
   D5 = -4540:      D6 = 10496:  D7 = -928:  D8 = 5888:  D9 = 989

'---- Compute limits of integration ZMIN and ZMAX and interval width

   IF (L < 2) OR (L > 6) THEN L = 6                  ' Number of intervals used in integration
   C = CDATA(L - 1)
   N = L * (M - 1) + 1
   SIGZ2 = SIGZ * SIGZ
   ALFA = H - MU! * SIGZ2
   BETA = SIGZ * SQR(2 * LOG(C))

   IF ALFA > 0 THEN
     ZMIN = ALFA - BETA
     IF ZMIN < 0 THEN ZMIN = 0
     ZMAX = ALFA + BETA
   ELSE
     ZMIN = 0
     ZMAX = ALFA + SQR(ALFA * ALFA + BETA * BETA)
   END IF

   DZ = (ZMAX - ZMIN) / (N - 1)

'-------  Compute exponential integral terms E(I)

   E(1) = 2.18907 - LOG(MU! * DZ)

   FOR I = 1 TO N
     Z = ZMIN + (I - 1) * DZ
     X = MU! * Z
     IF X > 0 THEN
       X2 = X * X:  X3 = X * X2:  X4 = X * X3:  X5 = X * X4
       IF X > 1 THEN
         CC = C0 + C1 * X + C2 * X2 + C3 * X3 + X4
         E(I) = (B0 + B1 * X + B2 * X2 + B3 * X3 + X4) / CC / (X * EXP(X))
       ELSE
         E(I) = -LOG(X) + A0 + A1 * X + A2 * X2 + A3 * X3 + A4 * X4 + A5 * X5
       END IF
     END IF
   NEXT

'--------  Compute integrand terms B(I) and P(I)

   FOR I = 1 TO N
     Z = ZMIN + (I - 1) * DZ
     G = EXP(-(Z + H) * (Z + H) / (2 * SIGZ2)) + EXP(-(Z - H) * (Z - H) / (2 * SIGZ2))
     B(I) = G * E(I)
     P(I) = G * EXP(-MU! * Z)
```

```
   NEXT

'--------  Perform integration using 9-point Newton-Cotes Formula

   SUMB = 0:  SUMP = 0
   MM = M - 1
   KM = N - M + 1
   FOR K = 1 TO KM STEP MM
     SUMB = SUMB + D1 * B(K) + D2 * B(K + 1) + D3 * B(K + 2) + D4 * B(K + 3) + D5 * B(K + 4)
     SUMB = SUMB + D6 * B(K + 5) + D7 * B(K + 6) + D8 * B(K + 7) + D9 * B(K + 8)
     SUMP = SUMP + D1 * P(K) + D2 * P(K + 1) + D3 * P(K + 2) + D4 * P(K + 3) + D5 * P(K + 4)
     SUMP = SUMP + D6 * P(K + 5) + D7 * P(K + 6) + D8 * P(K + 7) + D9 * P(K + 8)
   NEXT

   DI! = DZ * (SUMB + SUMP * ZK) / (D * 2.828427 * SIGZ)

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> DINTHAMAWI
```

```
'_____________________________________________________________________
SUB DOSE (HSTACK!, ET!(), U!(), XOQ!, DGAM!())                    ' 18 Nov 94
'_____________________________________________________________________

'     Calculates Finite cloud Gamma dose for each energy group and nuclide,
'     and XOQ for ground and elevated releses.

'     HSTACK     Release height, m                                        INPUT
'     ET()       Entrainment coefficient, unitless                        INPUT
'     XOQ        Dilution factor, s/m3                                    OUTPUT
'     DGAM()     Finite cloud gamma dose, mrad.  Ref:  RG 1.109-4 (6)     OUTPUT

'_____________________________________________________________________

   DEFSNG A-Z
   DEFINT I-K, N, S

   SHARED AE(), CONVERS, D2$, DIAM, DINTEGRAL$, FSUM, FREQ(), GMU()
   SHARED HBLD, HEFF, HPR, HPR$, HTERRAIN, I, JDIREC, MUA!()
   SHARED LAMDA(), NUKE$(), QREL(), SIGZ!, SPEEDNUM, STABCATS
   SHARED TELEV, TGND, TOTDIR, TOTAL, WAKE$, WO, X, ZPLUME

'_____________________________________________________________________

   THETA = 2 * PI / 16                              ' Sector width, radians
   A1 = 260 / X / THETA                             ' mrad m2 / s / Mev / Ci
   A2 = .7979                                       ' SQROOT(2/PI)

   FSUM = 0

   FOR N = 1 TO SPEEDNUM
     PRINT N;

'-----  Convert hr or % frequency to fraction and include entrainment coefficient for ground and elevated.
'-----  Entrainment coefficient:  ET() = 0 All Elevated; 0 < ET() < 1 Mixed mode; ET() = 1 All Ground

     FOR S = 1 TO STABCATS
'      PRINT S;
       IF FREQ(JDIREC, N, S) THEN
         IF HSTACK < 1 THEN
           ET = ET(N, S)
           IF TGND > 0 THEN FREK = ET * FREQ(JDIREC, N, S) * CONVERS     ' Mixed Mode only
         ELSE
           ET = 1 - ET(N, S)
           IF TELEV > 0 THEN FREK = ET * FREQ(JDIREC, N, S) * CONVERS    ' Elevated & Mixed Mode
         END IF

'------ Add plume rise and terrain height if elevated release  --------------

         IF HSTACK > 1 THEN
           CALL RISE(S, X, U(N, S), WO, DIAM, HPR)
'           IF N = 1 THEN
             IF HPR < 0 THEN
               HPR$ = "Plume Downwash"
             ELSEIF HPR = 0 THEN
               HPR$ = "No Plume Rise"
             ELSE
               HPR$ = "Plume Rise"
             END IF
'           END IF
           ZPLUME = MAXSNG!(HSTACK + HPR - HTERRAIN, 0)              ' Plume height, m
           IF TELEV > 0 THEN
             HEFF = HEFF + ZPLUME * FREQ(JDIREC, N, S) * ET / TELEV   ' Effective plume height
           ELSE
             HEFF = HEFF + ZPLUME * FREQ(JDIREC, N, S) / TOTDIR
           END IF
         ELSE
           ZPLUME = 0
         END IF

         CALL PASQUILL(S, X, SIGZ!)
         Q = QREL(I) * FNEXPN(LAMDA(I) * X / U(N, S))        ' Decay corrected release, Ci/y

         FOR K = 1 TO MAXEGROUPS
           IF AE(K, I) > 0 THEN
             ZK = (GMU(K) - MUA!(K)) / MUA!(K)
'              CALL DINT(ZPLUME, SIGZ!, GMU(K), ZK, DI):          DINTEGRAL$ = "Eckerman's Routine DI=" +
FormatS$(DI, "0.000")
             CALL DINTHAMAWI(ZPLUME, SIGZ!, GMU(K), ZK, DI): DINTEGRAL$ = "Hamawi's Routine DI=" + FORMATS$(DI,
"0.000")

             DGAM(K, I) = DGAM(K, I) + A1 * FREK * MUA!(K) * DI * Q * AE(K, I) / U(N, S)         ' Gamma dose,
mrad/y
'            IF I = 63 THEN GOSUB QAPRINT2         '--------  Otional QA Printout of DI and other parameters

           END IF
```

```
        NEXT  ' Energy group -------------------

        IF HSTACK < 1 THEN                        ' Wake correction for ground release
          TEMP1 = SQR(SIGZ! * SIGZ! + HBLD * HBLD / 2 / PI)
          TEMP2 = SQR(3) * SIGZ!
          SIGEXP! = 1 / MINSNG!(TEMP1, TEMP2)
          WAKE$ = "     Ground release -- Wake correction"
        ELSE
          SIGEXP! = EXP(-.5 * ZPLUME * ZPLUME / SIGZ! / SIGZ!) / SIGZ!
          WAKE$ = "Elevated release -- No wake correction"
        END IF

        FSUM = FSUM + FREK / U(N, S) * SIGEXP!
''        LPRINT S; N, U(N, S), FREK, FSUM, SIGEXP!
      END IF

    NEXT ' Stability -------------------------------
''    LPRINT
  NEXT ' Speed ----------------------------------------

  XOQ = A2 / X / THETA * FSUM * OPENTERRAIN!(X)           ' X/Q, s/m3

EXIT SUB

'------------------------ Gosubs ------------------------------------------

QAPRINT2: '-------- QA printout

 IF PRNTFLG% = FALSE THEN
   LPRINT
   WIDTH LPRINT 132
   LPRINT "--------  QA Printout of AG for "; NUKE$(I); " at X="; X; "m    Stack height="; HSTACK; "m
 "; D2$
   LPRINT
   LPRINT " I     N   S ZPLUME  SIGZ    K    GMU       MUA        ZK        AE        DI      FREK       Q";
   LPRINT "       U()     DGAM()"
 END IF
 I1$ = " ##   ##  #  ####  ##.#^^^^  #  ##.#^^^^  ##.#^^^^  ##.#^^^^  ##.#^^^^  ##.#^^^^ ##.#^^^^ ##.#^^^^
##.#^^^^ ##.#^^^^"
 LPRINT USING I1$; I; N; S; ZPLUME; SIGZ!; K; GMU(K); MUA!(K); ZK; AE(K, I); DI; FREK; Q; U(N, S); DGAM(K, I)

 PRNTFLG% = TRUE

RETURN

END SUB '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> DOSE
```

```
'_____________________________________________________________________
FUNCTION FSLC (stability%, HRELEASE!, HWIND!, HSENSOR!)          ' 29 Apr 92
'_____________________________________________________________________

'-----------  Sensor level correction for wind speed based on stability
'             Ref. XOQDOQ p. 32,33

'           STABILITY  Pasquill stability category
'           HRELEASE   Release height, m
'           HWIND      Wind height, m
'           HSENSOR    Anemometer height, m

'_____________________________________________________________________

   DEFSNG A-Z
   DEFINT I-K, N, S

'_____________________________________________________________________

    SELECT CASE stability
      CASE 1, 2, 3, 4
        EX = .25          ' A, B, C, D    TEMPORARY  .5
      CASE ELSE
        EX = .5           ' E, F, G
    END SELECT

'--- Set height to 10 m for ground releases when HWIND = 0

''    PRINT "--FSLC---"; HRELEASE; HWIND; HSENSOR

    IF HWIND = 0 THEN
      IF HRELEASE < 10 THEN HWIND = 10 ELSE HWIND = HRELEASE
    END IF

    IF HSENSOR = 0 THEN HSENSOR = 3              ' Minimum sensor height

    FSLC = (HWIND / HSENSOR) ^ EX

END FUNCTION  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  FSLC
```

```
'_____________________________________________________________________________
SUB MIXEDMODE (W!, U!, ET!)                                    ' 1 Oct 91
'_____________________________________________________________________________

'     Calculates entrainment coefficient ET() to determine fraction of time release
'     is at ground level as function of speed ratio for mixed mode or split
'     height release.
'     Ref: XOQDOQ, P. 33, A8 and Reg Guide 1.111-11.

'          W   Stack gas velocity, m/s                              INPUT
'          U   Wind speed at level of release, m/s                  INPUT
'          ET  Entrainment coefficient, unitless                    OUTPUT

'_____________________________________________________________________________

   DEFSNG A-Z
   DEFINT I-K, N

'_____________________________________________________________________________

   IF U > 0 THEN R = W / U ELSE EXIT SUB

   SELECT CASE R
     CASE IS > 5
       ET = 0                    ' All elevated
     CASE IS > 1.5
       ET = .3 - .06 * R
     CASE IS > 1
       ET = 2.58 - 1.58 * R
     CASE ELSE
       ET = 1                    ' All ground
   END SELECT

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  MIXEDMODE
```

```
'_____________________________________________________________________
FUNCTION OPENTERRAIN! (DISTANCE!)                          ' 25 SEP 91
'_____________________________________________________________________

'      Corrects for open terrain recirculation effects -- Increases X/Q
'      up to a factor of 4.  Ref. XOQDOQ, p. A.43

'      DISTANCE   Downwind receptor distance from release, m          INPUT

'_____________________________________________________________________

   DEFSNG A-Z
   DEFINT I-K, N

   SHARED OPEN$, FLGOPENTERRAIN%
   STATIC TEMP, X

'_____________________________________________________________________

   SELECT CASE FLGOPENTERRAIN%

     CASE IS = FALSE                  ' No Correction

       OPEN$ = "No Open Terrain Correction"
       OPENTERRAIN! = ONE!

     CASE IS = TRUE                   ' Standard NRC XOQDOQ correction

        OPEN$ = "   Open Terrain Correction"
        X = LOG(DISTANCE)

        SELECT CASE DISTANCE

          CASE IS < 10000
            TEMP = EXP(16.125 - (3.18951 * X) + (.1569306# * X * X))
            OPENTERRAIN! = MINSNG!(4, TEMP)          ' Correction factor not > 4

          CASE IS < 16090
            OPENTERRAIN! = EXP(1.1865 - (.1225 * X))

          CASE ELSE
            OPENTERRAIN! = ONE!

        END SELECT

     CASE ELSE
        BEEP: PRINT " Not a valid Terrain Correction Option"
        END

   END SELECT

END FUNCTION  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  OPENTERRAIN
```

```
'_____________________________________________________________________
SUB PASQUILL (PC%, DISTANCE!, SIGZ!)                    '  22 Nov 94
'_____________________________________________________________________

'   Calculates sigma-z for each Pasquill Categorys PC% for a specified DISTANCE.

'  Three methods of estimating sigz are given: 1) My CSC curve fits, 2) Briggs,
'  3) Martin & Tikvart (Eimutis & Konicek), and 4) Smith and Hosker (ANEMOS, ORNL-5913).

'  Martin & Tickvart method used (XOQDOQ p. A.42)

'           PC%       Pasquill category A thru G            INPUT
'           DISTANCE  Distance to receptor, m               INPUT
'           SIGZ      Sigma z, m                            OUTPUT
'_____________________________________________________________________

  DEFSNG A-Z
  DEFINT I-K, M-N

  SHARED SIGMA$
  STATIC A, SIG1, SIG2, SIG3, SIG4, X, X1

  DIM A(3, 6), B(3, 6), C(3, 6)
'_____________________________________________________________________

'----------Martin & Tickvart Parmeters
'--------------------------------------- > 1000 m
 A(1, 1) = .00024: B(1, 1) = 2.094: C(1, 1) = -9.6:  A(1, 2) = .055:  B(1, 2) = 1.098: C(1, 2) = 2!
 A(1, 3) = .113:   B(1, 3) = .911:  C(1, 3) = 0:     A(1, 4) = 1.26:  B(1, 4) = .516:  C(1, 4) = -13
 A(1, 5) = 6.73:   B(1, 5) = .305:  C(1, 5) = -34:   A(1, 6) = 18.05: B(1, 6) = .18:   C(1, 6) = -48.6
'--------------------------------------- 100-1000 m
 A(2, 1) = .00066: B(2, 1) = 1.941: C(2, 1) = 9.27:  A(2, 2) = .0382: B(2, 2) = 1.149: C(2, 2) = 3.3' As in
XOQDOQ P. A.42
 A(2, 3) = .113:   B(2, 3) = .911:  C(2, 3) = 0:     A(2, 4) = .222:  B(2, 4) = .725:  C(2, 4) = -1.7
 A(2, 5) = .211:   B(2, 5) = .678:  C(2, 5) = -1.3:  A(2, 6) = .086:  B(2, 6) = .74:   C(2, 6) = -.35
'--------------------------------------- < 100 m
 A(3, 1) = .192:  B(3, 1) = .936:   C(3, 1) = 0:     A(3, 2) = .156:  B(3, 2) = .922:  C(3, 2) = 0
 A(3, 3) = .116:  B(3, 3) = .905:   C(3, 3) = 0:     A(3, 4) = .079:  B(3, 4) = .881:  C(3, 4) = 0
 A(3, 5) = .063:  B(3, 5) = .871:   C(3, 5) = 0:     A(3, 6) = .053:  B(3, 6) = .814:  C(3, 6) = 0

'-------------------------------------------------------------------------------

  HLID = 1000             ' Lid height, m

  X = LOG(DISTANCE)
  X1 = DISTANCE
  SELECT CASE PC%
    CASE 1                                ' A
      IF X1 < 10000 THEN
        SIG1 = EXP(X / (3.01676 - .281085 * X))
      ELSE
        SIG1 = 1000
      END IF
      SIG2 = .2 * X1
      IF X1 > 1000 THEN
        SIG3 = A(1, 1) * X1 ^ B(1, 1) + C(1, 1)
      ELSEIF X1 < 100 THEN
        SIG3 = A(3, 1) * X1 ^ B(3, 1)
      ELSE
        SIG3 = A(2, 1) * X1 ^ B(2, 1) + C(2, 1)
      END IF
      SIG4 = .112 * X1 ^ 1.06 * (1 + .000538 * X1) ^ -.815

    CASE 2                                ' B
      SIG1 = EXP(.128768 * X ^ 1.88604)
      SIG2 = .12 * X1
      IF X1 > 1000 THEN
        SIG3 = A(1, 2) * X1 ^ B(1, 2) + C(1, 2)
      ELSEIF X1 < 100 THEN
        SIG3 = A(3, 2) * X1 ^ B(3, 2)
      ELSE
        SIG3 = A(2, 2) * X1 ^ B(2, 2) + C(2, 2)
      END IF
      SIG4 = .13 * X1 ^ .95 * (1 + .000652 * X1) ^ -.75

    CASE 3                                ' C
      SIG1 = EXP(-2.88518 + 1.15672 * X - .01997 * X * X)
      SIG2 = .08 * X1 / (1 + .0002 * X1) ^ .5
      IF X1 > 1000 THEN
        SIG3 = A(1, 3) * X1 ^ B(1, 3) + C(1, 3)
      ELSEIF X1 < 100 THEN
        SIG3 = A(3, 3) * X1 ^ B(3, 3)
      ELSE
        SIG3 = A(2, 3) * X1 ^ B(2, 3) + C(2, 3)
      END IF
      SIG4 = .112 * X1 ^ .92 * (1 + .000905 * X1) ^ -.718
```

```
    CASE 4                                          ' D
      A = 3.16229 - 2.55657 * X + .758323 * X * X
      B = -.0710894# * X * X * X + .00229827# * X * X * X * X
      SIG1 = EXP(A + B)
      SIG2 = .06 * X1 / (1 + .0015 * X1) ^ .5
      IF X1 > 1000 THEN
        SIG3 = A(1, 4) * X1 ^ B(1, 4) + C(1, 4)
      ELSEIF X1 < 100 THEN
        SIG3 = A(3, 4) * X1 ^ B(3, 4)
      ELSE
        SIG3 = A(2, 4) * X1 ^ B(2, 4) + C(2, 4)
      END IF
      SIG4 = .098 * X1 ^ .889 * (1 + .00135 * X1) ^ -.688

    CASE 5                                          ' E
      SIG1 = EXP(-4.91362 + 1.59146 * X - .062557 * X * X)
      SIG2 = .03 * X1 / (1 + .0003 * X1)
      IF X1 > 1000 THEN
        SIG3 = A(1, 5) * X1 ^ B(1, 5) + C(1, 5)
      ELSEIF X1 < 100 THEN
        SIG3 = A(3, 5) * X1 ^ B(3, 5)
      ELSE
        SIG3 = A(2, 5) * X1 ^ B(2, 5) + C(2, 5)
      END IF
      SIG4 = .0609 * X1 ^ .895 * (1 + .00196 * X1) ^ -.684

    CASE 6, 7                                       ' F, G
      A = -7.64538 + 2.12616 * X - .0608826# * X * X
      B = -.00763833# * X * X * X + .00042439# * X * X * X * X
      SIG1 = EXP(A + B)
      SIG2 = .016 * X1 / (1 + .0003 * X1)
      IF X1 > 1000 THEN
        SIG3 = A(1, 6) * X1 ^ B(1, 6) + C(1, 6)
      ELSEIF X1 < 100 THEN
        SIG3 = A(3, 6) * X1 ^ B(3, 6)
      ELSE
        SIG3 = A(2, 6) * X1 ^ B(2, 6) + C(2, 6)
      END IF
      SIG4 = .0638 * X1 ^ .783 * (1 + .00136 * X1) ^ -.672

      IF PC% = 7 THEN
        SIG1 = SIG1 * .65:   SIG2 = SIG2 * .65:   SIG3 = SIG3 * .65
        SIG4 = .0366 * X1 ^ .767 * (1 + .000544 * X1) ^ -.7427
      END IF
  END SELECT

  IF SIG1 > HLID THEN SIG1 = HLID
  IF SIG2 > HLID THEN SIG2 = HLID
  IF SIG3 > HLID THEN SIG3 = HLID
  IF SIG4 > HLID THEN SIG4 = HLID

''PRINT USING "##   #####    ####.##   ####.##   ####.##"; PC%; DISTANCE; SIG1; SIG2; SIG3

  SIGZ = SIG3                ' Martin and Tikvart

END SUB '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  PASQUILL
```

```
'_____________________________________________________________________
SUB PUTLINE (FILENUM%, RN%, LL$, RECLEN%) STATIC              '   5-JUL-90
'_____________________________________________________________________
'
'    Puts line LL$ of length RLEN to random file record
'
'         FILENUM% = File number                        INPUT
'         RN%      = Record Number                      INPUT
'         LL$      = Character string                   INPUT
'         RECLEN%  = Length of record                   INPUT
'
'_____________________________________________________________________


'_____________________________________________________________________

      CPRDOUT.REC = SPACE$(RECLEN%)
      IF LEN(LL$) > 0 THEN LSET CPRDOUT.REC = LL$
      PUT FILENUM%, RN%, CPRDOUT

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  PUTLINE
```

```
'-------------------------------------------------------------------------------
SUB READJFD (FILENUM%, LINENUM%)                        ' Last change: 17 Nov 94
'-------------------------------------------------------------------------------

'   Reads in parameters from .JFD files

'       FILENUM%    File number -- Assumes file opened for read
'       LINENUM%    Line flag:  false = read in first part of file

'-------------------------------------------------------------------------------

   DEFSNG A-Z
   DEFINT I-K, M-N

   SHARED DIRNUM%, FREQ(), FCALM(), FLGFORMAT%, FLGSPEED%, FLGWIND%, FREQ$, HSENSOR, IST
   SHARED SPEEDNUM%, SPEEDU$, STABCATS%, TOTALSTAB(), TOTAL, UMAX(), HOURS
   SHARED W$(), HBLD, DIAM, WO, HEIGHT, HTERRAIN, HWIND, AB

'-------------------------------------------------------------------------------

  IF LINENUM% = FALSE THEN

   DO
     CALL GETLINE(FILENUM%, COMSYMBOL$, LINE$)
     CALL PARSE2(LINE$, 20, " ,", NUM%, W$())

     IF INSTR(W$(1), "SENSOR") THEN
       V = VAL(W$(2)): U$ = W$(3):  N$ = "SENSOR"
       CALL CONVERT(V, U$, "DILUTION", SFLG%, ERFLG%)
       HSENSOR = V

     ELSEIF INSTR(W$(1), "XOQ") THEN
       WO = VAL(W$(2))                  ' Stack gas velocity, m/s      Note: no units check
       DIAM = VAL(W$(4))                ' Diameter of stack, m         Note: no units check
       HEIGHT = ABS(VAL(W$(6)))         ' Stack height, m              Note: no units check
       HBLD = ABS(VAL(W$(8)))           ' Bldg., m                     Note: no units check
       AB = VAL(W$(10))                 ' Cross-section area, m2       Note: no units check
       HWIND = VAL(W$(12))              ' Wind height, m               Note: no units check
       HTERRAIN = ABS(VAL(W$(14)))      ' Terrain height, m            Note: no units check
       UU$ = W$(3) + W$(5) + W$(7) + W$(9) + W$(11) + W$(13) + W$(15)
       IF UCASE$(UU$) <> "M/SMMMM2MM" THEN
          PRINT "Units error or other confusion in XOQ line of JFD file"
          PRINT "All units must be SI for this line !!!"
          BEEP: END
       END IF

     ELSEIF INSTR(W$(1), "SPEEDU") THEN
       SPEEDU$ = W$(2)

     ELSEIF INSTR(W$(1), "SPEEDS") THEN
       IF INSTR(W$(2), "MAX") THEN FLGSPEED% = TRUE ELSE FLGSPEED% = FALSE
       SPEEDNUM% = NUM% - 2
       FOR I = 3 TO SPEEDNUM% + 2
         V = VAL(W$(I))
         CALL CONVERT(V, SPEEDU$, "DILUTION", SFLG%, ERFLG%)
         IF ERFLG% THEN
            PRINT "Speed unit "; SPEEDU$; " not understood in SPEEDUNIT line of JFD file"
            BEEP: END
         END IF
         UMAX(I - 2) = V      ' Speeds converted to m/d
       NEXT I

     ELSEIF INSTR(W$(1), "STABC") THEN
        STABCATS% = VAL(W$(2))

     ELSEIF INSTR(W$(1), "FREQ") THEN
       FREQ$ = W$(2)
       HOURS = VAL(W$(3))

     ELSEIF INSTR(W$(1), "CALM") THEN
       T = 0
''     PRINT W$(1); W$(2); W$(3); W$(4); W$(5)
       FOR K = 1 TO STABCATS%
         FCALM(K) = VAL(W$(K + 1))
         T = T + FCALM(K)                    ' Total explicit calms
''         PRINT K, FCALM(K)
       NEXT K

'--------------  Check for explicit or implicit calms

       IF T > .0001 THEN
         IST = 2     ' Calms explicit -- Entered separately
       ELSE
         IST = 1     ' Calms implicit -- Included in first speed class in JFD
       END IF
```

```
     ELSEIF INSTR(W$(1), "PASQ") THEN
       IF W$(2) = "FROM" THEN FLGWIND% = TRUE ELSE FLGWIND% = FALSE      ' Wind directions from
       IF W$(3) = "DUS" THEN FLGFORMAT% = TRUE ELSE FLGFORMAT% = FALSE
       EXIT DO    ' File read pointer at line under PASQUILL line ready to read in JFD data.

     ELSE
       PRINT "Keyword -- "; W$(1); " in JFD file not accepted --- Check spelling.":  BEEP:  END
     END IF

   LOOP

  ELSE
'-------------  Read in JFD data in either DUS or DSU format  -------------

    IF FLGFORMAT% = TRUE THEN         ' DUS
      FOR K = 1 TO STABCATS%
        FOR I = IST TO SPEEDNUM%
         CALL GETLINE(FILENUM%, COMSYMBOL$, LINE$)
''         PRINT LINE$
'         IF INSTR(UCASE$(LINE$), "END") THEN CALL MESSAGES(19, A, B, A$, JFDFILE$)
         CALL PARSE2(LINE$, MAXDIRS%, " ,", DIRNUM%, W$())
         FOR J = 1 TO DIRNUM%
           FREQ(J, I, K) = VAL(W$(J))
'           TOTAL = TOTAL + FREQ(J, I, K)
           TOTALSTAB(K) = TOTALSTAB(K) + FREQ(J, I, K)
       NEXT J, I, K
       '' PRINT " JFD Format = DUS"
    ELSE                              ' DSU
      FOR I = IST TO SPEEDNUM%
        FOR K = 1 TO STABCATS%
         CALL GETLINE(FILENUM%, COMSYMBOL$, LINE$)
'         IF INSTR(UCASE$(LINE$), "END") THEN CALL MESSAGES(19, A, B, A$, JFDFILE$)
         CALL PARSE2(LINE$, MAXDIRS%, " ,", DIRNUM%, W$())
         FOR J = 1 TO DIRNUM%
           FREQ(J, I, K) = VAL(W$(J))
'           TOTAL = TOTAL + FREQ(J, I, K)                ' May not need
           TOTALSTAB(K) = TOTALSTAB(K) + FREQ(J, I, K)   ' May not need
       NEXT J, K, I
       '' PRINT " JFD Format = DSU"
    END IF

  END IF

END SUB '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  READJFD
```

```
'_____________________________________________________________________
SUB READXOQ (FILENUM%)                              ' Last change: 18 Nov 94
'_____________________________________________________________________

'   Reads in parameters from XOQyySnn.INx files

'       FILENUM%    File number -- Assumes file opened for read

'_____________________________________________________________________

   DEFSNG A-Z
   DEFINT I-K, M-N

   SHARED DIRNUM%, FCALM(), FREQ(), FLGFORMAT%, FLGSPEED%, FLGWIND%, FREK$, HSENSOR, IST
   SHARED SPEEDNUM%, SPEEDU$, STABCATS%, TOTAL, TOTALSTAB(), HOURS, UMAX()
   SHARED HBLD, DIAM, WO, HEIGHT, HTERRAIN, HWIND, AB
   SHARED NAMEJFD$, SITE$, NOTES$, SN%, W$(), HEADERJFD$

'_____________________________________________________________________

   ERASE TOTALSTAB                          ' Initialise running totals

   LINE INPUT #FILENUM%, L$
   IST = VAL(LEFT$(L$, 1)) + 1          ' Calms :  2 for explicit, 1 for implicit

     IF MID$(L$, 2, 1) = "0" THEN       ' Percent or hours
       FREK$ = "HOURS"
       HOURS = HperY                    ' Hours
     ELSE
       FREK$ = "%"                      ' percent
     END IF

   LINE INPUT #FILENUM%, L$
     SITE$ = LEFT$(L$, 20)
     HEADERJFD$ = L$

   LINE INPUT #FILENUM%, L$
     SPEEDNUM% = VAL(LEFT$(L$, 5)):  STABCATS% = VAL(MID$(L$, 6, 5))


   LINE INPUT #FILENUM%, L$
     HSENSOR = VAL(LEFT$(L$, 5))


   LINE INPUT #FILENUM%, L$
     FOR K = 1 TO STABCATS%
       FCALM(K) = VAL(MID$(L$, 5 * K - 4, 5))
     NEXT

   LINE INPUT #FILENUM%, L$             ' ----------------- ...

   LINE INPUT #FILENUM%, L$
     NAMEJFD$ = LEFT$(L$, 80)

   LINE INPUT #FILENUM%, L$             '  N  NNE  NE  ...
     DIRNUM% = 16                       ' XOQ number of directions
     FOR K = 1 TO STABCATS%
       LINE INPUT #FILENUM%, L$: '   PRINT L$;
       FOR I = IST TO SPEEDNUM%
         LINE INPUT #FILENUM%, L$
''         PRINT K; I, LEFT$(L$, 20), IST
         FOR J = 1 TO DIRNUM%
           FREQ(J, I, K) = VAL(MID$(L$, 5 * J - 4, 5))
         NEXT J
       NEXT I
     NEXT K

   LINE INPUT #FILENUM%, L$             '----------------- ...

   LINE INPUT #FILENUM%, L$             ' Speeds
     SPEEDU% = VAL(LEFT$(L$, 5))
     IF SPEEDU% > 100 THEN              ' Convert speeds to m/d
       UMULT = MperMILE * HperD         ' Speeds entered as MPH
       PRINT "Speeds entered as MPH ---"
     ELSE
       UMULT = SperD                    ' Speeds entered as m/s
       PRINT "Speeds entered as m/s ---"
     END IF

     FLGSPEED% = TRUE                       ' Speeds entered as max.
     FOR I = 1 TO SPEEDNUM%
       UMAX(I) = VAL(MID$(L$, 5 * I + 1, 5)) * UMULT        ' m/d
     NEXT

   LINE INPUT #FILENUM%, L$             ' 1 1 1 1

   FOR I = 1 TO 8
```

```
    LINE INPUT #FILENUM%, L$          ' Skip
  NEXT

  LINE INPUT #FILENUM%, L$            ' RUN

  LINE INPUT #FILENUM%, L$
' PRINT L$
    WO = VAL(LEFT$(L$, 5))            ' Stack vel., m/s
    DIAM = VAL(MID$(L$, 6, 5))        ' Stack diam, m
    HEIGHT = ABS(VAL(MID$(L$, 11, 5)))    ' Stack height, m
    HBLD = VAL(MID$(L$, 16, 5))       ' Bldg. height, m
    AB = VAL(MID$(L$, 21, 5))         ' Bldg. area, m2
    HWIND = VAL(MID$(L$, 26, 5))      ' Wind level, m

  LINE INPUT #FILENUM%, L$            '  A  0  0  0
  LINE INPUT #FILENUM%, L$
    RUNDATE$ = L$
  LINE INPUT #FILENUM%, L$
    IF INSTR(L$, "NOTES:") THEN
      NOTES$ = L$
'       HEADERJFD$ = NOTES$
'       PRINT L$
    ELSE
      BEEP:   PRINT "Error in XOQ file --"; SN%
      LPRINT "Error in XOQ file -- at Notes Line -- Site: "; SN%
      PRINT "NOTES: line is read here as:"
      PRINT L$
      END
    END IF

END SUB '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  READXOQ
```

```
'_____________________________________________________________________
SUB RISE (STAB%, X!, U!, W!, DIAM!, HPR!)              ' Last change: 8 Sep 91
'_____________________________________________________________________

'   Calculates rise from non-buoyant (momentum dominated) plumes.
'   Model from XOQDOQ,  NUREG/CR-2919, pp. 34-36 & A.41
'   Notes: Time units in s for W.  No Thermal buoyancy assumed-- cold plume.

'      STAB  Stability index of Pasquill category                INPUT
'      X     Distance to receptor, m                             INPUT
'      U     Wind speed at top of vent, m/s                      INPUT
'      W     Stack gas velocity, m/s                             INPUT
'      DIAM  Stack ID, m                                         INPUT
'      HPR   Plume rise, m                                       OUTPUT
'_____________________________________________________________________

      DEFSNG A-Z
      DEFINT I-K, M-N, S

'_____________________________________________________________________

      IF DIAM < .00001 THEN HPR = 0: EXIT SUB                 ' No rize for zero stack ID.
                                                              '   as in XOQDOQ
      IF U > 0 THEN VR = W / U                                ' Velocity ratio, m/s per m/s

      HPR1 = 1.44 * DIAM * (VR ^ .6667) * (X / DIAM) ^ .3333  ' Rise 1, m
      C = 3 * DIAM * (1.5 - VR)                               ' Downwash Correction factor
      HPR2 = 3 * DIAM * VR                                    ' Rise 2, m
      FM = (W * DIAM / 2) ^ 2                                 ' Momentum flux, m4/s2

      SE! = .000875                                           ' Restoring accelerations for
      SF! = .00175                                            '  stable conditions, 1/s2
      SG! = .00245

      SELECT CASE STAB

        CASE 1, 2, 3, 4                                       ' A, B, C, D
          HPR = MINSNG!(HPR1, HPR2)                           ' Select least rise
          IF VR < 1.5 THEN HPR = HPR - C                      ' Consider downwash

        CASE 5, 6, 7                                          ' E, F, G
          IF STAB = 5 THEN
            S! = SE!
          ELSEIF STAB = 6 THEN
            S! = SF!
          ELSE
            S! = SG!
          END IF
          HPR3 = 4 * (FM / S!) ^ .25                          ' Rise 3, m
          HPR4 = 1.5 * ((FM / U) ^ .3333) / S! ^ .1667        ' Rise 4, m
          HPR = MINSNG!(HPR1, HPR2)                           ' Select least rise
          HPR = MINSNG!(HPR, HPR3)
          HPR = MINSNG!(HPR, HPR4)

      END SELECT

'' PRINT "rise --"; HPR1; HPR2; HPR3; HPR4, HPR: SLEEP 2

END SUB '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> RISE
```

Appendix B

Utility Program Listings

APPENDIX B. UTILITY LISTINGS

Listings of the utility programs described in this manual are listed in this appendix. A list of listings is given below.

B.1 CPRDEDIT.BAS

```
' CPRDEDIT ****    Routine to edit SUMyySnn.OUx files
'       Version of 19 May 94
'-----------------------------------------------------------------------

'       Auther: D. A. Baker, PNL

'       Contact:  D. A. Baker, PNL, (509) 375 3809
'***************************** Abstract ************************************

'      Program edits summary file generated by the CPRDA and CPRDL programs.
'      Any field of a record may be changed by following the simple input steps.
'      A dump of the edited file may be elected for final check.

'***************************** Disclaimer **********************************

'      This program was prepared under a contract with an agency of the
'      U. S. Government.  Neither the agency, Pacific Northwest Laboratory,
'      nor the author makes any warranty or assumes any legal liability or
'      responsibility for the accuracy or usefullness of this program.

'***************************** Software ************************************

' Compiler:   Microsoft Basic 7.1
' Libraries:  DAB1.LIB & DAB1.QLB
' Supporting  Modules:  NONE

'************************** Update History *********************************

'************************** Command Line Input *****************************

'               CORDEDIT   SUM file spec.

' Ex.:          CPRDEDIT   SUM89S69.OUG

'***************************** Files ***************************************

'               Description             type       number          name

'   Input:      Output Summary          Random        1          SUMyySnn.OUx

'   Output:       Same file

'***************************** Initialization ******************************

   DECLARE SUB PARSE2 (COMSTRING$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())
   DECLARE SUB FINDFILE (FILE$, ENV$, ECODE%)
   DECLARE FUNCTION EXIST% (FILE$)
   DECLARE FUNCTION TIMESTAMP$ ()
'-----------------------------------------------------------------------------

   DEFINT A-Z

'-----------------------------------------------------------------------------

   CONST FALSE = 0, TRUE = NOT FALSE
   CONST MAXRECS = 100
   CONST RECLEN = 128
   CONST DELIM$ = " "
   CONST ENV$ = "CPRD"
   CONST MAXARGS = 41
   ESC$ = CHR$(27)

   TYPE RECSTRUCTURE
      Z AS STRING * RECLEN
   END TYPE

   DIM ARGS$(41)
   DIM SUMMARY AS RECSTRUCTURE
'-----------------------------------------------------------------------------
'------- Printer Strings -------------

    LPRINT ESC$; "&a4L";                    ' LaserJet margin for dump
    LPRINT ESC$; "&l4.55C"                  ' 10.5 lines/inch

'-----Select default string to leave printer --------
'
   PDS$ = ESC$ + "E"                        ' LaserJet Reset

'----------------------- Command Line & KB Input ------------------------
```

```
    COLOR 14, 1: CLS :  PRINT
    PRINT "  CPRDEDIT - Program to edit field of CPRD Summary file"

    PRINT
    IF COMMAND$ <> "" THEN
       F$ = COMMAND$
    ELSE
       PRINT :  LINE INPUT "Enter file spec for SUM file: "; Q$
       F$ = Q$
    END IF

' F$ = "SUM91S38.OUM"                ' Test

'    CALL FINDFILE(F$, ENV$, ECODE%)
'      IF ECODE% = FALSE THEN PRINT "File "; F$; " not found. *****": BEEP:  END

    IF EXIST%(F$) THEN
      OPEN F$ FOR RANDOM AS #1
      PRINT F$; " Opened in random mode ..."
    ELSE
      PRINT "File "; F$; " not found. *****": BEEP:  END
    END IF

    PRINT STRING$(80, 176)

'---  Edit Fields ------------------------------------------------------------

START:

    PRINT :   INPUT "Enter record number: ", REC
    IF REC = 0 THEN END

    GOSUB GETLINE
    IF LEFT$(L$, 1) = CHR$(0) THEN PRINT "Record is BLANK ---": END

    PRINT "Present Record:":   PRINT L$

    CALL PARSE2(L$, MAXARGS, DELIM$, NUMARGS, ARGS$())

NEWVAL:

  DO

    PRINT : LINE INPUT "Enter field number: "; Q$
    FELD = INT(VAL(Q$))
    IF FELD = 0 THEN EXIT DO                    ' No more changes
    PRINT "Present Value: "; ARGS$(FELD)
    LINE INPUT "Enter new value: "; VALUE$

    IF VALUE$ <> "" THEN                        ' No change when just Enter pressed

      L1 = 1                                    ' Start at beginning of record
      FOR I = 1 TO NUMARGS
        L = LEN(ARGS$(I))                       ' Length of field
        X = INSTR(L1, UCASE$(L$), ARGS$(I))     ' Start of field
        IF I = FELD THEN EXIT FOR               ' Correct field found
        L1 = X + L                              ' Skip over field to get new start point
      NEXT

      IF X > 0 THEN
        MID$(L$, X, L) = SPACE$(L)              ' Put spaces in field string
        MID$(L$, X) = VALUE$                    ' Put value in field
        SUMMARY.Z$ = L$                         ' Place record string in record
        PUT #1, REC, SUMMARY                    ' Write revised record to file
        GOSUB GETLINE                           ' Get latest revision of record
        CALL PARSE2(L$, MAXARGS, DELIM$, NUMARGS, ARGS$())
      ELSE
        PRINT "Error in value length or value not found":  BEEP:  END
      END IF

    END IF
  LOOP

    PRINT :  PRINT "New Record:":   PRINT L$

    PRINT :  LINE INPUT "OK ? (Y/N): "; Q$
    IF UCASE$(Q$) = "N" THEN GOTO NEWVAL


    LINE INPUT "Any more ?  (N/Y): "; Q$
    IF UCASE$(Q$) = "Y" THEN GOTO START

    PRINT :  LINE INPUT "Enter comments (< 100 characters): "; Q$
    IF Q$ <> "" THEN
      SUMMARY.Z$ = TIMESTAMP$ + " --- " + Q$
      PUT #1, 100, SUMMARY
    END IF

    PRINT : LINE INPUT "Print File ?  (Y/N): "; Q$
```

```
    IF UCASE$(Q$) = "N" THEN END

'----------------  Dump  ----------------------------------------------------

    WIDTH LPRINT 255
    PRINT :  PRINT "      Printing file "; F$; " . . ."
    LPRINT "Dump of "; F$:  LPRINT

    REC = 0
    DO UNTIL REC = MAXRECS
       REC = REC + 1:  LPRINT REC; " ";
       GET #1, REC, SUMMARY
       L$ = MID$(SUMMARY.Z$, 1, RECLEN - 2): LPRINT L$
    LOOP
    LPRINT PDS$;
    PRINT : PRINT " Dump completed ----"

    END

'-------------------------------------------------------------------------------
'                            GOSUBS
'-------------------------------------------------------------------------------

GETSITE: '********************

     INPUT "ENTER SITE NO.: ", Q$
     ARGS$(1) = Q$: SITENUM$ = Q$:   PRINT
  RETURN

GETDRIVE: '*********************

     PRINT "ENTER DRIVE LETTER HOLDING OUT FILE (Default = F): ";
     Q$ = "": WHILE Q$ = "": Q$ = INKEY$: WEND: PRINT Q$
     IF Q$ = CHR$(13) THEN ARGS$(2) = "F" ELSE ARGS$(2) = UCASE$(Q$)
     PRINT
  RETURN

GETLINE: '*********************

     GET #1, REC, SUMMARY
     L$ = MID$(SUMMARY.Z$, 1, RECLEN)
  RETURN

'*****************************  End of CPRDEDIT  *********************************
```

B.2 CPRDUMP.BAS

```
'  CPRDUMP ****    Routine to List SUMyySnn.OUx file at printer
'       Version of  4 Jun 93
'-----------------------------------------------------------------------

'       Auther: D. A. Baker, PNL

'       Contact:  D. A. Baker, PNL, (509) 375 3809

'****************************** Abstract ***********************************

'      Program reads summary file generated by the CPRDA and CPRDL programs
'      and directs records an HP Laser printer.

'****************************** Disclaimer *********************************

'      This program was prepared under a contract with an agency of the
'      U. S. Government.  Neither the agency, Pacific Northwest Laboratory,
'      nor the author makes any warranty or assumes any legal liability or
'      responsibility for the accuracy or usefullness of this program.

'****************************** Software ***********************************

'  Compiler:   Microsoft Basic 7.1
'  Libraries:  DAB1.LIB & DAB1.QLB
'  Supporting  Modules:  NONE

'************************** Update History *********************************

'************************** Command Line Input *****************************

'                CPRDUMP   Summary-file-spec

'  Ex.:          CPRDUMP   SUM89S69.OUG

'****************************** Files **************************************

'                Description              type       number          name

'    Input:      Output Summary           Random       1          SUMyySnn.OUx

'    Output:       None

'***************************** Initialization ******************************

   DECLARE SUB PARSE2 (COMSTRING$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())
   DECLARE SUB FINDFILE (FILE$, ENV$, ECODE%)

   CONST FALSE = 0, TRUE = NOT FALSE
   CONST MAXRECS = 100
   CONST RECLEN = 128
   CONST DELIM$ = " "
   CONST ENV$ = "CPRD"
   CONST MAXARGS = 41
   ESC$ = CHR$(27)


   TYPE RECSTRUCTURE
      Z AS STRING * RECLEN
   END TYPE

   DIM ARG$(12)
   DIM SUMMARY AS RECSTRUCTURE

'-------------------------------------------------------------------------
'------- Printer Strings -------------

    LPRINT ESC$; "&a4L";                    ' LaserJet margin for dump
    LPRINT ESC$; "&l4.55C"                  ' 10.5 lines/inch

'-----Select default string to leave printer --------
'
   PDS$ = ESC$ + "E"                        ' LaserJet Reset
'-------------------------------------------------------------------------

'------------------------  Command Line & KB Input  ------------------------

    COLOR 14, 1: CLS :  PRINT
    PRINT " 'CPRDUMP - Program to list to printer CPRD Summary file"
START:
    PRINT
    IF COMMAND$ <> "" THEN
       F$ = COMMAND$
```

```
    ELSE
       PRINT :  LINE INPUT "Enter file spec for SUM file: "; Q$
       F$ = Q$
    END IF

    CALL FINDFILE(F$, ENV$, ECODE%)
      IF ECODE% = FALSE THEN PRINT "File "; F$; " not found. *****": BEEP:  END

'-------------------------------------------------------------------------------

    WIDTH LPRINT 255
    PRINT :  PRINT "      Printing file "; F$; " . . ."
    LPRINT "Dump of "; F$:  LPRINT

    OPEN F$ FOR RANDOM AS #1
    REC = 0
    DO UNTIL REC = MAXRECS
       REC = REC + 1:  LPRINT REC; " ";
       GET #1,  REC, SUMMARY
       L$ = MID$(SUMMARY.Z$, 1, RECLEN - 2): LPRINT L$
    LOOP
    LPRINT PDS$;
    PRINT : PRINT " Dump completed ----"

    END

'-------------------------------------------------------------------------------
'                            GOSUBS
'-------------------------------------------------------------------------------

GETSITE: '********************

     INPUT "ENTER SITE NO.: ", Q$
     ARG$(1) = Q$: SITENUM$ = Q$:   PRINT
  RETURN

GETDRIVE: '********************

     PRINT "ENTER DRIVE LETTER HOLDING OUT FILE (Default = F): ";
     Q$ = "": WHILE Q$ = "": Q$ = INKEY$: WEND: PRINT Q$
     IF Q$ = CHR$(13) THEN ARG$(2) = "F" ELSE ARG$(2) = UCASE$(Q$)
     PRINT
  RETURN

GETLINE: '********************

     GET #1, REC, SUMMARY
     L$ = MID$(SUMMARY.Z$, 1, RECLEN)
  RETURN

'********************  End of CPRDUMP  ****************************************
```

B.3 CPRDPRNT.BAS

```
'  CPRDPRNT ****    Routine to print output summary file and detail files
'       Version of 15 Nov 94
'-----------------------------------------------------------------------

'       Auther: D. A. Baker, PNL

'       Contact:  D. A. Baker, PNL, (509) 375 3809

'****************************** Abstract ***************************************

'      Program reads summary file generated by the CPRDA and CPRDL programs
'      and directs selected lines to the printer for the summary and detailed
'      adult dose files.   Headers of input files, input data, and result
'      tables are printed.  Reports are automatically selected from input file
'      name.

'****************************** Disclaimer *************************************

'      This program was prepared under a contract with an agency of the
'      U. S. Government.  Neither the agency, Pacific Northwest Laboratory,
'      nor the author makes any warranty or assumes any legal liability or
'      responsibility for the accuracy or usefullness of this program.

'****************************** Software ***************************************

'  Compiler:   Microsoft Basic 7.1
'  Libraries:  DAB1.LIB & DAB1.QLB
'  Supporting  Modules:  NONE

'************************** Update History *********************************

'   9 Mar 82  WRITTEN BY R. A. PELOQUIN, BNW, RICHLAND, WA,
'   7 Jul 82  MODIFIED BY DA BAKER    7 JUL 82, 19 OCT 82 ,  2 JUN 83       ---
'  19 Oct 82
'   2 Jun 83
'  27 Feb 84  IBM PC VERSION , DA BAKER

'  30 Apr 89  Modified for Quickbasic 4.5
'   1 May 89  Ran
'  30 May 90
'  15 Nov 90  Added MISCMOD2 module and Basic 7.1 compatibility & made F default disk
'  26 Nov 90  Added BV, FM, and FF factors for air
'  28 Jan 91  Format modification
'   5 Feb 91  Replaced TWh with MW-h
'  10 Jul 91  Added MI Scenario doses
'  15 Jul 91  Combined CPRDOUT, READAIR, READWATR into this program
'   9 Aug 91  Modified command line processing routine. Add total of MI liquid doses.
'  12 Aug 91  Modified Summary air dose printout -- Appendix I..
'  11 Nov 91  Modified Summary Liquid printout -- App. I & percents des. obj.
'  25 Feb 92  Slight modifications.  G E M file suuport.
'   9 Mar 92  Added FORM$ function and PDS Format$ and time and date functions
'  17 Mar 92  Added FEXPOSR to SUMMARY sub.
'  19 Mar 92  Revised formats of D.Water, fish, and invert mixing to SUMMARY.  Added year
'  20 Mar 92  Split SUMMARY SUB into two parts.
'  16 APR 92  Minor cahanges
'  18 APR 92  Added Air gamma results to SUB SUMAIR
'  27 APR 93  Revised SITENAME$ SOURCE for SUMAIR and SUMLIQ subs.
'  27 JUL 93  Corrected "From CPRDA Run" line in sub AIR.
'  18 JAN 94  Minor formatting in subs sumair and sumliq.
'   5 Apr 94  Minor formatting in sumliq
'  15 Nov 94  Added rec 71 to SUMLIQ

'************************** Command Line Input *****************************

'                  Output-file-spec

'  Ex.:          CPRDPRNT   SUM89S69.OUG
'                CPRDPRNT   F:AIR89S25.OUG
'                CPRDPRNT   F:\OUTPUT\LIQ89S45.OUT

'****************************** Files ******************************************

'               Description             type       number          name

'    Input:     Output Summary          Random       1          OUTyySss.OUT

'    Output:      None

'***************************** Initialization **********************************

   DEFSNG A-Z
   DEFINT I-K
```

```
   DECLARE FUNCTION FORM$ (VALUE!)
   DECLARE FUNCTION ROUNDOFF! (VALUE!, SIGFIG%)
   DECLARE FUNCTION TIMESTAMP$ ()
   DECLARE SUB AIR (FILE$)
   DECLARE SUB LIQUID (FILE$)
   DECLARE SUB PARSE2 (COMSTRING$, MAXARGS%, DELIM$, NUMARGS%, ARG$())
   DECLARE SUB FINDFILE (FILE$, ENV$, ECODE%)
   DECLARE SUB SUMAIR (FILE$)
   DECLARE SUB SUMLIQ (FILE$)

'$INCLUDE: 'FORMAT.BI'
'$INCLUDE: 'DATIM.BI'

'------------------------ Parameter Definitions -----------------------------

   CONST FALSE = 0, TRUE = NOT FALSE
   CONST COMSYMBOL$ = "!'{|" ' Comment symbol
   CONST RECLEN = 128        ' Record length
   CONST N1% = 83            ' NUKES
   CONST MIN = 2.5           ' Minimum percent for sorted total printout
   CONST LM% = 12            ' Left margin
   CONST DELIM$ = " "        ' String parsing delimeter
   CONST ENV$ = "CPRD"       ' Environment string
   CONST MAXARGS = 20        ' Max no. args in line to parse
         ESC$ = CHR$(27)

'--------------------  Array Declarations  ---------------------------------

   DIM ARG$(MAXARGS)         ' Command line arguments
   DIM K$(MAXARGS)           ' Command line arguments
   DIM P(80)                 ' Substring delimeter position

   DIM SHARED FILE$          ' Input file name

'-----------------  Random File Record Structures  --------------------------

   TYPE RECSTRUCTURE
      Z AS STRING * RECLEN
   END TYPE

   TYPE TITLESTRUCTURE
     LL AS STRING * 60
   END TYPE

   TYPE RECORDTYPEAIR
     NUKE AS STRING * 8
     H1 AS SINGLE
     H2 AS SINGLE
     H3 AS SINGLE
     H4 AS SINGLE
     H5 AS SINGLE
     H6 AS SINGLE
     DUM AS STRING * 28
   END TYPE

   TYPE RECORDTYPELIQ
     NUKE AS STRING * 8
     H1 AS SINGLE
     H2 AS SINGLE
     H3 AS SINGLE
     H4 AS SINGLE
     H5 AS SINGLE
     H6 AS SINGLE
     H7 AS SINGLE
     H8 AS SINGLE
     H9 AS SINGLE
     H10 AS SINGLE
     DUM AS STRING * 12
   END TYPE

'-------------------------------------------------------------------------------
'------- Printer Strings -------------
'-----Left margin = 8; 7.2 lpi

   PSS$ = ESC$ + "&a10L" + ESC$ + "&l6.7C"      ' LaserJet left margin and line spacing

'-----Select default string to leave printer --------
'
   PDS$ = ESC$ + "E"                          ' LaserJet Reset
'-------------------------------------------------------------------------------

'------------------------  Command Line & KB Input  -------------------------

    COLOR 15, 1:  CLS
    PRINT "CPRDOUT - Program to print CPRD Output files"
    PRINT
    PRINT "COMMAND$="; COMMAND$

    IF LEN(COMMAND$) THEN
```

```
        IF INSTR(COMMAND$, "\") THEN
          CALL PARSE2(COMMAND$, MAXARGS%, "\", NUMARGS%, ARG$())
          FILEFLG$ = LEFT$(ARG$(NUMARGS%), 1)
        ELSEIF INSTR(COMMAND$, ":") THEN
          FILEFLG$ = MID$(COMMAND$, 3, 1)
        ELSE
          FILEFLG$ = LEFT$(COMMAND$, 1)
        END IF
        FILE$ = COMMAND$
    ELSE
        BEEP:  CLS : PRINT
        PRINT "        File to print must be entered on command line:"
        PRINT "          CPRDPRNT Filespec": PRINT
        PRINT "          Ex.   CPRDPRNT  F:OUT89S25.OUG":   PRINT
        PRINT
        END
    END IF

    PRINT "FILE$="; FILE$
    PRINT "FILEFLG$="; FILEFLG$

'----- Check for extension

    IF INSTR(FILE$, ".") THEN
      FILE$ = FILE$
    ELSE
      FILE$ = FILE$ + ".OUT"
    END IF

    CALL FINDFILE(FILE$, ENV$, ECODE%)
      IF ECODE% = FALSE THEN
        BEEP:   PRINT "File "; FILE$; " not found. *****":  END
      END IF

'-------------------------------------------------------------------------------

    WIDTH LPRINT 255
    LPRINT PSS$;                                  ' Set margin & LPI

'*************************  Summary file dump ******************************

'      LPRINT ESC$ + "&a4L"                     ' LaserJet margin for dump
'        REC = 0
'        DO UNTIL EOF(1)
'             REC = REC + 1:  LPRINT REC; " ";
'             GET #1, REC, SUMMARY
'             L$ = MID$(SUMMARY.Z$, 1, RECLEN - 2): LPRINT L$
'        LOOP
'        LPRINT CHR$(13); CHR$(12);

'*******************************************************************************

    PRINT "File selected: "; FILE$:   PRINT

    SELECT CASE FILEFLG$
      CASE "O", "S"                 ' OUTput, SUMmary
        CALL SUMLIQ(FILE$)
        CALL SUMAIR(FILE$)
      CASE "A", "G"                 ' AIR, GAS
        CALL AIR(FILE$)
      CASE "L", "W"                 ' LIQuid, WATer
        CALL LIQUID(FILE$)
    END SELECT

    LPRINT PDS$;                        ' Reset printer

END '********************  End CPRDPRNT main  *********************************
```

```
DEFSNG I-K
'-------------------------------------------------------------------------
SUB AIR (FILE$)                                    ' 18 JAN 94
'-------------------------------------------------------------------------

    DEFSNG A-Z
    DEFINT I-K, N

    SHARED ESC$

    IORG = 6                              ' Number of organs

    DIM M(N1) AS SINGLE                 ' Option 1 T. Body Dose for sort
    DIM DOSE(N1, IORG) AS SINGLE        ' Option 1 Dose
    DIM NUCNUM(N1%) AS INTEGER           '
    DIM NUKE(N1%) AS STRING * 8          ' Nuclide symbol
    DIM NK$(N1%)                         ' Nuclide symbol

    DIM DOSES AS RECORDTYPEAIR, TITLE AS TITLESTRUCTURE
'-------------------------------------------------------------------------

    HED1$ = "NUC.  ":  HED2$ = "NO.   "
    PATHS1$ = "  AIR    GND.   ------------------ INHALATION ---------------- ------------------ INGESTION
------------------"
    PATHS2$ = "  SUB.  IRRAD.  T.BODY    GUT     THY.   BONE    LIVER   LUNG   T.BODY    GUT     THY.   BONE
  LIVER   LUNG  "
    TOTAL1$ = " -TOTAL  BODY-":  TOTAL2$ = "  TOTAL    % "

'---------------------  Open File and Print Titles  --------------------------

    OPEN FILE$ FOR RANDOM AS #1 LEN = LEN(TITLE)
    GET #1, 1, TITLE:   L$ = TITLE.LL
    LPRINT
    LPRINT TAB(LM); " * * *  "; L$; "  * * *"; TAB(100); TIMESTAMP$
    PRINT L$:  LPRINT
    SITENAME$ = MID$(L$, INSTR(L$, ",") + 29, 23)
    YR$ = MID$(L$, INSTR(L$, ".") - 5, 2)

    GET #1, 2, TITLE
    LPRINT TAB(LM%); "From CPRDA "; TITLE.LL
    PRINT TITLE.LL: LPRINT
    SLEEP 1
'-------------------  Initialise Totals and Select Options  ------------------

    TT = 0:  TTB = 0

'------------  Organ dose by nuclide  -------------------------------

     LPRINT TAB(LM%); " *** OPTION 1 -- Nuclide vs. Organ -- Summed over sectors   ( Man-Rem )"
     LPRINT
     LPRINT TAB(LM%); "           T BODY    GI-LLI    THYROID     BONE     LIVER     LUNG     TBODY %"
     LPRINT

     J = 0: TTBODY = 0: TTHY = 0: TLIVER = 0: TGUT = 0: TBONE = 0: TLUNG = 0

     FOR I = 1 TO N1
       GET #1, , DOSES
       NUKE$(I) = DOSES.NUKE
       IF ASC(LEFT$(NUKE$(I), 1)) <> 0 THEN
         J = J + 1
         DOSE(I, 1) = DOSES.H1    ' T. body
         DOSE(I, 2) = DOSES.H2    ' GI
         DOSE(I, 3) = DOSES.H3    ' Thy
         DOSE(I, 4) = DOSES.H4    ' Bone
         DOSE(I, 5) = DOSES.H5    ' Liver
         DOSE(I, 6) = DOSES.H6    ' Lung
         PRINT USING "## \      \  ##.#^^^^"; I; NUKE$(I); DOSE(I, 1)
         M(J) = DOSE(I, 1)
         NK$(J) = NUKE$(I)

'------ SUMS

         TTBODY = TTBODY + DOSE(I, 1):   TGUT = TGUT + DOSE(I, 2)
         TTHY = TTHY + DOSE(I, 3):       TBONE = TBONE + DOSE(I, 4)
         TLIVER = TLIVER + DOSE(I, 5):   TLUNG = TLUNG + DOSE(I, 6)
       END IF

     NEXT I

     CLOSE
     N2 = J

'------------  Check for zero total and end, since no air releases

     IF TTBODY = 0 THEN GOTO FINISHAIR
```

```
'---------------------- Print Table

      FOR I = 1 TO N2
        IF ASC(LEFT$(NUKE$(I), 1)) <> 1 THEN
          LPRINT TAB(LM%): :  LPRINT USING " \       \"; NUKE$(I);
          FOR K = 1 TO IORG:  LPRINT USING " ##.#^^^^ "; DOSE(I, K); :  NEXT K
          LPRINT USING "  ###.#"; DOSE(I, 1) / TTBODY * 100
        END IF
      NEXT I

      LPRINT :   LPRINT TAB(LM%); "TOTAL     ";
      LPRINT USING " ##.#^^^^  ##.#^^^^  ##.#^^^^ "; TTBODY; TGUT; TTHY;
      LPRINT USING " ##.#^^^^  ##.#^^^^  ##.#^^^^ "; TBONE; TLIVER; TLUNG

'-------------------  Sort Nuclides

SORT:
     F = TRUE
     FOR J = 1 TO N2 - 1
        IF M(J) <= M(J + 1) THEN
           F = FALSE
           SWAP M(J), M(J + 1)
           SWAP NK$(J), NK$(J + 1)
        END IF
     NEXT J
     IF F = FALSE THEN GOTO SORT
     PRINT : PRINT N2; " VALUES SORTED":   PRINT

'-------------------  Print Sorted Nuclides  ---------------

     LPRINT
     LPRINT : LPRINT TAB(LM% + 14); "AIR --------  Sorted Total Body Contributors  > "; MIN; " %  ------- AIR"
     LPRINT
     FOR J = 1 TO N2
        IF M(J) / TTBODY > MIN / 100 THEN
           TOT = TOT + M(J)
           LPRINT TAB(LM% + 34); : LPRINT USING "\       \      ##"; NK$(J); M(J) / TTBODY * 100
           PRINT USING "\       \      ##"; NK$(J); M(J) / TTBODY * 100
        END IF
     NEXT
     LPRINT TAB(LM% + 34); : LPRINT USING "OTHER         ##"; 100 - (TOT / TTBODY) * 100
     PRINT USING "OTHER          ##"; 100 - (TOT / TTBODY * 100)

FINISHAIR:

    LPRINT ESC$ + "&a70R";                          ' Set print head on last line
    LPRINT TAB(90); "AIR - "; RIGHT$(FILE$, 1); "   "; SITENAME$; "  "; YR$;
    LPRINT CHR$(13);                    ' CR -- Since last line, form feed automatic
    CLOSE

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  AIR
```

```
DEFSNG I-K, N
'_____________________________________________________________________
FUNCTION FORM$ (X!)          '                              8 Mar 92
'_____________________________________________________________________

' Rounds using ROUNDOFF function and formats for report using FORMAT function
' Functions must be declared in main program.
'_____________________________________________________________________

   DEFINT A-Z
'----------------------------------------------------------------------

   SIGFIG% = 2
   MINI! = .01
   MAX! = 999999!

   N! = ROUNDOFF!(X!, SIGFIG%)

   SELECT CASE N!
     CASE IS < MINI!
         M$ = FormatS$(N!, "0.0E+00;;0.0")
     CASE IS < 1
       M$ = "0" + LTRIM$(STR$(N!))
     CASE IS < MAX!
       M$ = FormatS$(N!, "###,##0.#")
     CASE ELSE
       M$ = FormatS$(N!, "0.0E+00")
   END SELECT

   FORM$ = M$

END FUNCTION  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> FORM$
```

```
DEFSNG A-Z
'-----------------------------------------------------------------------
SUB LIQUID (FILE$)                                          ' 27 Jul 93
'-----------------------------------------------------------------------

   DEFSNG A-Z
   DEFINT I-K, N

   SHARED ESC$

   K1 = 10                        ' Paths

   DIM M(N1) AS SINGLE            ' T. Body dose by nuclide summed over food & water
   DIM NUKE(N1) AS STRING * 8     ' Nuclide symbol
   DIM D(K1) AS SINGLE            ' Dose array by path-organ
   DIM N(N1, K1) AS SINGLE        ' Dose array by nuclide and path-organ
   DIM T(K1) AS SINGLE            ' Sum over nuclides for each path-organ

   DIM DOSES AS RECORDTYPELIQ, TITLE AS TITLESTRUCTURE

'-----------------------------------------------------------------------

   HED1$ = " NUCLIDE ":  HED2$ = "          "
   PATHS1$ = "------------ DRINKING WATER ---------- ------------ AQUATIC FOODS ------------"
   PATHS2$ = " T.BODY    GUT     THY.  BONE    LIVER   T.BODY    GUT    THY.    BONE    LIVER "
   TOTAL1$ = " -TOTAL  BODY-":  TOTAL2$ = "  TOTAL    % "

'------------------------  Open file and Print Titles  ----------------------

    OPEN FILE$ FOR RANDOM AS #1 LEN = LEN(TITLE)
    GET #1, 1, TITLE
    LPRINT
    LPRINT TAB(LM%); " * * *  "; TITLE.LL; "  * * * "; TAB(100); TIMESTAMP$
    LPRINT :     PRINT TITLE.LL
    SITENAME$ = MID$(TITLE.LL, INSTR(TITLE.LL, ",") + 32, 23)
    YR$ = MID$(TITLE.LL, INSTR(TITLE.LL, ".") - 5, 2)

    GET #1, 2, TITLE
    LPRINT TAB(LM%); "From CPRDL "; MID$(TITLE.LL, 1, LEN(TITLE.LL) - 5)
    PRINT TITLE.LL: LPRINT

    LPRINT TAB(LM%); " *** NUCLIDES VS. PATHWAYS  (MAN-REM)":   LPRINT
    LPRINT TAB(LM%); HED1$; PATHS1$; " "; TOTAL1$
    LPRINT TAB(LM%); HED2$; PATHS2$; " "; TOTAL2$
    LPRINT :   PRINT

'-----------------------  Initialize Totals & Read in file  -----------------

  TTB = 0: J = 0:   TOT = 0

  FOR I = 1 TO N1%
    GET #1, , DOSES
    NUKE$(I) = DOSES.NUKE
    IF ASC(LEFT$(NUKE$(I), 1)) <> 0 THEN
      D(1) = DOSES.H1:     D(6) = DOSES.H6
      IF D(1) <> 0 OR D(6) <> 0 THEN
        J = J + 1
        NUKE$(J) = NUKE$(I)
        D(2) = DOSES.H2:   D(7) = DOSES.H7
        D(3) = DOSES.H3:   D(8) = DOSES.H8
        D(4) = DOSES.H4:   D(9) = DOSES.H9
        D(5) = DOSES.H5:   D(10) = DOSES.H10
        PRINT USING "## \       \  ##.#^^^^  ##.#^^^^   ##.#^^^^"; J; NUKE$(I); D(1); D(6); D(1) + D(6)

        FOR K = 1 TO K1
          N(J, K) = N(J, K) + D(K)                  ' Pathway-organ dose for each nuclide
          T(K) = T(K) + D(K)                        ' Sum over nukes for each pathway-organ
          IF K = 1 OR K = 6 THEN
            M(J) = M(J) + D(K): TTB = TTB + D(K)    ' T. Body Total for each nuke summed over
          END IF                                    '    water and foods
        NEXT K

      END IF
    END IF
  NEXT I

  CLOSE
  N2 = J

'------------  Check for zero total and end, since no liquid releases

  IF TTB = 0 THEN GOTO FINISHLIQ

'---------------------  Print out table  --------------

    FOR I = 1 TO N2              ' NUKE
      IF ASC(LEFT$(NUKE$(I), 1)) <> 0 THEN
```

```
        LPRINT TAB(LM%); : LPRINT USING "\      \ "; NUKE$(I);

        FOR K = 1 TO K1
          LPRINT USING "##.#^^^^"; N(I, K);
        NEXT K

        LPRINT USING " ##.#^^^^ ###.#"; M(I); M(I) / TTB * 100    '  TOTALS OVER PATHS & %'S
      END IF
    NEXT I

    LPRINT

    LPRINT TAB(LM%); "TOTAL    ";

    FOR K = 1 TO K1              ' PATH
       LPRINT USING "##.#^^^^"; T(K);     ' TOTALS
     NEXT K

     LPRINT USING " ##.#^^^^ ###.#"; TTB; TTB / TTB * 100
'-------------------  Sort Nuclides

SORTL:
     F = TRUE
     FOR J = 1 TO N2 - 1
        IF M(J) <= M(J + 1) THEN
           F = FALSE
           SWAP M(J), M(J + 1)
           SWAP NUKE$(J), NUKE$(J + 1)
        END IF
     NEXT J
     IF F = FALSE THEN GOTO SORTL
     PRINT : PRINT N2; " VALUES SORTED":   PRINT
'-------------------  Print Out Sorted Nuclides  --------------

     LPRINT
     LPRINT : LPRINT TAB(LM% + 15); "LIQUID ----------  Sorted Total Body Contributors  > "; MIN; " %  -------
LIQUID"
     LPRINT
     FOR J = 1 TO N2
        IF M(J) / TTB > MIN / 100 THEN
           TOT = TOT + M(J)
           LPRINT TAB(LM% + 35); : LPRINT USING "\       \      ##"; NUKE$(J); M(J) / TTB * 100
           PRINT USING "\       \      ##"; NUKE$(J); M(J) / TTB * 100
        END IF
     NEXT
     LPRINT TAB(LM% + 35); : LPRINT USING "OTHER        ##"; 100 - TOT / TTB * 100

     PRINT USING "OTHER          ##"; 100 - TOT / TTB * 100

FINISHLIQ:

    LPRINT ESC$ + "&a70R";                         ' Set print head on last line
    LPRINT TAB(87); "LIQUID -   "; SITENAME$; "  "; YR$;
    LPRINT CHR$(13);                        ' CR -- Since last line, form feed automatic

  EXIT SUB

END SUB '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> LIQUID
```

```
'-------------------------------------------------------------------------
SUB SUMAIR (FILE$)                                          ' 18 Jan 94
'-------------------------------------------------------------------------

   DEFSNG A-Z
   DEFINT I-K, N

   SHARED ARG$(), K$(), ESC$

   DIM SUMMARI AS RECSTRUCTURE

'-------------------------------------------------------------------------

   OPEN FILE$ FOR RANDOM AS #1 LEN = RECLEN

   REC = 9:     GOSUB GETLINE
   YR$ = MID$(L$, INSTR(L$, "REL") + 3, 2)

   REC = 1:  GOSUB GETLINE:  SITENAME$ = MID$(L$, INSTR(L$, "Site:") + 5, 24)
   LPRINT FILE$; TAB(103); TIMESTAMP$:  LPRINT
   LPRINT TAB(16); " * * * * * * * * Site Air Dose Summary Report For "; SITENAME$; "  * * * * * * * * "
   LPRINT
   REC = 1:    GOSUB GETLINE
   IF INSTR(L$, "CPRDA") = 0 THEN
     LPRINT : LPRINT "    !!!!!!!  Release type not run for "; SITENUM$; "  !!!!!!!"
     GOTO FINISHSUM
   END IF
   LPRINT L$
   LPRINT
   LPRINT STRING$(50, "-"); " Input Files "; STRING$(50, "-")
   ERASE ARG$, K$
   LPRINT
   REC = 9:     GOSUB GETLINE:    LPRINT L$
   REC = 6:     GOSUB GETLINE:    LPRINT L$
   REC = 7:     GOSUB GETLINE:    LPRINT L$
   REC = 5:     GOSUB GETLINE:    LPRINT L$
   LPRINT
   REC = 10:    GOSUB GETLINE:    LPRINT L$
   REC = 11:    GOSUB GETLINE:    LPRINT L$
   REC = 12:    GOSUB GETLINE:    LPRINT L$
   REC = 13:    GOSUB GETLINE:    LPRINT L$
   REC = 14:    GOSUB GETLINE:    LPRINT L$
   LPRINT
   REC = 69:    GOSUB GETLINE
   CALL PARSE2(L$, MAXARGS%, DELIM$, NUMARGS%, ARG$())
   REC = 75:    GOSUB GETLINE
   CALL PARSE2(L$, MAXARGS%, DELIM$, NUMARGS%, K$())
   LPRINT STRING$(40, "-"); " Air Parameters "; STRING$(40, "-")
   LPRINT
   LPRINT "Pop Factor= "; ARG$(1); "   Pop= "; FormatS$(VAL(K$(1)), "#,##0,000"); "   Prod. Factor= "; ARG$(2);
   LPRINT "   Pasture Factors= "; ARG$(3); "  "; ARG$(4)
   LPRINT "Productions= "; ARG$(5); "  "; ARG$(6); "  "; ARG$(7); "   TW-h= "; ARG$(8)
   LPRINT
   REC = 8:     GOSUB GETLINE:    LPRINT "Met: "; RTRIM$(L$)
   REC = 52:    GOSUB GETLINE:    LPRINT "P/C Ratio:   "; RTRIM$(L$)
   LPRINT
   LPRINT "Major Nukes    H-3      C-14      Ar-41     Co-60     Kr-88     I-131    Xe-133    Xe-135"
   REC = 73:  GOSUB GETLINE:  LPRINT "QREL(Ci/y): "; L$
   REC = 83:  GOSUB GETLINE:  LPRINT "Bv        : "; L$
   REC = 84:  GOSUB GETLINE:  LPRINT "Fm  (d/L) : "; L$
   REC = 85:  GOSUB GETLINE:  LPRINT "Ff  (d/L) : "; L$
   LPRINT
   REC = 76:    GOSUB GETLINE
   LPRINT "Sum Dil Factors (s/m3 or 1/m2):  "; RTRIM$(L$)
   REC = 77:    GOSUB GETLINE
   CALL PARSE2(L$, MAXARGS%, ";", NUMARGS%, ARG$())
   LPRINT "Pop Weighted Avgs (man-s/m3 or man/m2):   E3="; FORM$(VAL(ARG$(1))); "    K2="; FORM$(VAL(ARG$(2)))
   LPRINT

   LPRINT "  Location    meters         XQ1        XQ2        XQ3        DQ"
   LPRINT
   FOR I = 30 TO 33
      REC = I:   GOSUB GETLINE:    LPRINT L$
   NEXT
   LPRINT :  LPRINT

'--------------------------  Air Doses

   LPRINT STRING$(12, "-"); " AIR POP. DOSE COMMITMENTS   (person-rem) "; STRING$(12, "-")
   LPRINT
   LPRINT "              T. Body    GI       Thy       Bone      Liver     Lung"
   LPRINT
   FOR I = 47 TO 51
      REC = I:   GOSUB GETLINE:    LPRINT L$
      IF I = 50 THEN LPRINT
   NEXT
   LPRINT
```

```
  LPRINT STRING$(33, "-"); " AIR MI DOSE COMMITMENTS   (mrem) "; STRING$(33, "-")
'  LPRINT "                                                Infant"
'  LPRINT "  Location    meters       T. Body    GI        Thy     Bone     Liver    Lung     Gamma    Beta"
'  LPRINT
'  FOR I = 34 TO 37
'     REC = I:   GOSUB GETLINE:    LPRINT L$
'  NEXT

'  LPRINT
'  FOR REC = 86 TO 90
'     GOSUB GETLINE:  LPRINT TAB(14); L$
'  NEXT

   LPRINT
   LPRINT TAB(18); "Site Boundary      Residence  ---------------------- Max. Organ ----------------------"
   LPRINT TAB(18); "Gamma      Beta     T.Body      Inhal    Veg/Pro  Milk/Meat  Total    Age      Organ"
   LPRINT
   REC = 74:  GOSUB GETLINE:  LPRINT L$
   LPRINT
   REC = 82:  GOSUB GETLINE:  LPRINT L$

   LPRINT
   REC = 91:  GOSUB GETLINE:  LPRINT L$


FINISHSUM:

   LPRINT ESC$ + "&a70R";                  ' LaserJet Cursor positioning
   LPRINT TAB(91); "AIR - "; RIGHT$(FILE$, 1); "   "; SITENAME$; "  "; YR$;
   LPRINT CHR$(13);       ' CR
   CLOSE

EXIT SUB

'_____________________________________________________________________________
GETLINE: '**********************

     GET #1, REC, SUMMARI
     L$ = MID$(SUMMARI.Z, 1, RECLEN)
  RETURN

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  SUMAIR
```

```
'_____________________________________________________________________
SUB SUMLIQ (FILE$)                                    ' 18 Jan 94
'_____________________________________________________________________

   DEFSNG A-Z
   DEFINT I-K, N

   SHARED ARG$(), K$(), ESC$

   DIM SUMMARI AS RECSTRUCTURE

'_____________________________________________________________________

   OPEN FILE$ FOR RANDOM AS #1 LEN = RECLEN

   REC = 17:     GOSUB GETLINEL
   YR$ = MID$(L$, INSTR(L$, "REL") + 3, 2)

   REC = 2:  GOSUB GETLINEL:  SITENAME$ = MID$(L$, INSTR(L$, "Site:") + 5, 24)
   LPRINT FILE$; TAB(104); TIMESTAMP$:  LPRINT
   LPRINT TAB(16); " * * * * * * * *  Site Liquid Dose Summary Report For "; SITENAME$; "  * * * * * * * * * "
   LPRINT
   REC = 2:    GOSUB GETLINEL
   IF INSTR(L$, "CPRDL") = 0 THEN
     LPRINT : LPRINT "    !!!!!!!  CPRDL NOT RUN FOR THIS SITE "; SITENUM$; "  !!!!!!!"
     GOTO FINISHSUMLIQ
   END IF
   LPRINT L$
   LPRINT
   LPRINT STRING$(50, "-"); " Input Files "; STRING$(50, "-")
   LPRINT

   ERASE K$
   REC = 17:    GOSUB GETLINEL:    LPRINT L$
   REC = 16:    GOSUB GETLINEL:    LPRINT L$
   REC = 15:    GOSUB GETLINEL:    LPRINT L$
   LPRINT
   REC = 18:    GOSUB GETLINEL:    LPRINT L$
   REC = 19:    GOSUB GETLINEL:    LPRINT L$
   REC = 21:    GOSUB GETLINEL:    LPRINT L$
   REC = 23:    GOSUB GETLINEL:    LPRINT L$
   REC = 25:    GOSUB GETLINEL:    LPRINT L$
   LPRINT
   REC = 72:    GOSUB GETLINEL:
   CALL PARSE2(L$, MAXARGS%, DELIM$, NUMARGS%, ARG$())
   DWPOP$ = ARG$(6):  AFPOP$ = ARG$(9)
   REC = 70:    GOSUB GETLINEL
   CALL PARSE2(L$, MAXARGS%, DELIM$, NUMARGS%, K$())
   LPRINT STRING$(47, "-"); " Liquid Parameters "; STRING$(47, "-")
   LPRINT
   LPRINT "Pop Factor=  "; K$(1); "    D. Water Pop= "; FORM$(VAL(DWPOP$));
   LPRINT "     Total 80-km Pop= "; FORM$(VAL(AFPOP$)); "     Pop. Aquatic Food Exposure= "; K$(13)
   PF! = VAL(K$(4)):   RF! = VAL(K$(5))
   CFS! = PF! * 1.119E-09:  CFS$ = FORM$(CFS!) + " cfs"
   LPRINT "Water Types= "; K$(2); " "; K$(3); "    Pipe Flow (L/y)= "; K$(4); "  ("; CFS$; ")      River Flow
(cfs)= "; K$(5);
   IF RF! > 0 THEN LPRINT "   Complete Mixing= "; FORM$(CFS! / RF!) ELSE LPRINT "     No River"
   WMIX$ = FORM$(VAL(K$(6)))
   FMIX$ = FORM$(VAL(K$(8))):  SMIX$ = FORM$(VAL(K$(10)))
   LPRINT "Pop. Usage & Mixing:  D. Water= "; DWPOP$; " & "; WMIX$; "    Fish= "; K$(7); " & "; FMIX$;
   LPRINT "    Invert= "; K$(9); " & "; SMIX$; "    FSHORE= "; K$(11)
   LPRINT
   LPRINT "Major Nukes     H-3     Mn-54     Fe-55     Fe-59     Co-58     Co-60     Zn-65     Sr-90     I-131     Cs-134
 Cs-137"
   REC = 78:  GOSUB GETLINEL:  LPRINT "QREL (Ci/y) :"; L$
   REC = 79:  GOSUB GETLINEL:  LPRINT "Recirc.     :"; L$
   REC = 80:  GOSUB GETLINEL:  LPRINT "Fish  (L/kg):"; L$
   REC = 81:  GOSUB GETLINEL:  LPRINT "Invert(L/kg):"; L$
   LPRINT
   REC = 20:    GOSUB GETLINEL:    LPRINT "Infant: "; L$
   REC = 22:    GOSUB GETLINEL:    LPRINT "Child : "; L$
   REC = 24:    GOSUB GETLINEL:    LPRINT "Teen  : "; L$
   REC = 26:    GOSUB GETLINEL:    LPRINT "Adult : "; L$
   LPRINT
   REC = 71:    GOSUB GETLINEL:    LPRINT L$
   LPRINT

'--------------------Liquid Doses

    LPRINT STRING$(12, "-"); " LIQUID POP. DOSE COMMITMENTS  (PERSON-";
    LPRINT "REM) "; STRING$(13, "-"):   LPRINT
    LPRINT "                T. Body       GI          Thy        Bone        Liver"
    LPRINT
    FOR I = 42 TO 46
      REC = I:    GOSUB GETLINEL:    LPRINT L$
      IF I = 45 THEN LPRINT
    NEXT I
```

```
    LPRINT : LPRINT
    LPRINT STRING$(15, "-"); " LIQUID ADULT MI DOSE COMMITMENTS  (mrem) "; STRING$(14, "-")
    LPRINT
    LPRINT "                        Direct &"
    LPRINT "             Mixing     Ingestion   ---- Ingestion dose to any organ ----"
    LPRINT "  Path       Ratio       T. Body       GI        Thy       Bone      Liver"
    LPRINT
    IMAGE$ = " TOTAL                 ##.#^^^^   ##.#^^^^  ##.#^^^^  ##.#^^^^  ##.#^^^^"

    TBODY = 0: TGI = 0: TTHY = 0: TBONE = 0: TLIVR = 0
    FOR I = 38 TO 41
       REC = I:   GOSUB GETLINEL:    LPRINT L$
       CALL PARSE2(L$, MAXARGS, " ", NUMARGS%, ARG$())
       TBODY = TBODY + VAL(ARG$(3))    ' MI T. Body
       TGI = TGI + VAL(ARG$(4))        ' MI GI-LLI
       TTHY = TTHY + VAL(ARG$(5))      ' MI Tyroid
       TBONE = TBONE + VAL(ARG$(6))    ' MI Bone
       TLIVR = TLIVR + VAL(ARG$(7))    ' MI Liver
    NEXT
    LPRINT
    LPRINT USING IMAGE$; TBODY; TGI; TTHY; TBONE; TLIVR

    LPRINT :  LPRINT
    LPRINT  TAB(13);  "--------------- Total  Body ------------------     -------------------- Max.  Organ
----------------------"
    LPRINT TAB(13); "D. Wat   Fish/Shell  Shore      Total     %DO       D. Wat  Fish/Shell   Total     %DO
 Age    Organ"
    LPRINT
    REC = 29:  GOSUB GETLINEL:  LPRINT L$

FINISHSUMLIQ:

    LPRINT ESC$ + "&a70R";            ' Set print head on last line
    LPRINT TAB(87); "LIQUID -    "; SITENAME$; "  "; YR$;
    LPRINT CHR$(13);                  ' CR -- Since last line, form feed automatic
    CLOSE

 EXIT SUB

'_____________________________________________________________________________
GETLINEL: '*********************

     GET #1, REC, SUMMARI
     L$ = MID$(SUMMARI.Z, 1, RECLEN)
  RETURN

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  SUMLIQ
```

B.4 RELGEN.BAS

```
' RELGEN ****  Routine to generate REL files from the Brookhaven release file
'       Version of 16 Apr 93
'-----------------------------------------------------------------------

'       Auther: D. A. Baker, PNL

'       Contact:  D. A. Baker, PNL, (509) 375 3809
'***************************** Abstract ************************************

'      Program reads in the Brookhaven release data file and creates a REL file
'      for each site.  Manual input of population factors are required for each
'      site.

'***************************** Disclaimer **********************************

'      This program was prepared under a contract with an agency of the
'      U. S. Government.  Neither the agency, Pacific Northwest Laboratory,
'      nor the author makes any warranty or assumes any legal liability or
'      responsibility for the accuracy or usefullness of this program.

'***************************** Software ************************************

'  Compiler:   Microsoft Basic 7.1
'  Libraries:  DAB1.LIB & DAB1.QLB
'  Supporting  Modules:  NONE

'************************* Update History **********************************

'************************* Command Line Input ******************************

'               CPRDPRNT   Brookhaven-file-name

'***************************** Files ***************************************

'               Description             type       number          name

'    Input:     Brookhaven Data         Text          1          Variable

'    Output:    REL files               Text                     RELyySnn.DAT

'***************************** Initialization ******************************

   DEFINT I-K, N

   DECLARE FUNCTION EXIST% (FILE$)
   DECLARE SUB GETALINE (FILENUM%, LINE$)
   DECLARE SUB GETRELEASE ()
   DECLARE SUB PARSE2 (COMSTRING$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())
   DECLARE SUB RELWRITE ()
   DECLARE SUB STRINGS ()
   DECLARE FUNCTION TIMESTAMP$ ()
'-----------------------------------------------------------------------

   CONST FALSE = 0, TRUE = NOT FALSE
   CONST MAXARGS% = 10
   CONST MAXLINES% = 4800                  ' Max without exceeding 64k data and stack space

   CONST MAXNUKES = 83                     'no. of radionuclides considered
   CONST POPDEF = 1!                       'population factor default

   CONST COMSYMBOL$ = "!'{"                ' Valid comment symbols for data files.
   CONST DELIM$ = " ,"                     ' Valid delimiters
   CONST OFFSET% = 0

   STACK (512)                             ' Reduced to increase data in 64k space

   DIM ARGS$(MAXARGS)                      ' Parsed strings of lines for files 1 & 2
   DIM SHARED LINES%                       ' Line number count for input file
   DIM SHARED BYTES&(MAXLINES)             ' Bytes count for file by line number

' Note:  The begining byte number of each line is kept in long integer array BYTES&.
'  This array is updated at each call of GETALINE.
'  Thus for line 25, say, its begining byte would be BYTES&(25).

   DIM SHARED N1(85) AS STRING * 8, N2(85)  AS STRING * 8
   DIM SHARED R(4, 85) AS SINGLE
   DIM SHARED DK(85) AS STRING

   DIM SHARED B12$, B8$, H1$, H2$, H3$, H4$, H5$, H6$, I1$, I2$

'_____________  Switch definitions  _____________________________________
```

```
'  SW1%   Site found: TRUE = Site found; FALSE = Not Found
'  SW2%   Selected site found: TRUE = Found; FALSE = Not Found
'
'-------------------------------------------------------------------------------
DEF FNCOMMENT% (LINE$)
' Function checks for the first presence in line LINE$ of length NUM% of any comment symbols.
' Returns column number COL% of first comment symbol contained in COMSYMBOL$ or 0 if not found.
' COMSYMBOL$ is defined as a CONST in main program.

 STATIC COL%, NUM%, I1

  COL% = 0:   NUM% = LEN(LINE$)
  IF NUM% = 0 THEN FNCOMMENT% = 0: EXIT DEF
  FOR I1 = 1 TO NUM%
   COL% = INSTR(COMSYMBOL$, MID$(LINE$, I1, 1))
   IF COL% THEN EXIT FOR
  NEXT
  IF COL% THEN COL% = I1
  FNCOMMENT% = COL%
END DEF

'------------------------  Program Start  ---------------------------------------

   CALL STRINGS
   COLOR 14, 1                                  ' Yellow on blue

   IF COMMAND$ = "" THEN
'    ARGS$(1) = "SITEDATA.89"
'    ARGS$(1) = "NRC99"
     IF ARGS$(1) = "" THEN PRINT "Enter this year's filename on command line": BEEP:   END
   ELSE
     CALL PARSE2(COMMAND$, 2, " ", NUMARGS%, ARGS$())
   END IF

   CLS : PRINT
   PRINT "              RELGEN REL file Creation Program ":  PRINT : PRINT
   LINE INPUT "Enter INPUT file drive (C:, F:, etc.) (Current is Default): "; Q$
   IF Q$ = "" THEN DRV$ = "" ELSE DRV$ = Q$
   INFILE$ = DRV$ + ARGS$(1)
   PRINT
   LINE INPUT "Enter OUTPUT file drive (Current is default): "; Q$:   PRINT
   IF Q$ = "" THEN DRV$ = "" ELSE DRV$ = Q$

   LINE INPUT "Enter initials (dAb Default): "; Q$
   IF Q$ = "" THEN INI$ = "dAb" ELSE INI$ = Q$
   PRINT INI$; " it is ****":  PRINT
   LINE INPUT "Enter year of releases: 19__ (89 Default): "; Q$
   IF Q$ = "" THEN YR$ = "90" ELSE YR$ = Q$
   PRINT YR$; " it is ****":  PRINT
   PRINT :  SLEEP 1

'-------------------------------------------------------------------------------

   OPEN INFILE$ FOR INPUT AS #1 LEN = 4096
   CALL GETALINE(1, L$)
   HEAD$ = L$

   EXPFILE$ = DRV$ + "REL.EXP"
   IF EXIST%(EXPFILE$) THEN
     OPEN EXPFILE$ FOR APPEND AS #3
     PRINT #3, :  PRINT #3, "Appending at "; TIMESTAMP$
     PRINT #3,
   ELSE
     OPEN EXPFILE$ FOR OUTPUT AS #3
     PRINT #3, "     CPRD Exception File for "; INFILE$; " run on "; TIMESTAMP$; "  "; INI$
     PRINT #3,
   END IF

'------------------------ Test read
GOTO AGAIN        ' Remmark to test file

   DO UNTIL EOF(1)
     CALL GETALINE(1, L$)
     CALL PARSE2(L$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())
     BYTES&(LINES%) = BYTES&(LINES%) + OFFSET%
     PRINT LINES%; BYTES&(LINES%); " *** "; L$
   LOOP
   PRINT "END OF FILE"
   PRINT

  CLOSE : OPEN INFILE$ FOR BINARY AS #1 LEN = 1024
  I = 1: C$ = STRING$(1, " ")   '  Initialization
  FOR I = 1 TO 35
    SEEK 1, BYTES&(I): GET 1, BYTES&(I), C$
''    PRINT I, BYTES&(I), "=="; C$; "=="
  NEXT
   PRINT "End of file ------------"
'   PRINT CHR$(12);
   CLOSE
```

```
  STOP
'-------------------------------------------

AGAIN:
   CLS : PRINT HEAD$: PRINT : PRINT
   PRINT "     Enter the site number or A for all sites in order."
   PRINT "     After creation of individual REL file, it will be displayed."
   PRINT "     Hit escape to clear displayed file from screen."
   PRINT "     Enter RETURN to exit program."
   PRINT

   LINE INPUT ">>> "; Q$
   IF Q$ = "" THEN GOTO FINISH
   IF INSTR(Q$, "A") THEN SN = 0 ELSE SN = VAL(Q$)

PRINT "********** Searching ********************  ";

   SW1% = FALSE                    ' Site not found
   SW2% = FALSE                    ' Not release line
   SEEK #1, LEN(HEAD$) + 1         ' Start Search at SECOND line

   DO UNTIL EOF(1)      ' 1 ---- Search file for site-number line
     CALL GETALINE(1, L$)
     IF SN > 0 THEN LOCATE 10, 40:   PRINT SEEK(1);
''     PRINT "=="; L$
     CALL PARSE2(L$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())
     X$ = ARGS$(1)

     IF ASC(X$) < 58 AND ASC(X$) > 47 THEN                ' Found site number Line

       SITENUM$ = LEFT$(L$, 3):   SITE$ = RIGHT$(L$, LEN(L$) - 4)

       IF SN > 0 THEN                                     ' Single site selection check
         IF VAL(SITENUM$) <> SN THEN SW1% = FALSE:  GOTO ENDLOOP
       END IF

       PRINT SITENUM$; SITE$; " -- "
       PRINT #3, :  PRINT #3, SITENUM$; SITE$
       SW1% = TRUE                                        ' Site found
       SOUND 5000, 1
       INPUT "Enter pop change mutiplier from 1980 (1 is default): ", POP

     ELSEIF SW1% = TRUE AND INSTR(X$, "DAT") THEN
       NUMPLANTS = VAL(ARGS$(2))
       IF NUMPANTS > 4 THEN
         CLS :  PRINT "  Number of plants at site more than 4 --"
         PRINT "   Outside range suported by program.":  BEEP:  GOTO FINISH
       END IF

     ELSEIF SW1% = TRUE AND INSTR(X$, "FLO") THEN
       FLOWPIPE = VAL(ARGS$(2)) + VAL(ARGS$(3)) + VAL(ARGS$(4)) + VAL(ARGS$(5))
''       PRINT "FLOW"; FLOWPIPE
     ELSEIF SW1% = TRUE AND INSTR(X$, "ENE") THEN
       MWHR = VAL(ARGS$(2)) + VAL(ARGS$(3)) + VAL(ARGS$(4)) + VAL(ARGS$(5))

     ELSEIF SW1% = TRUE AND INSTR(X$, "REL") THEN
       SW2% = TRUE                              ' Set for start of release list
       RS& = SEEK(1)
     END IF

     IF SW2% = TRUE THEN                        ' Start of release list
       RELSTART% = LINES% + 0                   ' Line no. starting nuclide plant list
''       PRINT "RELSTART="; RELSTART%; RS&
       CALL GETRELEASE
     END IF


''     PRINT "X$"; X$
     IF SW1% = TRUE AND INSTR(X$, "***") > 0 THEN            ' Generate REL file
       IF MID$(SITENUM$, 2, 1) = " " THEN MID$(SITENUM$, 2, 1) = "0"
       OUTFILE$ = "REL" + YR$ + "S" + MID$(SITENUM$, 2, 2) + ".DAT"

       HEADER$ = OUTFILE$ + " *** " + YR$ + H1$ + " *** " + TIMESTAMP$ + "  " + INI$
       OUTFILE$ = DRV$ + OUTFILE$
'       PRINT "Outfile: "; OUTFILE$

       CALL RELWRITE                                      ' Generate REL file

       PRINT OUTFILE$; " CREATED":  PRINT
       ERASE R:  SW1% = FALSE:  SW2% = FALSE
       IF SN > 0 THEN EXIT DO
     END IF

ENDLOOP:

   LOOP

   IF LEN(OUTFILE$) > 0 THEN
```

```
      SHELLSTR$ = "BR " + OUTFILE$
      SHELL SHELLSTR$
'     CLOSE #3
'     SHELL "BR F:REL.EXP"
   ELSE
      BEEP:  PRINT "     Site number "; SN; " not in file ": SLEEP 2
   END IF
   IF SN > 0 THEN GOTO AGAIN

FINISH:
   CLOSE
   CLS

END '============================  End RELGEN.BAS Main Program  ==================
```

```
'
'*************************************************************************
SUB GETALINE (FILENUM%, L$)          '                    Last change: 27 Feb 92
'
'   Gets line of file and checks for comments, and then outputs data line
'   Assumes file open and comment symbol defined in CONST statement and FNCOMMENT%

'       FILENUM%    File number -- Assumes file opened          INPUT
'       L$          Line of data from file                      OUTPUT
'
'-------------------------------------------------------------------------

   DO UNTIL EOF(FILENUM%)              ' Skip lines with comment symbol or blank
     START& = SEEK(FILENUM%)
     LINE INPUT #FILENUM%, L$
     IF LEN(L$) > 0 THEN
       LINES% = LINES% + 1
       BYTES&(LINES%) = START& - OFFSET  ' BYTE NUMBER FOR START OF LINE
       L% = FNCOMMENT%(L$)
       IF L% > 0 THEN
         L$ = LEFT$(L$, L% - 1)      ' Comment symbol found, neglect part to right
         IF L% > 10 THEN EXIT DO     ' Assume data line if symbol in col. > 10
       ELSEIF L% = 0 THEN
         EXIT DO                     ' Not found so line is data line
       END IF
     END IF
   LOOP

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  GETALINE
```

```
'*****************************************************************************
SUB GETRELEASE                  '                                16 Apr 93
'-----------------------------------------------------------------------------
  SHARED NUMPLANTS, RELSTART%, L$, X$
  REDIM A$(10)
'-----------------------------------------------------------------------------
   DO
     CALL GETALINE(1, L$)
     CALL PARSE2(L$, MAXARGS, DELIM$, NUMARGS, A$())
     X$ = A$(1)                                          ' First field (Nuclide)
'     PRINT L$
     IF INSTR(X$, "***") > 0 THEN EXIT DO                ' End of list for site

     RA1 = VAL(A$(2)):  RA2 = VAL(A$(3))
     RA3 = VAL(A$(4)):  RL1 = VAL(A$(5))

'--------------- Eliminate Odballs
'  Two nuclides in equalibrium are assumed to be equal.  The values are halved -
'   each half going to each nuclide of the pair and added to any activity listed
'   separately for that nuclide.

     IF X$ = "BA-LA-140" OR X$ = "BA/LA-140" THEN
        R(1, 74) = RA1 / 2 + R(1, 74):  R(1, 75) = RA1 / 2 + R(1, 75)
        R(2, 74) = RA2 / 2 + R(2, 74):  R(2, 75) = RA2 / 2 + R(2, 75)
        R(3, 74) = RA3 / 2 + R(3, 74):  R(3, 75) = RA3 / 2 + R(3, 75)
        R(4, 74) = RL1 / 2 + R(4, 74):  R(4, 75) = RL1 / 2 + R(4, 75)
       GOTO SKIP
     ELSEIF X$ = "ZR-NB-95" OR X$ = "ZR/NB-95" THEN
        R(1, 40) = RA1 / 2 + R(1, 40):  R(1, 42) = RA1 / 2 + R(1, 42)
        R(2, 40) = RA2 / 2 + R(2, 40):  R(2, 42) = RA2 / 2 + R(2, 42)
        R(3, 40) = RA3 / 2 + R(3, 40):  R(3, 42) = RA3 / 2 + R(3, 42)
        R(4, 40) = RL1 / 2 + R(4, 40):  R(4, 42) = RL1 / 2 + R(4, 42)
       GOTO SKIP
     ELSEIF X$ = "MO-99-TC-99M" OR X$ = "MO-99/TC-99M" THEN
        R(1, 44) = RA1 / 2 + R(1, 44):  R(1, 45) = RA1 / 2 + R(1, 45)
        R(2, 44) = RA2 / 2 + R(2, 44):  R(2, 45) = RA2 / 2 + R(2, 45)
        R(3, 44) = RA3 / 2 + R(3, 44):  R(3, 45) = RA3 / 2 + R(3, 45)
        R(4, 44) = RL1 / 2 + R(4, 44):  R(4, 45) = RL1 / 2 + R(4, 45)
       GOTO SKIP
     ELSEIF INSTR(X$, "-") = FALSE THEN
        PRINT L$:  PRINT #3, L$
        GOTO SKIP
     END IF

'------  Remove hyphen from rest ------------

     P1 = INSTR(X$, "-")                                  'remove hyphen from symbol
     IF P1 > 0 THEN
      N$ = LEFT$(X$, P1 - 1) + MID$(X$, P1 + 1) + "       "   'CPRD approved symbol
      N$ = MID$(N$, 1, 8)
     END IF

'------- Match symbol  ------------------------

   FOR J = 1 TO MAXNUKES                                  'match name  set IFF, NUC number
     IF N$ = N1$(J) OR N$ = N2$(J) THEN
       IFF = J: ICHK = 0: EXIT FOR
     ELSE
       ICHK = 1                                           ' not matched
     END IF
   NEXT

'---  Assign values  ----  Add any contributions fron equalibrium nuclides above if necessay

     IF ICHK = 0 THEN
        R(1, IFF) = RA1 + R(1, IFF)
        R(2, IFF) = RA2 + R(2, IFF)
        R(3, IFF) = RA3 + R(3, IFF)
        R(4, IFF) = RL1 + R(4, IFF)
         PRINT X$; R(1, IFF); R(2, IFF); R(3, IFF); R(4, IFF)
     ELSE
        PRINT "Unmatched:  "; N$; ":  "; MID$(L$, 1, 60)
        PRINT #3, "Unmatched:  "; N$; ": "; MID$(L$, 1, 60)
     END IF

SKIP:

   LOOP

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  GETRELEASE
```

```
'*************************************************************************
SUB RELWRITE                '                                    28 Feb 92
'             Create and write REL file
'_____________________________________________________________________
  SHARED HEADER$, OUTFILE$, SITE$, SITENUM$, POP, FLOWPIPE, MWHR, NUMPLANTS
  DIM ZERO AS STRING * 12
'_____________________________________________________________________

    ZERO = "    0.0     "

    OPEN OUTFILE$ FOR OUTPUT AS #2
    PRINT #2, HEADER$

    IF POP = 0 THEN POP = POPDEF

    PRINT #2, USING "\ \"; SITENUM$;
    PRINT #2, "  ";
    PRINT #2, USING "\                    \"; SITE$;
    PRINT #2, "  ";
    PRINT #2, USING "##.###"; POP;
    PRINT #2, "  ";
    PRINT #2, USING "##.##^^^^"; FLOWPIPE;
    PRINT #2, "  ";
    PRINT #2, USING "##.###^^^^"; MWHR;
    PRINT #2, "  ";
    PRINT #2, NUMPLANTS

    PRINT #2, H2$
    PRINT #2, H3$

    FOR I = 1 TO MAXNUKES
      IF R(1, I) > 0 OR R(2, I) > 0 OR R(3, I) > 0 OR R(4, I) > 0 THEN
        PRINT #2, USING I1$; I;
        PRINT #2, USING "\       \"; N1$(I);
        IF R(1, I) > 0 THEN
           PRINT #2, USING I2$; R(1, I);
        ELSE
           PRINT #2, ZERO;
        END IF
        IF R(2, I) > 0 THEN
           PRINT #2, USING I2$; R(2, I);
        ELSE
           PRINT #2, ZERO;
        END IF
        IF R(3, I) > 0 THEN
           PRINT #2, USING I2$; R(3, I);
        ELSE
           PRINT #2, ZERO;
        END IF
        IF R(4, I) > 0 THEN
           PRINT #2, USING I2$; R(4, I);
        ELSE
           PRINT #2, ZERO;
        END IF

        PRINT #2, "      1.0"

         PRINT I; N1$(I), R(1, I); R(2, I); R(3, I); R(4, I)
      END IF
    NEXT

    PRINT #2, "EOF ------------------------------------------------------------------------------"

    CLOSE #2

END SUB  '>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>  RELWRITE
```

```
'*******************************************************************************
SUB STRINGS                                                    27 FEB 92
'                    String assignments for program
'_______________________________________________________________________________

   H1$ = " RELEASE FILE - CPRD"    '          '          '          '          '
   H2$ = "  No.    Nuclide        Air-Gnd    Air-Elev    Air-Mm      Water     RECIRC."
   H3$ = "                       ------------------ Ci/y -------------------"
   H4$ = " *** "
   H5$ = "-"
   H6$ = "UNIDENTIFIED"

   I1$ = "  ##     "
   I2$ = "   ##.##^^^^"

   ND$ = "N/D"
   B12$ = "            "
   B8$ = "        "

   T1$ = "AIRBORNE"
   T2$ = "LIQUID"
   T3$ = "V"
   T4$ = "D"
   T5$ = "   "

   N1$(1) = "H3       ":  N2$(1) = "         "
   N1$(2) = "BE10     ":  N2$(2) = "         "
   N1$(3) = "C14      ":  N2$(3) = "         "
   N1$(4) = "N13      ":  N2$(4) = "         "
   N1$(5) = "F18      ":  N2$(5) = "         "
   N1$(6) = "NA22     ":  N2$(6) = "         "
   N1$(7) = "NA24     ":  N2$(7) = "         "
   N1$(8) = "AR41     ":  N2$(8) = "         "
   N1$(9) = "SC46     ":  N2$(9) = "         "
   N1$(10) = "CR51     ": N2$(10) = "         "
   N1$(11) = "MN54     ": N2$(11) = "         "
   N1$(12) = "MN56     ": N2$(12) = "         "
   N1$(13) = "FE55     ": N2$(13) = "         "
   N1$(14) = "FE59     ": N2$(14) = "         "
   N1$(15) = "CO57     ": N2$(15) = "         "
   N1$(16) = "CO58     ": N2$(16) = "         "
   N1$(17) = "CO60     ": N2$(17) = "         "
   N1$(18) = "NI57     ": N2$(18) = "         "
   N1$(19) = "NI63     ": N2$(19) = "         "
   N1$(20) = "NI65     ": N2$(20) = "         "
   N1$(21) = "CU64     ": N2$(21) = "         "
   N1$(22) = "ZN65     ": N2$(22) = "         "
   N1$(23) = "ZN69M+D  ": N2$(23) = "ZN69M    "
   N1$(24) = "AS76     ": N2$(24) = "         "
   N1$(25) = "BR82     ": N2$(25) = "         "
   N1$(26) = "KR83M    ": N2$(26) = "         "
   N1$(27) = "KR85M    ": N2$(27) = "         "
   N1$(28) = "KR85     ": N2$(28) = "         "
   N1$(29) = "KR87     ": N2$(29) = "         "
   N1$(30) = "KR88+D   ": N2$(30) = "KR88     "
   N1$(31) = "KR89     ": N2$(31) = "KR89     "
   N1$(32) = "RB88     ": N2$(32) = "         "
   N1$(33) = "RB89+D   ": N2$(33) = "RB89     "
   N1$(34) = "SR89+D   ": N2$(34) = "SR89     "
   N1$(35) = "SR90+D   ": N2$(35) = "SR90     "
   N1$(36) = "SR91+D   ": N2$(36) = "SR91     "
   N1$(37) = "SR92+D   ": N2$(37) = "SR92     "
   N1$(38) = "Y90      ": N2$(38) = "         "
   N1$(39) = "Y91M+D   ": N2$(39) = "Y91M     "
   N1$(40) = "ZR95+D   ": N2$(40) = "ZR95     "
   N1$(41) = "ZR97+D   ": N2$(41) = "ZR97     "
   N1$(42) = "NB95     ": N2$(42) = "         "
   N1$(43) = "NB97     ": N2$(43) = "         "
   N1$(44) = "MO99+D   ": N2$(44) = "MO99     "
   N1$(45) = "TC99M    ": N2$(45) = "         "
   N1$(46) = "RU103+D  ": N2$(46) = "RU103    "
   N1$(47) = "RU106+D  ": N2$(47) = "RU106    "
   N1$(48) = "AG110M+D": N2$(48) = "AG110M   "
   N1$(49) = "CD115M   ": N2$(49) = "         "
   N1$(50) = "CD115    ": N2$(50) = "         "
   N1$(51) = "SN125+D  ": N2$(51) = "SN125    "
   N1$(52) = "SB124    ": N2$(52) = "         "
   N1$(53) = "SB125+D  ": N2$(53) = "SB125    "
   N1$(54) = "TE132+D  ": N2$(54) = "TE132    "
   N1$(55) = "TE133M+D": N2$(55) = "TE133M   "
   N1$(56) = "I131+D   ": N2$(56) = "I131     "
   N1$(57) = "I132     ": N2$(57) = "         "
   N1$(58) = "I133+D   ": N2$(58) = "I133     "
   N1$(59) = "I134     ": N2$(59) = "         "
   N1$(60) = "I135+D   ": N2$(60) = "I135     "
   N1$(61) = "XE131M   ": N2$(61) = "         "
```

```
    N1$(62) = "XE133M   ": N2$(62) = "          "
    N1$(63) = "XE133    ": N2$(63) = "          "
    N1$(64) = "XE135M   ": N2$(64) = "          "
    N1$(65) = "XE135    ": N2$(65) = "          "
    N1$(66) = "XE137    ": N2$(66) = "          "
    N1$(67) = "XE138+D  ": N2$(67) = "XE138     "
    N1$(68) = "CS134    ": N2$(68) = "          "
    N1$(69) = "CS136    ": N2$(69) = "          "
    N1$(70) = "CS137+D  ": N2$(70) = "CS137     "
    N1$(71) = "CS138    ": N2$(71) = "          "
    N1$(72) = "CS139+D  ": N2$(72) = "CS139     "
    N1$(73) = "BA139    ": N2$(73) = "          "
    N1$(74) = "BA140+D  ": N2$(74) = "BA140     "
    N1$(75) = "LA140    ": N2$(75) = "          "
    N1$(76) = "LA141    ": N2$(76) = "          "
    N1$(77) = "CE141    ": N2$(77) = "          "
    N1$(78) = "CE144+D  ": N2$(78) = "CE144     "
    N1$(79) = "EU152    ": N2$(79) = "          "
    N1$(80) = "EU154    ": N2$(80) = "          "
    N1$(81) = "W187     ": N2$(81) = "          "
    N1$(82) = "TH232+D  ": N2$(82) = "TH232     "
    N1$(83) = "NP239    ": N2$(83) = "          "

END SUB  '>>>>>>>>>>>>>>>  End RELGEN.BAS  >>>>>>>>>>>>>>>>>>>>>>>>>>  STRINGS
```

B.5 SSUM.BAS

```
'
'  SSUM.BAS          Generated Site Summary pages for CPRD Annual reports.
'
'  Creates Word Perfect 5.1 compatible file with using template file.
'  Special marks in template file determine data array to use and format.
'
'
'
'      Author: D. A. Baker, PNL              Date  12 Jan 92
'
'      Contact:  D. A. Baker, PNL, (509) 375 3809
'
'*************************************************************************

   CONST VERDATE$ = "SSUM          8 Aug 94"

'*************************************************************************
'                              Disclaimer
'
'    The author or his employer make neither any warranty nor representation,
'    expressed or implied, with respect to the accuracy, completeness,
'    or usefulness of this program; or assume any liability with respect
'    to the use of, or for damages resulting from the use of this program.
'
'
'                          Compiler, Modules, and Libraries
'
'      Compiler version:  Microsoft Basic PDS 7.1
'
'      Modules needed:  None
'
'      Libraries needed:  QBX.QLB & BCL71EFR.LIB
'                         DQB1.QLB & DAB1.LIB
'
'                              Update History
'
'  10 Mar 92  Test run
'  11 Mar 92  Microsoft Formatx function used.
'  26 May 92  Added Air Gamma results in SUB GetDoses
'  27 May 92  Corrections and slight format mods.
'  15 Jun 92  Added check for something in PARAM$() element for pasture in
'             SUB GetData.
'  18 Aug 92  Added per unit flag and capability of per unit percents of App I
'  23 Aug 92  Modified for skipping notes.  Added DEBUG2 subroutine.
'  24 Aug 92  Got rid of null byte at beteen sites-- still after last site.
'  22 Sep 93  Set up for 90
'   8 Aug 94  Set up for 91
'
'                                  Files
'
'              ---- Description -------      -- Type --  Number  -- Name --
'
'    Input:    WP Template file                Binary       1      FileWPIN$
'              Alpha list of sites             Text         2      FileSite$
'              SUM files of results            Random       3      FileSUM$
'
'    Output:   WP Site Summary File            Binary       4      FileWPOUT$
'
'                              File Names & Flags

    CONST FILESUMPREFIX$ = "\Y91\OUT\SUMMARY\SUM91S"     ' Site Summaries prefix
    CONST FileWPOUT$ = "F:SUM91.WP"                      ' WP Site Summary section
    CONST FileSite$ = "\Y91\REPORT\SITEPOP.DAT"          ' City pop list
''    CONST FileWPIN$ = "TESTIQ.TMP"                       ' Test Template
    CONST FileWPIN$ = "\Y91\REPORT\SUMMARY.TMP"          ' Template

    CONST FALSE = 0, TRUE = NOT FALSE
    CONST FLGPERUNITA = TRUE                    ' True will calculate App I %s on per unit basis for air
    CONST FLGPERUNITL = TRUE                    ' True will calculate App I %s on per unit basis for liquid

'
```

```
'Notes:
'   Ability to generate Site Summaries WP file at one time in order of sites in alfa file.
'   Program skips sites whose SUM ...OU1 file not found and goes on to next in order.
'   Ability to replace site pages with updated results.
'   Insertions of new pages not supported yet.  Must as yet generate file from scratch.
'   No automatic backup provided.  User is warned to have backup file before poceeding.
'   Adding results of multiple air release points supported.


'********************************  Generic Type  ********************************

   DEFINT A-Z

'*****************************  CONST Statements  *****************************

   CONST COMSYMBOL$ = "!'{!"
   CONST DELIM$ = " "
   CONST LPYperCFS = 8.937E+08            ' L/y per CFS
   CONST RECLEN = 128
   CONST MAXCENTER = 6
   CONST MAXRELOC = 3
   CONST HARDPAGE = 12
   CONST SOFTPAGE = 11
   CONST HARDRET = 10
   CONST SOFTRET = 13
   CONST ATRIBON = &HC3
   CONST ATRIBOF = &HC4
   CONST SUPSCRPT = 5
   CONST SUBSCRPT = 6
   CONST BOLD = &HC
   CONST ULINE = &HE
   CONST CHARperLINE = 79
   CONST LINESperPAGE = 60
   CONST BACKGND = 1          ' Blue
   CONST BORDER = 2           ' Green
   CONST FORGND = 14          ' Yellow

'**************************  FUNCTION & SUB Declarations  **********************

'       Note: Must come after Local Param Declarations (DIMs) if argument list
'             contains type structure.

   DECLARE FUNCTION CENTER$ (A$, L%)
   DECLARE SUB DEBUG (FileNum%, STARTBYTE&, number&, Mode$)
   DECLARE SUB DEBUG2 (FileNum%, MidByte&, WINDO%, STRNG$, Mode$)
   DECLARE FUNCTION EXIST% (FileName$)
   DECLARE SUB FINDPAGE (FileNum%, BYTE&)

   DECLARE FUNCTION FORM$ (X!)
   DECLARE FUNCTION FormatS$ (BYVAL A!, B$)
   DECLARE SUB GetDATA (FileNum%, SiteNum%, RELEASETYPE$)
   DECLARE SUB GetDOSES (FileNum%, SiteNum%)

   DECLARE SUB GETLINE (FileNum%, COMSYMBOL$, LINE$)
   DECLARE FUNCTION INDEX$ (FileNum%, BYTE&)
   DECLARE FUNCTION MAXSNG! (A!, B!)
   DECLARE FUNCTION StringStart& (FileNum%, BYVAL BYTE&, STRNG$)
   DECLARE FUNCTION PAGE& (FileNum%, BYTE&, STRNG$)
   DECLARE FUNCTION PARAM$ (FileNum%, RECNUM%, ArgNum%)
   DECLARE SUB PARSE2 (LINE$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())

   DECLARE SUB PUTSTR (NUM%, S$, EXTENSION%)
   DECLARE FUNCTION ROUNDOFF! (X!, K%)
   DECLARE SUB TmpltPreface (FileNumTmplt%, FileNumOut%, BYTE&)
   DECLARE FUNCTION TIMESTAMP$ ()
   DECLARE FUNCTION WPTEXT$ (A$)

   DECLARE SUB WRITENUM (FileNum%, BYTE&, DAT!, FORM$)
   DECLARE SUB WriteSitePages (FileNum1%, BYTE1&, FileNum2%, BYTE2&, ENDBYTE&, FLG%)
   DECLARE SUB WRITESTR (FileNum%, BYTE&, DAT$)
   DECLARE SUB WRITESTRNUM (FileNum%, BYTE&, DAT$, FORM$)

'-------------  Crescent QP Pro7 routines in WP.LIB & WP.QLB

'  DECLARE SUB QPRINT (Word$, COLR%, PAGE%)
'  DECLARE SUB READSCRN (ROW%, COL%, Word$, PAGE%)

'*************************  TYPE Structure Definitions  ***********************
```

```
   TYPE SUMRECORDTYPE
     Z AS STRING * RECLEN
   END TYPE
'************************* Global Parameter Declarations ******************

   DIM SHARED SSDATA(40) AS STRING              ' Site Specific data
   DIM SHARED CENTR(10) AS STRING               ' Population centers

'------------- Dose estimate value arrays
   DIM SHARED AIRPOP(5, 6) AS SINGLE
   DIM SHARED LIQPOP(5, 5) AS SINGLE
   DIM SHARED AIRMI(12) AS SINGLE
   DIM SHARED LIQMI(15) AS SINGLE

   DIM SHARED PCF(3) AS SINGLE                  ' Prod/Consumption Factors

   DIM SHARED AIRMAXORG AS STRING * 19          ' Max. organ for air
   DIM SHARED LIQMAXORG AS STRING * 17          ' Max. organ for liquid

   DIM SHARED PREFACE(76) AS INTEGER            ' WP preface
   DIM SHARED SITEBYTES AS INTEGER              ' Number of bytes conprising 2 site pages

   DIM SHARED LLINE AS STRING * CHARperLINE     ' Long Line string for file
   DIM SHARED L80 AS STRING * 80                ' Blank string for screen
   DIM SHARED SLINE AS STRING * 15              ' Short line

'-------------- WP commands
   DIM SHARED UNDON AS STRING * 3               ' Underline on
   DIM SHARED undOF AS STRING * 3               '      "     off

   DIM SHARED BOLDON AS STRING * 3              ' BOLD on
   DIM SHARED boldOF AS STRING * 3              '  "   off

   DIM SHARED SUPON AS STRING * 3               ' Super on
   DIM SHARED supOF AS STRING * 3               '   "   off

   DIM SHARED SUBON AS STRING * 3               ' Sub on
   DIM SHARED subOF AS STRING * 3               '   " off

   DIM SHARED Hrt AS STRING * 1                 ' Hard return
   DIM SHARED HPage AS STRING * 1               ' Hard page

   DIM SHARED SUMMARI AS SUMRECORDTYPE          ' Summary file record typeype

   DIM SHARED SITENAME AS STRING                ' Name of site
   DIM SHARED CITY AS STRING                    ' Nearest town
   DIM SHARED LAT AS STRING * 9                 ' Latitude
   DIM SHARED LON AS STRING * 9                 ' Longitude
   DIM SHARED WATERBODY AS STRING * 30          ' Receiving water body
   DIM SHARED WATYPE AS STRING * 1              ' R = river, E = Estuary, etc.
   DIM SHARED NSITE$
   DIM SHARED RELTYPE(3) AS STRING * 1          ' Release location type: G, E, or M.

'************************* Local Parameter Declarations ********************

   DIM FLGSITE AS INTEGER                     ' TRUE  Site line active line
   DIM B AS STRING * 1                        ' Byte
   DIM IBYTE  AS LONG                         ' Byte number of WP template file
   DIM JBYTE AS LONG                          ' Byte number of WP Summary file
   DIM STARTBYTE  AS LONG                     ' Starting place in file
   DIM ENDBYTE AS LONG                        ' Place to end overwrite for change mode
   DIM SKIPBYTE AS LONG                       ' Start of skip of Notes on data page

'************************ WordPerfect Generic Preface ************************
'-------- Don't need for template method

   DATA FF, 57, 50, 43, 4C, 00, 00, 00,   01, 0A, 00, 00, 00, 00, 00, 00
   DATA FB, FF, 05, 00, 32, 00, 00, 00,   00, 00, 06, 00, 08, 00, 00, 00
   DATA 42, 00, 00, 00, 08, 00, 02, 00,   00, 00, 4A, 00, 00, 00, 00, 00
   DATA 00, 00, 00, 00, 00, 00, 00, 00,   00, 00, 00, 00, 00, 00, 00, 00
   DATA 00, 00, 08, 00, 7C, 00, 78, 00,   00, 00, 00, 00

   FOR I = 1 TO 76
     READ BYTE$
     PREFACE(I) = VAL("&H" + BYTE$)
   NEXT

'************************* WP Functions ***************************************

    UNDON = CHR$(ATRIBON) + CHR$(ULINE) + CHR$(ATRIBON)
    undOF = CHR$(ATRIBOF) + CHR$(ULINE) + CHR$(ATRIBOF)

    BOLDON = CHR$(ATRIBON) + CHR$(BOLD) + CHR$(ATRIBON)
    boldOF = CHR$(ATRIBOF) + CHR$(BOLD) + CHR$(ATRIBOF)

    SUPON = CHR$(ATRIBON) + CHR$(SUPSCRPT) + CHR$(ATRIBON)
    supOF = CHR$(ATRIBOF) + CHR$(SUPSCRPT) + CHR$(ATRIBOF)
```

```
    SUBON = CHR$(ATRIBON) + CHR$(SUBSCRPT) + CHR$(ATRIBON)
    subOF = CHR$(ATRIBOF) + CHR$(SUBSCRPT) + CHR$(ATRIBOF)

    Hrt = CHR$(HARDRET)
    HPage = CHR$(HARDPAGE)

    RELTYPE$(1) = "G":  RELTYPE$(2) = "E":  RELTYPE$(3) = "M"

'************************  Keyboard Input & File Selection  *********************

START:
    SCREEN 0
    COLOR FORGND, BACKGND, BORDER
    CLS : PRINT VERDATE$:  PRINT :  PRINT
    LINE INPUT "  Enter Site number for replacement, 'ALL' for complete run: "; Q$
    IF INSTR(UCASE$(Q$), "A") THEN SN = 99 ELSE SN = VAL(Q$)
    IF SN = 0 THEN
      LOCATE 12, 22
      BEEP: PRINT "Site cannot be zero -- try again"
      SLEEP 2:  GOTO START
    END IF

'*******************************  Program  ************************************

'-----------------------  Open Site Summaries Word Perfect file  -------------

   IF EXIST(FileWPOUT$) THEN
     PRINT :  PRINT "   Caution -- Summary File: "; FileWPOUT$; " exists -- "
     IF SN = 99 THEN
       SOUND 600, 4:  COLOR 30, 4:  LOCATE 8, 16
       PRINT "   Proceeding will delete existing file !!!!  ":  PRINT
       COLOR FORGND, BACKGND
       PRINT "   Before proceeding, be sure you have back up of this file."
       PRINT "   To proceed, Press  Y  ---  Any other key to quit: "
       Q$ = "":  WHILE Q$ = "": Q$ = INKEY$:  WEND
       IF UCASE$(Q$) <> CHR$(89) THEN END
       KILL FileWPOUT$:  PRINT : PRINT "   File  "; FileWPOUT$; " has been deleted.":  PRINT
     ELSE
       SOUND 2000, 3:  COLOR 10, 6:  LOCATE 8, 9
       PRINT "   Replacement will overwrite existing pages for site "; SN; "   "
       COLOR FORGND, BACKGND:  PRINT
       PRINT "   Before proceeding, be sure you have back up of this file."
       PRINT "   To proceed, Press Y  ---  Any other key to quit: "
       Q$ = "": WHILE Q$ = "":  Q$ = INKEY$:  WEND
       IF UCASE$(Q$) <> CHR$(89) THEN END
       PRINT :  PRINT "Replacement of Site "; SN; " proceeding. . . . ."
     END IF
     CLS
   ELSE
     PRINT
     IF SN = 99 THEN
       PRINT "Creating WP Site Summaries file for ALL sites. . . .":  SLEEP 1
     ELSE
       BEEP: PRINT "   Summary file not found --- Replacement cannot be made.":  SLEEP 2
       END
     END IF
   END IF

'-----------------  Open Binary files  ---------

   OPEN FileWPIN$ FOR BINARY AS #1        ' Template
   OPEN FileWPOUT$ FOR BINARY AS #4       ' Site Summary

   PRINT "WP output file:  "; FileWPOUT$

'-----------------------  Open SitePOP File  -----------------------------

   IF EXIST(FileSite$) THEN
     OPEN FileSite$ FOR INPUT AS #2
     LINE INPUT #2, H$                                ' Header
'    LINE INPUT #2, DUM$
   ELSE
     PRINT "File "; FileSite$; " not found.": BEEP
     END
   END IF

'-------------  Read parameters and doses and generate WP file  ---------------

   IF SN = 99 THEN     '------------  All sites in alpha order
     PRINT :  PRINT "Writing preface . . . . ";
     CALL TmpltPreface(1, 4, STARTBYTE)                    ' Write Preface
     IBYTE = STARTBYTE                                     ' Beginning of template document
     PRINT "Preface written thru byte "; IBYTE; " and 2 bytes further."
     CALL DEBUG2(4, IBYTE, 24, "IBYTE at ", "H")
'================================================================================

     SITE = 0:  FLGP = FALSE
```

```
''          ' DO UNTIL NSITE = 5    '    68                              ' Loop thru first 4 sites sites
for TESTING
     DO UNTIL EOF(2)                                          ' Loop thru all sites

       FOR I = 1 TO 40:   SSDATA$(I) = "***":   NEXT      ' Initialise array

       CALL GETLINE(2, COMSYMBOL$, L$)
       IF LEFT$(L$, 3) = "END" THEN EXIT DO

       NSITE$ = MID$(L$, 2, 2):    NSITE = VAL(NSITE$)

'''    IF NSITE <> 57 THEN GOTO SKIP        '!!!!!!!!!!!!!!!!!!!!!!!!!!!!

       SITENAME$ = MID$(L$, 5, 18)
       PRINT :  PRINT SITENAME$; ""
       UNITSAIR = VAL(MID$(L$, 23, 1))
       UNITSLIQ = UNITSAIR

       CITY$ = MID$(L$, 24, 21)
       LAT$ = MID$(L$, 47, 10):   LON$ = MID$(L$, 60, 10)
       WATERBODY$ = MID$(L$, 75)                              ' Water body
       PRINT WATERBODY$

       GOSUB POPCENTERS

'--  See if at least one summary file exists for site -- skip if not.

       TEMP$ = FILESUMPREFIX$ + NSITE$ + ".OU"
       IF EXIST(TEMP$ + "G") THEN
         FileSum$ = TEMP$ + "G"
         OPEN FileSum$ FOR RANDOM AS 3
         CALL GetDATA(3, NSITE, "G"):   FLGDATA = TRUE

       ELSEIF EXIST(TEMP$ + "E") THEN
         FileSum$ = TEMP$ + "E"
         OPEN FileSum$ FOR RANDOM AS 3
         CALL GetDATA(3, NSITE, "E"):   FLGDATA = TRUE

       ELSEIF EXIST(TEMP$ + "M") THEN
         FileSum$ = TEMP$ + "M"
         OPEN FileSum$ FOR RANDOM AS 3
         CALL GetDATA(3, NSITE, "M"):   FLGDATA = TRUE

       ELSE
         FLGDATA = FALSE                                  ' No SUM file found

       END IF

       ERASE AIRPOP, AIRMI, LIQPOP, LIQMI, PCF       '  Initialize result arrays

       IF FLGDATA THEN
         PRINT "File "; FileSum$; " found  ---"
         CALL GetDOSES(3, NSITE)
         CLOSE #3
       ELSE
         PRINT "File not found -- writing dummy data to site pages ---"
       END IF
'-------------------------------------------------------------------

       IF SITE = 0 THEN
         JBYTE = SEEK(4) - 3                              ' Position after end of preface of Summary file.
       ELSE
         JBYTE = SEEK(4)                                  ' Position after last page written in Summary file.
         CLOSE #1:   OPEN FileWPIN$ FOR BINARY AS #1       ' Set EOF(1) to FALSE for Template file
         IBYTE = STARTBYTE                                ' Position after template preface
       END IF

       SITE = SITE + 1
       CALL WriteSitePages(1, IBYTE, 4, JBYTE, 0, FALSE)
'      CALL DEBUG2(1, IBYTE, 24, "IBYTE offset in template is ", "H")
       J& = SEEK(4)
'      CALL DEBUG2(4, J&, 24, "J offset in summary is ", "H")
'      CALL DEBUG2(4, JBYTE, 24, "JBYTE offset in summary is ", "H")

       SITEBYTES = IBYTE - STARTBYTE                      ' No. of bytes for each site
       PRINT : PRINT :  SOUND 4000, 1
       PRINT SITEBYTES - STARTBYTE; " Bytes added.  At Site Summary byte: "; JBYTE;
       PRINT "     Site Number: "; SITE
SKIP:
     LOOP

   ELSE                '--------------  Selected site to replace

     DO UNTIL EOF(2)
       LINE INPUT #2, L$
       NSITE$ = MID$(L$, 2, 2):  NSITE = VAL(NSITE$)

       IF SN = NSITE THEN
         SITENAME$ = MID$(L$, 5, 18)
```

```
        PRINT :  PRINT "Processing Selected Site:  "; NSITE; "  "; SITENAME$: PRINT
        UNITSAIR = VAL(MID$(L$, 23, 1))
        UNITSLIQ = UNITSAIR
        CITY$ = MID$(L$, 24, 21)
        LAT$ = MID$(L$, 47, 9):   LON$ = MID$(L$, 60, 9)
        WATERBODY$ = MID$(L$, 75)
        PRINT WATERBODY$

        GOSUB POPCENTERS

'--  See if at least one summary file exists for site -- skip if not.

        TEMP$ = FILESUMPREFIX$ + NSITE$ + ".OU"
        IF EXIST(TEMP$ + "G") THEN
          FileSum$ = TEMP$ + "G"
          OPEN FileSum$ FOR RANDOM AS 3
          CALL GetDATA(3, NSITE, "G"):   FLGDATA = TRUE

        ELSEIF EXIST(TEMP$ + "E") THEN
          FileSum$ = TEMP$ + "E"
          OPEN FileSum$ FOR RANDOM AS 3
          CALL GetDATA(3, NSITE, "E"):   FLGDATA = TRUE

        ELSEIF EXIST(TEMP$ + "M") THEN
          FileSum$ = TEMP$ + "M"
          OPEN FileSum$ FOR RANDOM AS 3
          CALL GetDATA(3, NSITE, "M"):   FLGDATA = TRUE

        ELSE
          FLGDATA = FALSE                                  ' No SUM file found

        END IF

        PRINT "File "; FileSum$; " found."

        IF FLGDATA THEN
          CALL GetDOSES(3, NSITE)

          JBYTE = 1
          PRINT : PRINT "Searching for site page location . . ."
          PRINT
          CALL TmpltPreface(0, 4, STARTBYTE)                    ' Find position of document in Template
          JBYTE = PAGE&(4, 1, SITENAME$)                        ' Find position of Site page in Summary
          SKIPBYTE = StringStart&(4, BYVAL JBYTE, "Notes:")     ' Find start of Data page notes
          ENDBYTE = StringStart&(4, BYVAL SKIPBYTE + 3000, "Notes:")      ' Find start of Dose page Notes

          CALL DEBUG2(4, JBYTE, 24, "JBYTE offset is ", "H")
          CALL DEBUG2(4, SKIPBYTE, 24, "SKIPBYTE offset is ", "H")
          CALL DEBUG2(4, ENDBYTE, 24, "ENDBYTE offset is ", "H")


          CALL WriteSitePages(1, STARTBYTE, 4, JBYTE, ENDBYTE, TRUE)


        END IF

        EXIT DO
      END IF
    LOOP

  END IF

GOTO FINI  '------------  End Program

'----------------------  Gosub Routines  -----------------------------------

POPCENTERS:  '----- Reads population center data

        ERASE CENTR$:  K = 0
        DO
          CALL GETLINE(2, COMSYMBOL$, L$)
          K = K + 1
          CENTR$(K) = MID$(L$, 7, 65)
           PRINT SITENAME$; "  "; LEFT$(CENTR$(K), 15), K
        LOOP UNTIL INSTR(L$, "===")

        IF K - 1 < 6 THEN
          FOR K1 = K TO MAXCENTER
             CENTR$(K1) = SPACE$(65)      ' Load with blanks if more centers
          NEXT
        END IF

 RETURN

FINI:  '-------------------------------------------------------------------

'  PRINT :  PRINT "Successfull End of Proceedure.":   BEEP:  BEEP
  CLOSE
```

```
END  /********************  End Main Program  **********************************
```

```
'-------------------------------------------------------------------------
FUNCTION CENTER$ (STRNG$, LENG%)                '                    20 Jan 92

'    Returns string STRNG$ centered in space of length LENG%
'      or error message if string to long for space.
'    String adjusted to left if exact centering not possible.

'-------------------------------------------------------------------------

   DEFINT A-Z

'-------------------------------------------------------------------------

   LA = LEN(STRNG$):    S$ = SPACE$(LENG)

   IF LENG < LA THEN
     CENTER$ = "STRING TOO LONG TO FIT"
   ELSE
'     B$ = SPACE$((LENG - LA) \ 2)
'     LSET S$ = B$ + STRNG$ + B$

      L = (LENG - LA) \ 2 + 1        '  This method slightly faster (4%) than above
      MID$(S$, L) = STRNG$

     CENTER$ = S$
   END IF

END FUNCTION  '[redacted] CENTER$
```

```
'________________________________________________________________________
SUB FINDPAGE (FLNUM%, BYTE&)                                 '    3 Jan 92

'   Finds page in summary file of selected site.
'   Routine reads lines of file ending in hard return and searches for line
'   with matching sitename, which is at top of each data page.
'________________________________________________________________________

   DEFINT A-Z

   DIM B AS STRING * 1
'________________________________________________________________________

   DO UNTIL EOF(FLNUM)

     J& = BYTE:     L$ = ""

     DO UNTIL ASC(B$) = HARDRET
       J& = J& + 1
       GET #FLNUM, J&, B$
       L$ = L$ + B$
     LOOP
     BYTE = SEEK(FLNUM)

     IF INSTR(L$, SITENAME$) THEN                 ' Check for site name match
       BYTE = BYTE - LEN(L$)                      ' Set byte to start of data page
       EXIT SUB                                   '   and return to calling program
     END IF

   LOOP

   BEEP: PRINT SITENAME$; " not found in "; FileWP$:     END

END SUB '                                                      FINDPAGE
```

```
'_____________________________________________________________________
FUNCTION FORM$ (X!)          '                                  8 Mar 92
'  Rounds using ROUNDOFF function and formats for report using FORMATS$ function
'  Functions must be declared in main program.
'_____________________________________________________________________

   DEFINT A-Z

'_____________________________________________________________________

   SIGFIG% = 2
   MIN! = .01
   MAX! = 1000000!

   N! = ROUNDOFF!(X!, SIGFIG%)


   SELECT CASE N!
     CASE IS < MIN!
          M$ = FormatS$(N!, "0.0E+00;0.0")
     CASE IS < 1
       M$ = "0" + LTRIM$(STR$(N!))
     CASE IS < MAX!
       M$ = FormatS$(N!, "###,##0.#")
     CASE ELSE
       M$ = FormatS$(N!, "0.0E+00")
   END SELECT

   FORM$ = M$

END FUNCTION  '                                                  FORM$
```

```
'-------------------------------------------------------------------------
SUB GetDATA (FileNum%, SiteNum%, RT$)                          '   15 JUN 92

'     Get Data from site SUM files and put into data array.
'     File opened in random mode by calling program.

'      FileNum        File number                                  INPUT
'      SiteNum        Site Number                                  INPUT
'      RT$            Release location type: G, E, M               INPUT

'-------------------------------------------------------------------------

   DEFINT A-Z

   DIM D AS STRING * 3

'-------------------------------------------------------------------------

   N = FileNum%

'------------------------  Airborne Pathways  -------------------------------

   WATYPE$ = PARAM$(N, 70, 3)                                  ' Dilution Waterbody type
   SSDATA$(1) = PARAM$(N, 75, 1)                               ' Population

   REC = 8:     GOSUB GETLINE:    SSDATA$(2) = MID$(L$, 2, 44)  ' Met period

   SSDATA$(3) = PARAM$(N, 69, 5)                               ' Veg
   SSDATA$(4) = PARAM$(N, 69, 6)                               ' Milk
   SSDATA$(5) = PARAM$(N, 69, 7)                               ' Meat

   SSDATA$(6) = PARAM$(N, 69, 2)                               ' Reg Prod
   SSDATA$(7) = PARAM$(N, 69, 3)                               ' An graz

   SSDATA$(8) = PARAM$(N, 30, 2)                               ' SB distance
   IF VAL(SSDATA$(8)) = 0 THEN
     SSDATA$(8) = MID$(SUMMARI.Z, 16, 5)
     SSDATA$(9) = MID$(SUMMARI.Z, 23, 3)
   ELSE
     LSET D$ = PARAM$(N, 30, 3)
     SSDATA$(9) = D$                                           ' SB direc
   END IF

   SSDATA$(10) = PARAM$(N, 31, 2)                              ' Res
   LSET D$ = PARAM(N, 31, 3)
   SSDATA$(11) = D$                                            ' Res

   SSDATA$(12) = PARAM$(N, 32, 2)                              ' Gard
   LSET D$ = PARAM$(N, 32, 3)
   SSDATA$(13) = D$                                            ' Gard

'-------------  Check if 2nd field numeric or character for pasture
   IF PARAM$(N, 33, 2) <> "" THEN
     IF ASC(PARAM$(N, 33, 2)) < 58 THEN                        ' Numeric
       SSDATA$(14) = PARAM$(N, 33, 2)                            ' Dist in 2nd
       LSET D$ = PARAM$(N, 33, 3)
       SSDATA$(15) = D$                                        ' Direc in 3rd
     ELSE                                                      ' Character (COW or GOAT)
       SSDATA$(14) = PARAM$(N, 33, 3)                            ' Dist in 3rd
       LSET D$ = PARAM$(N, 33, 4)
       SSDATA$(15) = D$                                        ' Direc in 4th
     END IF
   END IF
'---------------------------  Waterborne Pathways  ----------------------------

'--- Flows

   SSDATA$(16) = PARAM$(N, 70, 4)                             ' Pipe flow  L/y
   SSDATA$(17) = STR$(VAL(PARAM$(N, 70, 5)) * LPYperCFS)      ' River flow L/y
   SSDATA$(18) = PARAM$(N, 70, 5)                             ' River flow CFS

'--- Population --

'-----------  Mixing --------------

   IF VAL(PARAM$(N, 70, 6)) = 0 THEN                             ' D. Water
     SSDATA$(19) = "  ---  "
   ELSE
     SSDATA$(19) = PARAM$(N, 70, 6)
   END IF

   IF VAL(PARAM$(N, 70, 8)) = 0 THEN                                 ' Fish
     SSDATA$(21) = "  ---  "
   ELSE
     SSDATA$(21) = PARAM$(N, 70, 8)
   END IF
```

```
'   PRINT PARAM$(N, 70, 7), SSDATA$(22)

   IF VAL(PARAM$(N, 70, 10)) = 0 THEN                                  ' Invert
     SSDATA$(23) = "  ---  "
   ELSE
     SSDATA$(23) = PARAM$(N, 70, 10)
   END IF

   SSDATA$(25) = "  ---   "                                           ' Shore

'-----------  Usages --------------

   IF VAL(PARAM$(N, 27, 1)) = 0 THEN                                   ' DW
     SSDATA$(20) = "  None "
     SSDATA$(35) = "  None "
   ELSE
     SSDATA$(20) = PARAM$(N, 27, 1)
     SSDATA$(35) = "   RG  "
   END IF

   IF PARAM$(N, 70, 7) = "G" THEN                                      ' Fish
     SSDATA$(22) = "   RG  "
   ELSE
     SSDATA$(22) = PARAM$(N, 70, 7)
   END IF

'   PRINT PARAM$(N, 70, 7), SSDATA$(22)

   IF PARAM$(N, 70, 9) = "G" THEN                                       ' Invert
     SSDATA$(24) = "   RG  "
   ELSE
     SSDATA$(24) = PARAM$(N, 70, 9)
   END IF

   SSDATA$(26) = "  ---   "                                           ' Shore


'--- Individual --  Mixing    --------      Usage

   SSDATA$(27) = PARAM$(N, 38, 2): '  SSDATA$(28) = " RG "             ' DW
   SSDATA$(29) = PARAM$(N, 39, 2): '  SSDATA$(30) = " RG "             ' Fish
   SSDATA$(31) = PARAM$(N, 40, 2): '  SSDATA$(32) = " RG "             ' Invert
   SSDATA$(33) = PARAM$(N, 41, 2):   SSDATA$(34) = " RG "             ' Shore

'-----------  Usages --------------

   IF VAL(PARAM$(N, 38, 2)) = 0 THEN                                   ' DW
     SSDATA$(28) = "None"
   ELSE
     SSDATA$(28) = " RG "
   END IF

   IF VAL(PARAM$(N, 39, 2)) = 0 THEN                                   ' Fish
     SSDATA$(30) = "None"
   ELSE
     SSDATA$(30) = " RG "
   END IF

   IF VAL(PARAM$(N, 40, 2)) = 0 THEN                                   ' Invert
     SSDATA$(32) = "None"
   ELSE
     SSDATA$(32) = " RG "
   END IF

   CLOSE #N

'     FOR I = 1 TO 34: LPRINT I, SSDATA$(I): NEXT


EXIT SUB '-----------------------------------------------------------------

GETLINE:

   GET #N, REC, SUMMARI
   L$ = SUMMARI.Z
 RETURN

END SUB  ' [redacted] GetDATA
```

```
DEFSNG A-Z
'-----------------------------------------------------------------------
SUB GetDOSES (FileNum%, SiteNum%)                              '     3 May 94

'     Get doses from site SUM files and sum for report.  Calculate percentages
'     of Appendix I design objectives.

'      FileNum     File number                                  INPUT
'      SiteNum     Site Number                                  INPUT

'  Note that the arrays have been previously defined as global single precision.

'-----------------------------------------------------------------------

   DEFINT A-Z

   SHARED UNITSAIR, UNITSLIQ

'-----------------------------------------------------------------------

'  ----  Appendix I design objectives  -----------

   CONST HgamAppI = 10                              ' mrad/y
   CONST HbetAppI = 20                              ' mrad/y
   CONST HtbodAirAppI = 5                           ' mrem/y
   CONST HorgAirAppI = 15                           ' mrem/y

   CONST HtbodLiqAppI = 3                           ' mrem/y
   CONST HorgLiqAppI = 10                           ' mrem/y

   N = FileNum

   SBGAMMA! = 0:  SBETA! = 0:  RESTBODY! = 0        ' Initialize Air Gamma Doses

   FOR K = 1 TO MAXRELOC

     FileSum$ = FILESUMPREFIX$ + NSITE$ + ".OU" + RELTYPE$(K)
     IF NOT EXIST(FileSum$) THEN GOTO NEXTONE
     PRINT FileSum$; " Processing Doses . . . . ."

     OPEN FileSum$ FOR RANDOM AS #N

'-----  Check first two lines of file to determine if data & doses written to it.

     IF PARAM$(N, 1, 1) = "CPRDA" THEN FLGAIR = TRUE ELSE FLGAIR = FALSE
     IF PARAM$(N, 2, 1) = "CPRDL" THEN FLGLIQ = TRUE ELSE FLGLIQ = FALSE

'--------------  Get Doses from files and save sums in arrays

'---------  POP

     FOR I = 1 TO 5
       IF FLGAIR THEN
         FOR J = 1 TO 6
           AIRPOP(I, J) = AIRPOP(I, J) + VAL(PARAM$(N, 46 + I, J + 1))
         NEXT
       END IF
       IF FLGLIQ THEN
         FOR J = 1 TO 5
           LIQPOP(I, J) = VAL(PARAM$(N, 41 + I, J + 1))
         NEXT
       END IF
     NEXT

     IF FLGAIR THEN
       PCF(1) = VAL(PARAM$(N, 52, 3))               ' Production/consumption factors
       PCF(2) = VAL(PARAM$(N, 52, 6))
       PCF(3) = VAL(PARAM$(N, 52, 9))
     END IF

'------  Individual

     IF FLGPERUNITL = TRUE THEN U = UNITSLIQ ELSE U = 1
     IF U = 0 THEN BEEP:  PRINT "Number of units is zero, check SitePop file": END

     IF FLGLIQ THEN
       LIQMI(1) = VAL(PARAM$(N, 29, 2)) / U             ' D. Water
       LIQMI(2) = VAL(PARAM$(N, 29, 3)) / U             ' Fish/Shellfish
       LIQMI(3) = VAL(PARAM$(N, 29, 4)) / U             ' Shoreline

       LIQMI(6) = VAL(PARAM$(N, 29, 7)) / U             ' D. Water organ
       LIQMI(7) = VAL(PARAM$(N, 29, 8)) / U             ' Fish/Shellfish organ
       LIQMAXORG$ = "(" + PARAM$(N, 29, 11) + " " + PARAM$(N, 29, 12) + ")"
     END IF

     IF FLGAIR THEN
```

```
'-----  Compare CPRDA and AirGamma resuts for direct doses and take maximum
'-----  for each release type

       SBGAMMA! = MAXSNG!(VAL(PARAM$(N, 74, 2)), VAL(PARAM$(N, 91, 4)))
       RESTBODY! = MAXSNG!(VAL(PARAM$(N, 74, 4)), VAL(PARAM$(N, 92, 4)))

''     SBETA! = MAXSNG!(VAL(PARAM$(N, 74, 3)), VAL(PARAM$(N, 91, 5)))
       SBETA! = VAL(PARAM$(N, 74, 3))     ' Use Beta dose from CPRDA-- semi infinite

'-----------  Sum the Air doses

       IF FLGPERUNITA = TRUE THEN U = UNITSAIR ELSE U = 1
       IF U = 0 THEN BEEP:  PRINT "Number of units is zero, check SitePop file": END

       AIRMI(1) = AIRMI(1) + SBGAMMA! / U                          ' Site Boundary Gamma
       AIRMI(3) = AIRMI(3) + SBETA! / U                            ' Site Boundary Beta
       AIRMI(5) = AIRMI(5) + RESTBODY! / U                         ' Residence T.Body

       AIRMI(7) = AIRMI(7) + VAL(PARAM$(N, 74, 5)) / U             ' Residence Inhalation
       AIRMI(8) = AIRMI(8) + VAL(PARAM$(N, 74, 6)) / U             ' Garden veg/produce
       AIRMI(9) = AIRMI(9) + VAL(PARAM$(N, 74, 7)) / U             ' Pasture milk/meat
       AIRMAXORG$ = "(" + PARAM$(N, 74, 9) + " " + PARAM$(N, 74, 10) + ")"

    END IF

    CLOSE #N

NEXTONE:

   NEXT

'--------  Totals

   AIRMI(10) = AIRMI(7) + AIRMI(8) + AIRMI(9)                    ' Total Organ

   LIQMI(4) = LIQMI(1) + LIQMI(2) + LIQMI(3)                     ' Total Body
   LIQMI(8) = LIQMI(6) + LIQMI(7)                                ' Total Organ

'---------  Percents of Design Objectives ----------------------------------

  AIRMI(2) = AIRMI(1) / HgamAppI * 100                           ' Gamma
  AIRMI(4) = AIRMI(3) / HbetAppI * 100                           ' Beta
  AIRMI(6) = AIRMI(5) / HtbodAirAppI * 100                       ' T. Body
  AIRMI(11) = AIRMI(10) / HorgAirAppI * 100                      ' Organ

  LIQMI(5) = LIQMI(4) / HtbodLiqAppI * 100                       ' T. Body
  LIQMI(9) = LIQMI(8) / HorgLiqAppI * 100                        ' Organ

END SUB  '                                                                GetDOSES
```

```
'_____________________________________________________________________
FUNCTION INDEX$ (FileNum%, MarkByte&)                    ' 15 Jan 92

'  Returns two digit index number following MarkByte as string.
'  File FileNum must be already opened in BINARY mode.

'_____________________________________________________________________

   DEFINT A-Z

   DIM A1 AS STRING * 1, A2 AS STRING * 1

'_____________________________________________________________________

  GET #FileNum, MarkByte& + 1, A1$
  GET #FileNum, , A2$
  INDEX$ = A1$ + A2$

END FUNCTION  '                                                INDEX$
```

```
'_____________________________________________________________________
FUNCTION PAGE& (FLNUM%, BYTE&, STRNG$)                    '   27 Jan 92

'   Returns number of begining of STRING$, which is the sitename.
'   BYTE& is offset into file to start searching.
'   Routine steps thru file one byte at a time starting at BYTE& and reading
'   twenty bytes at a time until match is made.  Then returns byte number
'   of underline command for "Site" just preceeding.

'_____________________________________________________________________

   DEFINT A-Z

   DIM B AS STRING * 20
   DIM P AS LONG

'_____________________________________________________________________
PRINT "PAGE$  START"
   S$ = RTRIM$(SITENAME$)

   DO UNTIL EOF(FLNUM)

       GET #FLNUM, BYTE&, B$
       IF INSTR(B$, "Site") THEN P = BYTE&

       IF INSTR(B$, S$) THEN                    ' Check for site name match in line
         PAGE& = P - 3                          ' Set byte to start of data page
         EXIT FUNCTION                          '   and return to calling program
       END IF

       BYTE& = BYTE& + 1                        ' Advance 1 byte at a time
       IF BYTE& MOD 1000 = 0 THEN PRINT BYTE&;
   LOOP

   BEEP: PRINT SITENAME$; " not found in "; FileWP$:     END

END FUNCTION    '[redacted] PAGE&
```

```
'_____________________________________________________________________
FUNCTION PARAM$ (FileNum%, RECNUM%, ParNum%)                  8 Jan 92

'     Get parameter from line in SUM file.
'     File already opened in RANDOM mode.

'     FileNum   File Number
'     RecNum    Record Number
'     ParNum    Parameter number in record

'_____________________________________________________________________

   DEFINT A-Z

'_____________________________________________________________________

   MAXARGS = 15
   REDIM ARGS$(MAXARGS)

   GET #FileNum, RECNUM, SUMMARI
   CALL PARSE2(SUMMARI.Z, MAXARGS, DELIM$, NUMARGS, ARGS$())
   IF INSTR(ARGS$(ParNum), "%") THEN
     A$ = LEFT$(ARGS$(ParNum), LEN(ARGS$(ParNum)) - 1)
   ELSE
     A$ = ARGS$(ParNum)
   END IF
   PARAM$ = A$

END FUNCTION  '                                                  PARAM$
```

```
'_____________________________________________________________________
SUB PUTSTR (FileNum%, S$, EXTENSION%)                    '     23 JAN 92

'   Writes string to binary file and puts Word Perfect Hard return at end
'   Assumes file alredy opened for binary output by calling program.

'       FILENUM   File Number                                      INPUT
'       S$        String to write                                  INPUT

'_____________________________________________________________________

   DEFINT A-Z

'_____________________________________________________________________

   C = CHARperLINE + EXTENSION
   LINEN$ = SPACE$(C)

   DOT$ = "."                          ' Optional indicator for testing

   LSET LINEN$ = S$
   FOR I = 1 TO C
     BYTE$ = MID$(LINEN$, I, 1)
     PUT #FileNum, , BYTE$
   NEXT
   PUT #FileNum, , Hrt

END SUB  '                                                          PUTSTR
```

```
DEFSNG A-Z
'-------------------------------------------------------------------------
FUNCTION StringStart& (FLNUM%, BYVAL BYTE&, STRNG$)            '   24 Aug 92

'   Returns number of begining of STRNG$.
'   BYTE& is offset into file to start searching.
'   Routine steps thru file one byte at a time starting at BYTE& and reading
'   multiple bytes at a time until match is made.  Then returns byte number
'   of first character in STRNG$.

'-------------------------------------------------------------------------

   DEFINT A-Z

'-------------------------------------------------------------------------

   B1& = BYTE&
   B = LEN(STRNG$)
   S$ = SPACE$(B)                              ' String to check from file

   DO UNTIL EOF(FLNUM)

       GET #FLNUM, B1&, S$

       IF INSTR(S$, STRNG$) THEN               ' Check for site name match in line
         StringStart& = B1&                    ' Set byte to start STRNG$
         EXIT FUNCTION                         '   and return to calling program
       END IF

       B1& = B1& + 1                           ' Advance 1 byte at a time

   LOOP

   BEEP: PRINT STRNG$; " not found.":     END

END FUNCTION    '[redacted] StringStart&
```

```
'_____________________________________________________________________
SUB TmpltPreface (FileNumTmplt, FileNumOut, STARTBYTE&)          '   28 Jan 92

'   Writes preface of template file to Site Summary File in WP format.
'   Position of document start is STARTBYTE.
'   If Template file number 0, then finds position of marker in Summary file.
'   Files must already be opened in binary mode.

'    FileNumTmplt       Template file number                                  INPUT
'    FileNumOut         Summary file number                                   INPUT
'    STARTBYTE&         Position of marker (start of document part of file)   OUTPUT


'_____________________________________________________________________

   DEFINT A-Z

   DIM POSITION1 AS LONG
   DIM POSITION2 AS LONG

   DIM B AS STRING * 1
   DIM C AS STRING * 3
   DIM MARKER AS STRING * 3
'_____________________________________________________________________

   MARKER = UNDON              ' Marker for start of document - Start Underline command


GOTO STA
'----------  Find Begining of File document section after preface  ----------

   PRINT FileNumTmplt
   GET #FileNumTmplt, 5, B$:   LOWBYTE = ASC(B$)
   GET #FileNumTmplt, , B$:    HIBYTE = ASC(B$)
   STARTBYTE& = HIBYTE * 256 + LOWBYTE + 1                 ' Calculate decimal pointer

   GET #FileNumTmplt, STARTBYTE&, B$                       ' Get byte for checking
   PRINT "Hex:   Hi="; HEX$(HIBYTE); "    Lo="; HEX$(LOWBYTE); "      START="; HEX$(STARTBYTE)
   PRINT "       Hi="; HIBYTE; "  Lo="; LOWBYTE; "   START="; STARTBYTE&; "   Begin byte="; HEX$(ASC(B$))

'---------------------- Write Preface to output file  --------------------------

   FOR I = 1 TO STARTBYTE& - 1
     GET #FileNumTmplt, I, B$
     PUT #FileNumOut, I, B$
   NEXT

'-------------------  Write Document up to start underline of "Site" -----------

   I = STARTBYTE&

STA:

   I = 1

   IF FileNumTmplt > 0 THEN        ' Write Preface to Summary file from Template

     DO UNTIL C$ = MARKER
       GET #FileNumTmplt, I, C$
       PUT #FileNumOut, I, C$
       I = I + 1
     LOOP
     STARTBYTE& = SEEK(FileNumTmplt) - LEN(MARKER)          ' Position of start of MARKER in template file

   ELSE                            ' Find position of marker in summary file

     DO UNTIL C$ = MARKER
       GET #FileNumOut, I, C$
       I = I + 1
     LOOP
     STARTBYTE& = SEEK(FileNumOut) - LEN(MARKER)            ' Position of start of MARKER in SUMMARY file

   END IF

'     CALL DEBUG(4, 1881, 16, "H"):   PRINT "STARTBYTE= "; STARTBYTE&

END SUB  ' [redacted] TmpltPreface
```

```
'_____________________________________________________________________
FUNCTION WPTEXT$ (LINE$)
'  Prints out line of printable characters in WP File
'_____________________________________________________________________

   DEFINT A-Z

   STATIC I, L
   DIM C AS STRING * 1, T AS STRING * 1, TX AS STRING
'_____________________________________________________________________

    L = LEN(LINE$):   TX$ = ""
    FOR I = 1 TO L
      C$ = MID$(LINE$, I, 1)
      IF ASC(C$) > 32 AND ASC(C$) < 123 THEN
        T$ = C$
      ELSE
        T$ = " "
      END IF
      TX$ = TX$ + T$
    NEXT

   WPTEXT$ = TX$
END FUNCTION  '[redacted] WPTEXT$
```

```
'_____________________________________________________________________________
SUB WRITENUM (FileNum%, MarkByte&, DAT!, FMT$)                '   8 Sep 92

'   Writes number DAT in format FORM$ to binary file begining at MARKBYTE.
'   position in template file.  Returns new position in file after string as MARKBYTE.
'   File FileNum must be already opened in BINARY mode.

'_____________________________________________________________________________

   DEFINT A-Z

   DIM D AS STRING * 1
   DIM A AS STRING
   DIM SP AS STRING * 1

'_____________________________________________________________________________


      SP$ = SPACE$(1)                         '  For test set = to "+"
      PUT #FileNum, , SP$
       PRINT DAT!, FMT$
      A$ = Format$$(DAT!, FMT$)
      L = LEN(A$)

      FOR K = 1 TO L
        D$ = MID$(A$, K, 1)
        PUT #FileNum, , D$
      NEXT

      MarkByte& = MarkByte& + L

END SUB  '                                                    WRITENUM
```

```
DEFSNG A-Z
'-----------------------------------------------------------------------
SUB WriteSitePages (FT%, TBYTE&, FS%, SBYTE&, EB&, FLG%)   '    24 Aug 92
'-----------------------------------------------------------------------

'   Writes Both left and right hand side of Site Summary Section file (FS%) for a
'   site using template file (FT%) starting at TBYTE.  Files are in WordPerfect format.

'   Template file must have WP hard return as end of line character.
'   Routine reads in template file bytes one at a time and when any of the
'   markbytes are found, sets data array index to the two numbers following.
'   Markbytes are the characters: ^ ~ ` ? $ @ ! which are not in text of Summary.
'   Then the value or string in the array is written to the file starting at the
'   location of the markbyte.  Numeric data are formatted with the FORMAT$$ function
'   thru the WRITE subroutines.

'   Both template file and Site Summary file must be binary files already
'   opened for input and output respectively.
'
'       FT        Template file number                          INPUT
'       TBYTE     Template byte number                          INPUT
'       FS        Site Summary file number                      INPUT
'       SBYTE     Site Summary byte number                      INPUT
'       EB&       Byte to stop for change mode                  INPUT
'       FLG%      Flag for change mode                          INPUT

'-----------------------------------------------------------------------

   DEFINT A-Z
   DEFLNG S-T

   DIM B AS STRING * 1
   DIM S AS STRING * 20
   DIM PREVB AS STRING * 1
   DIM H AS STRING * 3
   DIM BACKUP AS LONG
   DIM SPA AS STRING * 72

   SHARED SKIPBYTE AS LONG, FLGP

'-----------------------------------------------------------------------

   F1$ = " 0.0E+00;; 0.     ":  F11$ = " 0.0E+00;;  \N\o\n\e  "
                                F12$ = " 0.0E+00;;  ---      "
   F2$ = "#0\%"
   F3$ = "<1%"
   F4$ = "###,000 \c\f\s;; 0.     "
   F5$ = "#0.0#"
   F6$ = "#,000;;   \N\o\n\e          ":    F66$ = " ##0,000;;  \N\o\n\e  "
   F7$ = "#0.0##"
   F8$ = "0.000"
   F9$ = "#0.0####"
'-----------------------------------------------------------------------

  ADV = &HD3                            ' WP Command
  IMARK = ASC("/")                      ' Main marker
  SP$ = SPACE$(1)
'  SP$ = "+"                            'Indicator For testing

'------------  Set locations in Template & Summary file  -----------------

   SEEK #FT, TBYTE                              ' Set location in template

   IF FLGP = TRUE THEN
     SBYTE = SBYTE - 1                          ' Second and succeding sites
   ELSE
     FLGP = TRUE                                ' First site sets flag
   END IF

   SEEK #FS, SBYTE                              ' Set location in Summary

'   CALL DEBUG2(FT, TBYTE, 24, "TBYTE ", "H")
'   CALL DEBUG2(FS, SBYTE, 24, "SBYTE ", "H")
'   PRINT "Hit any key ": SLEEP
   PRINT "Writing output file lines . . . . .";

'-------------------------------------------------

   P = 0
   DO UNTIL EOF(FT)                             ' Read in template

     BASC = 0
     COLOR FORGND, BACKGND, BORDER
     LINEOUT = LINEOUT + 1:  PRINT LINEOUT;
     DO UNTIL (BASC = HARDRET OR EOF(FT))                   ' Read until end of line
     GET #FT, TBYTE, B$                                     ' Template byte
```

```
        BASC = ASC(B$)

        IF BASC = IMARK THEN
          PREVB$ = B$
          TBYTE = TBYTE + 1
          GET #FT, TBYTE, B$                                  ' Template byte
          BASC = ASC(B$)
'          PRINT B$;

          IND = VAL(INDEX$(FT, TBYTE))
'          PRINT "IND="; IND
          SELECT CASE BASC                                          ' Select the data group

            CASE 94                                                 ' ^  Misc.

'            PRINT "---"; INDEX$(FT, TBYTE)
             SELECT CASE INDEX$(FT, TBYTE)
               CASE "SN"
                 CALL WRITESTR(FS, TBYTE, SITENAME$)
'    CALL DEBUG(FS, SEEK(FS) - 127, 130, "H"): '  SLEEP 4

               CASE "SM"
                 CALL WRITESTR(FS, TBYTE, CENTER$(RTRIM$(SITENAME$), 20))
               CASE "CT"
                 CITY$ = RTRIM$(CITY$)
                 RSET S$ = CITY$
                 CALL WRITESTR(FS, TBYTE, S$)
                 S$ = ""
               CASE "LA"
                 CALL WRITESTR(FS, TBYTE, LAT$)
               CASE "LO"
                 CALL WRITESTR(FS, TBYTE, LON$)
               CASE "WB"
                 CALL WRITESTR(FS, TBYTE, WATERBODY$)
               CASE "AO"
                 CALL WRITESTR(FS, TBYTE, LIQMAXORG$)
               CASE "WO"
                 CALL WRITESTR(FS, TBYTE, AIRMAXORG$)
               CASE ELSE
                 PRINT "No ^ mark index": END
             END SELECT

            CASE 92                                                 ' \    Waterborne pop
              I1 = VAL(LEFT$(INDEX$(FT, TBYTE), 1))
              I2 = VAL(RIGHT$(INDEX$(FT, TBYTE), 1))
              CALL WRITENUM(FS, TBYTE, LIQPOP(I1, I2), F1$)

            CASE 36                                                 ' $    Airborne pop
              I1 = VAL(LEFT$(INDEX$(FT, TBYTE), 1))
              I2 = VAL(RIGHT$(INDEX$(FT, TBYTE), 1))
              CALL WRITENUM(FS, TBYTE, AIRPOP(I1, I2), F1$)

            CASE 33                                                 ' !    Waterborne MI
              SELECT CASE IND
                CASE 5, 9
                  IF LIQMI(IND) < 1 THEN
                    CALL WRITESTR(FS, TBYTE, F3$)                       ' <1%
                  ELSE
                    IF LIQMI(IND) < 9.5 THEN
                      CALL WRITENUM(FS, TBYTE, LIQMI(IND), " " + F2$)   ' <10%
                    ELSE
                      CALL WRITENUM(FS, TBYTE, LIQMI(IND), F2$)         ' >10%
'  %
                    END IF
                  END IF
                CASE ELSE
                  CALL WRITENUM(FS, TBYTE, LIQMI(IND), F11$)            ' Doses
              END SELECT

            CASE 63                                                 ' ?    Airborne MI
              SELECT CASE IND
                CASE 2, 4, 6, 11
                  IF AIRMI(IND) < 1 THEN
                    CALL WRITESTR(FS, TBYTE, F3$)                       ' <1%
                  ELSE
                    IF AIRMI(IND) < 9.5 THEN
                      CALL WRITENUM(FS, TBYTE, AIRMI(IND), " " + F2$)   ' <10%
                    ELSE
                      CALL WRITENUM(FS, TBYTE, AIRMI(IND), F2$)         ' >10%
'  %
                    END IF
                  END IF
                CASE ELSE
                  CALL WRITENUM(FS, TBYTE, AIRMI(IND), F11$)            ' Doses
              END SELECT

            CASE 123                                                ' {    CENTERS
              CALL WRITESTR(FS, TBYTE, CENTR$(IND))
```

```
          CASE 126                                                  ' -     SSDATA$
            SELECT CASE IND
              CASE 2
                CALL WRITESTR(FS, TBYTE, SSDATA$(IND))              ' Recovery
              CASE 6, 7
                CALL WRITENUM(FS, TBYTE, VAL(SSDATA$(IND)), F5$)    ' Prod & Graz
              CASE 8, 10, 12, 14
                V! = ROUNDOFF!(VAL(SSDATA$(IND)), 2)
                IF V! < 1000 THEN F$ = "  " + F6$ ELSE F$ = F6$
                CALL WRITENUM(FS, TBYTE, V!, F$)                    ' Distances
              CASE 9, 11, 13, 15
                CALL WRITESTR(FS, TBYTE, SSDATA$(IND))              ' Directions
              CASE 17
                IF VAL(SSDATA$(IND)) = 0 THEN
                  TEMP$ = " "
                  BACKUP = SEEK(FS) - 40
                  FOR I = 1 TO 72
                    PUT #FS, BACKUP + I, TEMP$
                  NEXT
                  TBYTE = TBYTE - 40 + 72
                  ELSE
                    CALL WRITENUM(FS, TBYTE, VAL(SSDATA$(IND)), F1$) ' River flow L/Y
                  END IF
              CASE 18
                IF VAL(SSDATA$(IND)) > 0 THEN
                  CALL WRITENUM(FS, TBYTE, VAL(SSDATA$(IND)), F4$)  ' River flow cfs
                END IF
              CASE 20
                CALL WRITENUM(FS, TBYTE, VAL(SSDATA$(IND)), F66$)   ' Pop Water
              CASE 19, 21, 23, 27, 29, 31, 33
                CALL WRITENUM(FS, TBYTE, VAL(SSDATA$(IND)), F12$)   ' Pop & MI Mixing
              CASE 22, 24
                CALL WRITESTRNUM(FS, TBYTE, SSDATA$(IND), F11$)     ' Pop  usages

              CASE 25, 26
                CALL WRITESTR(FS, TBYTE, SSDATA$(IND))              ' Pop. Shore
              CASE 28, 30, 32, 34, 35
                CALL WRITESTR(FS, TBYTE, SSDATA$(IND))              ' MI usages & pop Water
              CASE ELSE
                CALL WRITENUM(FS, TBYTE, VAL(SSDATA$(IND)), F1$)    ' Other numbers
            END SELECT

            CASE 124                                                ' |  Prod/Cons ratio
              CALL WRITENUM(FS, TBYTE, ROUNDOFF!(PCF(IND), 2), F7$)

            CASE HARDRET
              PUT #FS, , B$:   TBYTE = TBYTE + 1                    ' Write hard return
              EXIT DO

            CASE ELSE
               P& = SEEK(FS)
               IF (P& = EB&) AND (FLG% = TRUE) THEN
                 PRINT : PRINT "-  1 Exiting sub at ------ P&="; P&
                 EXIT SUB                ' Don't overwrite notes
               END IF
               PUT #FS, P&, PREVB$:     TBYTE = TBYTE + 1                ' Just transfer byte to WP Summary
file
               PUT #FS, P& + 1, B$

          END SELECT

        ELSE
          P& = SEEK(FS)
          IF (P& = SKIPBYTE) AND (FLG% = TRUE) THEN
             PRINT : PRINT "-  2 Skipping Notes at ------ P&="; P&
             PP& = StringStart&(FS, BYVAL P&, "POPULATION")         ' Find start of Dose page of Summary
             SEEK FS, PP&
             TT& = StringStart&(FT, BYVAL TBYTE, "POPULATION")  ' Find start of Dose page of Template
             SEEK FT, TT&
             TBYTE = SEEK(FT)
             EXIT DO
          END IF
          IF (P& = EB&) AND (FLG% = TRUE) THEN
             PRINT : PRINT "-  2 Exiting sub at ------ P&="; P&
             EXIT SUB                ' Don't overwrite data page notes
          END IF
          PUT #FS, , B$:   TBYTE = TBYTE + 1                        ' Just transfer byte to WP Summary file
        END IF
      LOOP                                                          ' on characters per line
    LOOP                                                            ' on lines per template file
END SUB  ' [redacted] WriteSitePages
```

```
'_____________________________________________________________________
SUB WRITESTR (FileNum%, MarkByte&, DAT$)                    '   8 Sep 92

'   Writes string DAT$ to binary file begining at MARKBYTE position in template file.
'   Returns new position in file after string as MARKBYTE.
'   File FileNum must be already opened in BINARY mode.

'_____________________________________________________________________

   DEFINT A-Z

   DIM D AS STRING * 1
   DIM SP AS STRING * 1

'_____________________________________________________________________

      SP$ = SPACE$(1)                  ' Put in "=" for test
      PUT #FileNum, , SP$
      L = LEN(DAT$)

      FOR K = 1 TO L
        D$ = MID$(DAT$, K, 1)
        PUT #FileNum, , D$
      NEXT

      MarkByte& = MarkByte& + L

END SUB  '                                                    WRITESTR
```

```
'_____________________________________________________________________________
SUB WRITESTRNUM (FileNum%, MarkByte&, DAT$, FMT$)              '   8 Sep 92

'  Writes string DAT$ to binary file begining at MARKBYTE position in template file.
'  Returns new position in file after string as MARKBYTE.
'  File FileNum must be already opened in BINARY mode.

'_____________________________________________________________________________

   DEFINT A-Z

   DIM D AS STRING * 1
   DIM SP AS STRING * 1

'_____________________________________________________________________________
'    PRINT "DAT$="; DAT$

   SP$ = SPACE$(1)                          ' Put in "*" for testing
   PUT #FileNum, , SP$
   IF DAT$ = "" THEN DAT$ = "0.0"
   FIRST = ASC(LEFT$(DAT$, 1))
   IF FIRST = 0 THEN
     PRINT "Nul character at "; SEEK(1)
   ELSE
'     PRINT "FIRST"; FIRST, DAT$:
     IF FIRST > 47 AND FIRST < 58 THEN
       A$ = FormatS$(VAL(DAT$), FMT$):    L = LEN(A$)   '  Number
     ELSE
       A$ = DAT$:   L = LEN(DAT$)                       '  String
     END IF

     FOR K = 1 TO L
       D$ = MID$(A$, K, 1)
       PUT #FileNum, , D$
     NEXT
     MarkByte& = MarkByte& + L
   END IF

END SUB  '************************** End of File ************************** WRITESTRNUM
```

B.6 SUMTAB.BAS

```
SUMTAB.BAS     Summary Table 4 values                          No. M89971

Program generates values from SUM files for each site in Table 4 format.
Includes AirGamma and selects larger value for Gamma & TBody doses.
Site alfa order taken from order in SITEPOP.DAT file.

    Author: D. A. Baker, PNL          Date   16 Apr 93 start date
    Contact:  D. A. Baker, PNL, (509) 375 3809

CONST VERDATE = "28 Mar 95"
CONST CRN$ = "Copyright (C) 1993 Battelle Memorial Institute"

                              Disclaimer

  The author or his employer make neither any warranty nor representation,
  expressed or implied, with respect to the accuracy, completeness,
  or usefulness of this program; or assume any liability with respect
  to the use of, or for damages resulting from the use of this program.

                        Compiler, Modules, and Libraries

    Compiler version:  Microsoft Basic PDS 7.1
    Modules needed:  None
    Libraries needed:  DAB1.QLB, BCL71EFR.LIB, DAB1.LIB

                              Update History
 2 Jun 93 Modified from TTAB4.BAS
29 Jul 93 In sub GetAlfa, made UNIT index the same as site number.
31 Mar 94 Added means for indiv. doses
26 APR 94 Used PARSE2 to parse MI doses.
19 MAY 94 Added % of APP I design criteria
14 JUL 94 Added CB sorted lists for POP, MI T. Body, and MI organ.
20 DEC 94 Revised some formats; added list of pop doses and percents.
28 MAR 95 Revised default drive; C/B Table spacing; > 100 value printout.

                                  Files

   ------ Name ------------        Type  Number ------ Description ----
  Input:
  CONST FilePop$ = "SITEPOP.DAT"     ' Text    Free    Pop center data
  CONST FileSUM$ = Multiple          ' Random  Free    Result summary files
  Output:
  None
```

```
'******************************** Generic Type    ******************************

   DEFINT I-K

'***************************** CONST Statements  ******************************

   CONST FALSE = 0, TRUE = NOT FALSE
   CONST COMSYMBOL$ = "!'{¦"            ' Comment symbol
   CONST DELIM$ = " "                   ' Data file field delimeter
   CONST ColrFor = 14                    ' Foreground color
   CONST ColrBak = 1                     ' Background color
   CONST RECLEN = 128

'***************************** Array Maxima  **********************************

   CONST MaxSites% = 74              ' Total number of sites

'************************* TYPE Structure Definitions  ************************

'----------------------- Type Structure Declarations  -------------------------

'************************* FUNCTION & SUB Declarations  ***********************

'          Note: Must come after Local Param Declarations if argument list
'                contains type structure.

   DECLARE FUNCTION FF$ (Value!)
   DECLARE SUB GetAlfa (FileName$, SN%(), UNITS%(), N1%)
   DECLARE SUB OPENIN (FileName$, FLNum1%, Head$)
   DECLARE SUB WRITESTR (FileNum%, DAT$, Flag$)

'-------------------- In DAB1.LIB  ----------------------------------------

   DECLARE FUNCTION EXIST% (FileName$)
   DECLARE FUNCTION FORMAT$ (BYVAL Value!, FORM$)
   DECLARE SUB GETLINE (FileNum%, COMSYMBOL$, LINE$)
   DECLARE FUNCTION MAXSNG! (A!, B!)
   DECLARE SUB PARSE2 (LINE$, MAXARGS%, DELIM$, NUMARGS%, ARGS$())
   DECLARE FUNCTION ROUNDOFF! (Value!, Figures%)
   DECLARE FUNCTION TIMESTAMP$ ()

'***************************** Local declarations  ****************************

   TYPE RECSTRUCTURE
      Z AS STRING * RECLEN
   END TYPE

   DIM RELTYPE(3) AS STRING * 1
   DIM SUMMARI AS RECSTRUCTURE

   DIM ARGS$(10)
   DIM SITE AS STRING * 18
   DIM SN%(MaxSites%)
   DIM UNITS%(MaxSites%)
   DIM W$(15)

   DIM ENERGY(MaxSites%) AS SINGLE
   DIM DPOPLIQ(MaxSites%) AS SINGLE
   DIM DPOPAIR(MaxSites%) AS SINGLE
   DIM DPOPTOT(MaxSites%) AS SINGLE
   DIM CB(MaxSites%) AS SINGLE
   DIM SITENAME(MaxSites%) AS STRING * 20


   DIM EORG(MaxSites%) AS SINGLE
   DIM DORGLIQ(MaxSites%) AS SINGLE
   DIM DORGAIR(MaxSites%) AS SINGLE
'  DIM DORGTOT(MaxSites%) AS SINGLE
   DIM CBORG(MaxSites%) AS SINGLE
   DIM SITENameOrg(MaxSites%) AS STRING * 20

   DIM EBOD(MaxSites%) AS SINGLE
   DIM DBODLIQ(MaxSites%) AS SINGLE
   DIM DBODAIR(MaxSites%) AS SINGLE
'  DIM DBODTOT(MaxSites%) AS SINGLE
   DIM CBBOD(MaxSites%) AS SINGLE
   DIM SITENameBod(MaxSites%) AS STRING * 20
   DIM PCENTS(1 TO MaxSites, 1 TO 6) AS SINGLE

'------------------------------------------------------------------------------

   WIDTH LPRINT 160

   RELTYPE$(1) = "G"
   RELTYPE$(2) = "E"
   RELTYPE$(3) = "M"
```

```
   MINL = 1E+30:   MAXL = 0
   MINA = 1E+30:   MAXA = 0
   MINLA = 1E+30:  MAXLA = 0

   CRFF$ = CHR$(13) + CHR$(12)                                  ' Carraige return - Form Feed
   CRLF$ = CHR$(13) + CHR$(10)                                  ' Carraige return - Line Feed
   ESC$ = CHR$(27)                                              ' ASCII escape

'--------------------------  Flags  ----------------------------------------

'   FlgALFA%          True will Print in alpha order; False, site no. order.
'   FlgPERUNIT%       True will calculate per App I doses and %s on per unit; False, per site. basis
'   FlgCB%            True will print 3 sorted C/B lists; False will slip

'_____________________________________________________________________________

'************************  Option Section  ** Comment out when debugged ********

    YEAR$ = "92"

    FlgALFA% = TRUE         ' True will Print in alpha order; False, site no. order.
    FlgPERUNIT% = TRUE      ' True will calculate per App I doses and %s on per unit; False, per site. basis
    FlgCB% = TRUE            ' True will print 3 sorted C/B lists; False will slip
''   GOTO SKIP               ' Skip command line input for debugging

'*******************************************************************************


'                    Command line and KB input
'

   IF COMMAND$ > "" THEN
     CALL PARSE2(COMMAND$, 10, DELIM$, NUMARGS%, ARGS$())
     YEAR$ = RIGHT$(ARGS$(1), 2)
     IF INSTR(ARGS$(2), "T") THEN FlgALFA% = TRUE ELSE FlgALFA% = FALSE
     IF INSTR(ARGS$(3), "T") THEN FlgPERUNIT% = TRUE ELSE FlgPERUNIT% = FALSE
     IF INSTR(ARGS$(4), "T") THEN FlgCB% = TRUE ELSE FlgCB% = FALSE

   ELSE
     CLS :  PRINT :  PRINT :   BEEP
     PRINT "   Enter options on command line:":   PRINT
     PRINT "              SUMTAB  YEAR  ALFA-FLAG  PERUNIT-FLAG  C/B FLAG":   PRINT
     PRINT "   Ex.        SUMTAB  90  T  T  T"
     END
   END IF

SKIP:

'-----------------  Standard directories  --------------------------------

   DIREC1$ = "\Y" + YEAR$ + "\OUT\SUMMARY\"
   DIREC3$ = "\Y" + YEAR$ + "\REPORT\"

'---------------------------  Printer Setup ---------------------------------
   CLS
   LPRINT CHR$(27); "&l1O";                                     ' Landscape
   LPRINT CHR$(27); "&a15L";                                    ' Left Margin
   LPRINT CHR$(27); "&l5.3D";                                   ' 9 LPI
   LPRINT TAB(122); "SUMTAB run of "; TIMESTAMP$: LPRINT : LPRINT

'---------------------------  Titles and Images  ----------------------------

  IF FlgPERUNIT% THEN A$ = "per Unit Basis" ELSE A$ = "per Site Basis"
  LPRINT TAB(25); YEAR$; " Table 4 Summary -- Liquid and Air Pathway Doses.  Individual App. I Doses on a ";
A$:   LPRINT
  LPRINT
  LPRINT "No.    Site        Units Type   Population Dose (man-rem)                    ---------------------
Individual App. I Dose (mrem) --------------------"
  LPRINT "                        Energy    Liquid    Air       Total        PoP          ---- Liquid ----
--------------------- Air --------------------------"
  LPRINT "                        (TW-hr)                                                Tbody    Organ      Gamma
  AGam     Beta     Tbody    ATbody   Organ "                                             (3)      (10)       -----
  LPRINT "
(10) -----    (20)    ------ (5) -----   (15)  "
  LPRINT STRING$(146, CHR$(196))
  I1$ = "##  & # !   ##.#^^^^  ##.#^^^^  ##.#^^^^              ##.#^^^^ ##.#^^^^   ##.#^^^^ ##.#^^^^ ##.#^^^^
##.#^^^^ ##.#^^^^ ##.#^^^^"
  I2$ = "    Total              ##.##    ##.#^^^^  ##.#^^^^  ##.#^^^^   ##.#^^^^    ##.#^^^^ ##.#^^^^
##.#^^^^    ##.#^^^^      ##.#^^^^  ##.#^^^^"
  I3$ = "    Percent Appendix I on a \          \ *                                    ###.##    ###.##
###.##      ###.##        ###.##    ###.##"
  I4$ = "    Totals         ###.##   ##.#^^^^  ##.#^^^^  ##.#^^^^   ##.#^^^^   "
  I5$ = "    Arithmetic Mean  ##.##   ##.#^^^^  ##.#^^^^  ##.#^^^^   ##.#^^^^    ##.#^^^^ ##.#^^^^
##.#^^^^    ##.#^^^^      ##.#^^^^  ##.#^^^^"
  I8$ = "      Percent Appendix I Dose on a \           \ *  ----------------  ##.## %  ##.## %
##.## %     ##.## %       ##.## %   ##.## %"
  I6$ = "    Geometric Mean   ##.##   ##.#^^^^  ##.#^^^^  ##.#^^^^   ##.#^^^^    ##.#^^^^ ##.#^^^^
##.#^^^^    ##.#^^^^      ##.#^^^^  ##.#^^^^"
```

```
  I9$ = "        Percent Appendix I Dose on a \           \ *  ----------------  ##.## %  ##.## %
##.## %    ##.## %       ##.## %       ##.## %"
  I7$ = "     \       \  &      ##.#^^^^"

'------------------------  Site Alfa order  -------------------------------

  CALL GetAlfa(DIREC3$ + FilePop$, SN%(), UNITS%(), N1%)

'----------------------------- Input Result Files --------------------------

  FILE1$ = "SUMyySXX.OUX":                  ' Site dose summary file
  MID$(FILE1$, 4, 2) = YEAR$


  FileNum% = 3
  OPEN "LPT1:" FOR OUTPUT AS #FileNum%
  R$ = CRLF$: Eject$ = CRFF$:   TAB$ = "  "

'-------------------------  Loop for Each Site  ------------------------------

   IF FlgALFA% THEN Max% = N1% ELSE Max% = MaxSites%   ' Select max operational sites

   FOR I = 1 TO Max%
     FLGNOSITE% = TRUE          ' Set to false if SUM file for site found.

     IF FlgALFA% = TRUE THEN
       SN% = SN%(I)             ' Alpha order
     ELSE
       SN% = I                  ' Site number order
     END IF

     IF SN% < 10 THEN SITENUM$ = "0" + LTRIM$(STR$(SN%)) ELSE SITENUM$ = LTRIM$(STR$(SN%))
     MID$(FILE1$, 7, 2) = SITENUM$

'-------------------------------------------------------------------------------
     IF SN% > 0 THEN

       NUM% = UNITS%(SN%)
       IF FlgPERUNIT% THEN NUMUNITS% = NUM% ELSE NUMUNITS% = 1

       TOTPOPA = 0:    TOTPOPL = 0:  TAGM = 0: TADTBA = 0:  TTGAM = 0:  TTDTBA = 0
       TGAM = 0: TBET = 0: TDTBA = 0: TDORA = 0: TDTBL = 0: TDORL = 0:  POP = 0
       TWH = 0:  TLA = 0

       FOR J = 1 TO 3                                   ' Loop on the 3 Rel Types
         MID$(FILE1$, 12, 1) = RELTYPE$(J)
         F$ = DIREC1$ + FILE1$
          PRINT F$
         IF EXIST(F$) THEN                              ' Check for SUM file
           FLGNOSITE% = FALSE
           OPEN F$ FOR RANDOM AS #1 LEN = RECLEN        ' Open and read in data & Doses

           REC = 16:     GOSUB GETLINE                  ' POP file header
           IF LEFT$(L$, 10) <> SPACE$(10) THEN
             L1 = INSTR(L$, "TION") + 4:   L2 = INSTR(L$, "(k")
             SITE$ = MID$(L$, L1, L2 - L1)
           END IF
           PRINT K; I, "=="; SITE$; "=="; NUMUNITS%

           REC = 69:  GOSUB GETLINE                     ' TW Hr
           CALL PARSE2(L$, 10, " ", NUMARGS%, ARGS$())
           TEMP = VAL(ARGS$(8))
           IF TEMP > 0 THEN TWH = TEMP

           REC = 75:  GOSUB GETLINE                     ' Population
             POP = VAL(MID$(L$, 1, 12))
             IF POP = 0 THEN
               REC = 72:  GOSUB GETLINE
               POP = VAL(MID$(L$, 65, 12))
             END IF

           REC = 46:  GOSUB GETLINE                     ' Liquid pop dose
             POPL = VAL(MID$(L$, 13, 10))
             TOTPOPL = TOTPOPL + POPL

           REC = 51:  GOSUB GETLINE                     ' Air pop dose
             POPA = VAL(MID$(L$, 13, 10))
             TOTPOPA = TOTPOPA + POPA

           REC = 29:  GOSUB GETLINE                                 ' Liquid MI dose
             CALL PARSE2(L$, 15, DELIM$, NUMARGS%, W$())
             DTBL = VAL(W$(5)):  TDTBL = TDTBL + DTBL
             DORL = VAL(W$(9)):  TDORL = TDORL + DORL


           REC = 74:  GOSUB GETLINE                                 ' Air MI dose from CPRDA
             CALL PARSE2(L$, 15, DELIM$, NUMARGS%, W$())
             GAM = VAL(W$(2)):   TGAM = TGAM + GAM
             BET = VAL(W$(3)):   TBET = TBET + BET
```

```
            DTBA = VAL(W$(4)):  TDTBA = TDTBA + DTBA
            DORA = VAL(W$(8)):  TDORA = TDORA + DORA

          REC = 91:  GOSUB GETLINE                                    ' Air MI dose from Air Gamma
            AGAM = VAL(MID$(L$, 54, 9)):   TAGAM = TAGAM + AGAM
          REC = 92:  GOSUB GETLINE
            ADTBA = VAL(MID$(L$, 44, 9)):  TADTBA = TADTBA + ADTBA

          CLOSE #1

        S$ = SPACE$(17):  LSET S$ = SITE$
        LPRINT USING I1$; SN%; S$; NUM%; RELTYPE$(J); POPL; POPA; POPA + POPL; DTBL; DORL; GAM; AGAM; BET; DTBA;
ADTBA; DORA

          IF J = 1 THEN                                               '  Sum Gamma & TBody; for E & M types
take maximum
            TTGAM = TTGAM + GAM:  TTDTBA = TTDTBA + DTBA
          ELSE
            TTGAM = TTGAM + MAXSNG!(AGAM, GAM):  TTDTBA = TTDTBA + MAXSNG!(DTBA, ADTBA)
          END IF
        END IF

      NEXT

      IF FLGNOSITE% = FALSE THEN                                      ' Correct for number of units at valid
site
        K = K + 1
        TDTBL = TDTBL / NUMUNITS%:   TDORL = TDORL / NUMUNITS%
        TTGAM = TTGAM / NUMUNITS%:  TBET = TBET / NUMUNITS%
        TTDTBA = TTDTBA / NUMUNITS%:   TDORA = TDORA / NUMUNITS%
'        LPRINT USING I2$; TWH; TOTPOPL; TOTPOPA; TOTPOPA + TOTPOPL; POP; TDTBL; TDORL; TTGAM; TBET; TTDTBA;
TDORA

        L$ = "     Total  ======  " + FORMAT$$(TWH, "  00.00") + "  " + FF$(TOTPOPL) + "  " + FF$(TOTPOPA) +
" " + FF$(TOTPOPA + TOTPOPL)
        L$ = L$ + FORMAT$$(POP, "  0.0E+00     ") + FF$(TDTBL) + " " + FF$(TDORL) + "      " + FF$(TTGAM) +
"   " + FF$(TBET) + "     " + FF$(TTDTBA) + "    " + FF$(TDORA)
        CALL WRITESTR(FileNum%, L$, "T")

        PCENTS(I, 1) = TDTBL / .03
        PCENTS(I, 2) = TDORL / .1
        PCENTS(I, 3) = TTGAM / .1
        PCENTS(I, 4) = TBET / .2
        PCENTS(I, 5) = TTDTBA / .05
        PCENTS(I, 6) = TDORA / .15

        LPRINT USING I3$; A$; TDTBL / .03; TDORL / .1; TTGAM / .1; TBET / .2; TTDTBA / .05; TDORA / .15
      ELSE
        LPRINT "Site: "; SITENUM$; " SUM file not found ------------."
        PRINT SITENUM$;" NOT FOUND ---------"
      END IF

'-----------  Grand totals --------------

      TLIQ = TLIQ + TOTPOPL
      TAIR = TAIR + TOTPOPA
      TLA = TOTPOPL + TOTPOPA
      TOT = TOT + TLA
      TTWH = TTWH + TWH
      TPOP = TPOP + POP

      TILIQ = TILIQ + TDTBL
      TILIQO = TILIQO + TDORL
      TIGAM = TIGAM + TTGAM
      TIBET = TIBET + TBET
      TIAIR = TIAIR + TTDTBA
      TIAIRO = TIAIRO + TDORA


      IF TOTPOPL > 0 THEN LL = LL + LOG(TOTPOPL)
      IF TOTPOPA > 0 THEN LA = LA + LOG(TOTPOPA)
      IF TLA > 0 THEN LTOT = LTOT + LOG(TLA)
      IF TWH > 0 THEN LTWH = LTWH + LOG(TWH)
      IF POP > 0 THEN LPOP = LPOP + LOG(POP)

      IF TDTBL > 0 THEN LILIQ = LILIQ + LOG(TDTBL)
      IF TDORL > 0 THEN LILIQO = LILIQO + LOG(TDORL)
      IF TTGAM > 0 THEN LIGAM = LIGAM + LOG(TTGAM)
      IF TBET > 0 THEN LIBET = LIBET + LOG(TBET)
      IF TTDTBA > 0 THEN LIAIR = LIAIR + LOG(TTDTBA)
      IF TDORA > 0 THEN LIAIRO = LIAIRO + LOG(TDORA)

'-------------------------------------------------------------------------------

      IF TWH > 0 THEN                    ' Only operating sites counted for Max or Min
        IF TOTPOPL < MINL THEN MINL = TOTPOPL:  SITEMINL$ = SITE$
        IF TOTPOPL > MAXL THEN MAXL = TOTPOPL:  SITEMAXL$ = SITE$

        IF TOTPOPA < MINA THEN MINA = TOTPOPA:  SITEMINA$ = SITE$
```

```
        IF TOTPOPA > MAXA THEN MAXA = TOTPOPA:  SITEMAXA$ = SITE$

        IF TLA < MINLA THEN MINLA = TLA:  SITEMINLA$ = SITE$
        IF TLA > MAXLA THEN MAXLA = TLA:  SITEMAXLA$ = SITE$
      END IF

    ELSE
      LPRINT "Site: "; SITENUM$; SITE$; " NOT on list ------------."
      PRINT "Site: "; SITENUM$; SITE$; " NOT on list ------------."
      PRINT
    END IF

    LPRINT STRING$(146, CHR$(196))

'----------  Population

    ENERGY(I) = TWH
    DPOPLIQ(I) = TOTPOPL:    DPOPAIR(I) = TOTPOPA:    DPOPTOT(I) = TOTPOPA + TOTPOPL
    IF ENERGY(I) > 0 THEN CB(I) = DPOPTOT(I) / ENERGY(I) ELSE CB(I) = 999
    SITENAME$(I) = LTRIM$(SITE$)

'----------  MI ORGan

    EORG(I) = TWH
    DORGLIQ(I) = TDORL:    DORGAIR(I) = TDORA
    IF EORG(I) > 0 THEN CBORG(I) = (DORGLIQ(I) + DORGAIR(I)) / EORG(I) ELSE CBORG(I) = 999
    SITENameOrg$(I) = LTRIM$(SITE$)

'----------  MI T. BODy

    EBOD(I) = TWH
    DBODLIQ(I) = TDTBL:    DBODAIR(I) = TTDTBA
    IF EBOD(I) > 0 THEN CBBOD(I) = (DBODLIQ(I) + DBODAIR(I)) / EBOD(I) ELSE CBBOD(I) = 999
    SITENameBod$(I) = LTRIM$(SITE$)


  NEXT I

  PRINT :  PRINT "Sites Counted: "; K; " out of "; MaxSites%; " sites."

  L$ = "     Totals          " + FORMAT$$(TTWH, "  000.00  ") + FF$(TLIQ) + "  " + FF$(TAIR) + " " + FF$(TOT)
+ FORMAT$$(TPOP, "  0.0E+00")
  CALL WRITESTR(FileNum%, R$ + L$ + R$, "T")
  LPRINT "     Operational Sites Counted: "; K; " out of total of "; MaxSites%; " sites."

'------------ Arith and geom. means ----------------------

  LPRINT :  LPRINT USING I5$; TTWH / K; TLIQ / K; TAIR / K; TOT / K; TPOP / K; TILIQ / K; TILIQO / K; TIGAM
/ K; TIBET / K; TIAIR / K; TIAIRO / K
  LPRINT USING I8$; A$; TILIQ / K / 3 * 100; TILIQO / K / 10 * 100; TIGAM / K / 10 * 100; TIBET / K / 20 * 100;
TIAIR / K / 5 * 100; TIAIRO / K / 15 * 100
  LPRINT
  LPRINT :  LPRINT USING I6$; EXP(LTWH / K); EXP(LL / K); EXP(LA / K); EXP(LTOT / K); EXP(LPOP / K); EXP(LILIQ
/ K); EXP(LILIQO / K); EXP(LIGAM / K); EXP(LIBET / K); EXP(LIAIR / K); EXP(LIAIRO / K)
  LPRINT USING I9$; A$; EXP(LILIQ / K) / 3 * 100; EXP(LILIQO / K) / 10 * 100; EXP(LIGAM / K) / 10 * 100;
EXP(LIBET / K) / 20 * 100; EXP(LIAIR / K) / 5 * 100; EXP(LIAIRO / K) / 15 * 100

  LPRINT : LPRINT
  LPRINT USING I7$; "MIN Liq"; SITEMINL$; MINL
  LPRINT USING I7$; "MAX Liq"; SITEMAXL$; MAXL
  LPRINT
  LPRINT USING I7$; "MIN Air"; SITEMINA$; MINA
  LPRINT USING I7$; "MAX Air"; SITEMAXA$; MAXA
  LPRINT
  LPRINT USING I7$; "MIN Tot"; SITEMINLA$; MINLA
  LPRINT USING I7$; "MAX Tot"; SITEMAXLA$; MAXLA

  LPRINT :  LPRINT STRING$(80, 205)
  LPRINT "*  These values represent percentages of the Appendix I annual design objectives."
  LPRINT "   For compliance purposes, each pathway would be compared on a quarterly basis."
  LPRINT "   as per Appendix I."

  LPRINT CHR$(27); "&l0O";                              ' Set printer back to Portrait

'------------------------------  Print Pop List  ------------------------------

    LPRINT CHR$(27); CHR$(13);
    LPRINT TAB(110); TIMESTAMP$:   LPRINT : LPRINT
    LPRINT TAB(17); "***********  "; YEAR$; " Population Dose and Max. Individual Percentages of Appendix I
**********   ":   LPRINT
    LPRINT
    LPRINT "                                          ---------- Population ----------   --------------- Max.
Individual ------------------"
    LPRINT "            Site              Energy    Liquid    Air     Total   Percent of    --- Liquid ---
-------------  Air  ------------"
    LPRINT "                             TW-hr     -------- man-rem -----      Total     Body     Organ     Gamma
  Beta     Body     Organ"
    LPRINT
```

```
    FOR I = 1 TO K
      LINE$ = SPACE$(7) + SITENAME$(I) + FORMAT$$(ENERGY(I), " 00.00   ") + FF$(DPOPLIQ(I)) + FF$(DPOPAIR(I))
+ FF$(DPOPTOT(I)) + "  " + FF$(DPOPTOT(I) / TOT * 100)
      LINE$ = LINE$ + " " + FF$(PCENTS(I, 1)) + FF$(PCENTS(I, 2)) + FF$(PCENTS(I, 3)) + FF$(PCENTS(I, 4)) +
FF$(PCENTS(I, 5)) + FF$(PCENTS(I, 6))
      LPRINT LINE$
      IF I MOD 5 = 0 THEN LPRINT
    NEXT
    LINE$ = "         Totals          " + FORMAT$$(TTWH, "  000.00   ") + FF$(TLIQ) + FF$(TAIR) + FF$(TOT)
    LPRINT : LPRINT LINE$; TAB(110); K; " Sites listed";
    LPRINT CRFF$;

  IF NOT FlgCB% THEN END  '=========================  SKIP C/B OUTPUT  ======================

   PRINT : PRINT "SORTING ....  "

   DO   '-----------------------  Sort Sites for POP CB  ---------------

    F = TRUE
    FOR J = 1 TO K - 1
      IF CB(J) > CB(J + 1) THEN
        F = FALSE
        SWAP CB(J), CB(J + 1)
        SWAP DPOPLIQ(J), DPOPLIQ(J + 1)
        SWAP DPOPAIR(J), DPOPAIR(J + 1)
        SWAP DPOPTOT(J), DPOPTOT(J + 1)
        SWAP ENERGY(J), ENERGY(J + 1)
        SWAP SITENAME$(J), SITENAME$(J + 1)
      END IF
    NEXT

   LOOP WHILE F = FALSE

   PRINT K; " Sites sorted"


  DO   '-----------------------  Sort Sites for Organ CB --------------------------

    F = TRUE
    FOR J = 1 TO K - 1
      IF CBORG(J) > CBORG(J + 1) THEN
        F = FALSE
        SWAP CBORG(J), CBORG(J + 1)
        SWAP DORGLIQ(J), DORGLIQ(J + 1)
        SWAP DORGAIR(J), DORGAIR(J + 1)
        SWAP EORG(J), EORG(J + 1)
        SWAP SITENameOrg$(J), SITENameOrg$(J + 1)
      END IF
    NEXT

  LOOP WHILE F = FALSE

  PRINT K; " Sites sorted"

  DO   '-----------------------  Sort Sites for T. Bod CB  --------------------------

    F = TRUE
    FOR J = 1 TO K - 1
      IF CBBOD(J) > CBBOD(J + 1) THEN
        F = FALSE
        SWAP CBBOD(J), CBBOD(J + 1)
        SWAP DBODLIQ(J), DBODLIQ(J + 1)
        SWAP DBODAIR(J), DBODAIR(J + 1)
        SWAP EBOD(J), EBOD(J + 1)
        SWAP SITENameBod$(J), SITENameBod$(J + 1)
      END IF
    NEXT

  LOOP WHILE F = FALSE
  PRINT K; " Sites sorted": PRINT

'------------------------------  Print Sorted Pop C/B  -----------------------

     LPRINT CHR$(27); CHR$(13);
     LPRINT TAB(110); TIMESTAMP$;  LPRINT : LPRINT
     LPRINT TAB(17); "*********** "; YEAR$; " Population Cost/Benefit Summary  -- Sorted in Order of Decreasing
Benefit  **********   ":  LPRINT
     LPRINT
    LPRINT "              Site                  Liquid      Air       Total     Energy     Cost / Benefit"
    LPRINT "                                    ---------- man-rem ---------    TW-hr      man-rem / TW-hr"
    LPRINT
'   I10$ = "       \                    \   ##.#^^^^  .##.#^^^^   ##.####     ##.##          #.####"

    FOR I = 1 TO K
'     LPRINT USING I10$; SITENAME$(I); DPOPLIQ(I); DPOPAIR(I); DPOPTOT(I); ENERGY(I); CB(I)
      LINE$ = SPACE$(10) + SITENAME$(I) + "     " + FF$(DPOPLIQ(I)) + "  " + FF$(DPOPAIR(I)) + "   " +
FF$(DPOPTOT(I)) + "   " + FF$(ENERGY(I)) + "    " + FF$(CB(I))
      LPRINT LINE$
      IF I MOD 5 = 0 THEN LPRINT
```

```
    NEXT
    LPRINT : LPRINT :   LPRINT "          "; K; " Sites sorted."
   SHELL "E:FF"

'------------------------------ Print Sorted MI Organ C/B -----------------------

     LPRINT TAB(110); TIMESTAMP$:  LPRINT :  LPRINT
     LPRINT TAB(17); "*********** "; YEAR$; " MI Organ Cost/Benefit Summary -- Sorted in Order of Decreasing
Benefit **********   ":   LPRINT
     LPRINT
    LPRINT "              Site                  Liquid      Air       Total      Energy      Cost / Benefit"
    LPRINT "                                    ---------- mrem  ----------    TW-hr       mrem / TW-hr"
    LPRINT
'    I10$ = "        \                   \   ##.#^^^^  ##.#^^^^   ##.####     ##.##          #.####"

    FOR I = 1 TO K
      LINE$ = SPACE$(10) + SITENameOrg$(I) + "     " + FF$(DORGLIQ(I)) + "  " + FF$(DORGAIR(I)) + "  " +
FF$(DORGLIQ(I) + DORGAIR(I)) + "   " + FF$(EORG(I)) + "    " + FF$(CBORG(I))
      LPRINT LINE$
'     LPRINT USING I10$; SITENameOrg$(I); DORGLIQ(I); DORGAIR(I); DORGLIQ(I) + DORGAIR(I); EORG(I); CBORG(I)
      IF I MOD 5 = 0 THEN LPRINT
    NEXT
    LPRINT :  LPRINT :  LPRINT "          "; K; " Sites sorted."
   SHELL "E:FF"

'------------------------------ Print Sorted MI T. Body C/B ----------------------

     LPRINT TAB(110); TIMESTAMP$:  LPRINT :  LPRINT
     LPRINT TAB(16); "***********  "; YEAR$; " MI T. Body Cost/Benefit Summary  --  Sorted in Order of
Decreasing Benefit  ********** ":   LPRINT
     LPRINT
    LPRINT "              Site                  Liquid      Air       Total      Energy      Cost / Benefit"
    LPRINT "                                    ---------- mrem  ----------    TW-hr       mrem / TW-hr"
    LPRINT
'    I10$ = "        \                   \   ##.#^^^^  ##.#^^^^   ##.####     ##.##          #.####"

    FOR I = 1 TO K
      LINE$ = SPACE$(10) + SITENameBod$(I) + "     " + FF$(DBODLIQ(I)) + "  " + FF$(DBODAIR(I)) + "  " +
FF$(DBODLIQ(I) + DBODAIR(I)) + "   " + FF$(EBOD(I)) + "    " + FF$(CBBOD(I))
      LPRINT LINE$
'     LPRINT USING I10$; SITENameBod$(I); DBODLIQ(I); DBODAIR(I); DBODLIQ(I) + DBODAIR(I); EBOD(I); CBBOD(I)
      IF I MOD 5 = 0 THEN LPRINT
    NEXT
    LPRINT :  LPRINT :  LPRINT "          "; K; " Sites sorted."
   SHELL "E:FF"


   END

'_____________________________________________________________________________
GETLINE: '**********************

     GET #1, REC, SUMMARI
     L$ = MID$(SUMMARI.Z, 1, RECLEN)
  RETURN

  END '-----------------------------------------------------------------------
```

```
'-------------------------------------------------------------------------
FUNCTION FF$ (Value!)                    '                        28 Mar 95

'  Returns value in common numeric format in two sig. figures.
'  Requires FORMATS$() and ROUNDOFF!() functions.

'     Value     Single precision positive value.  Zero returns "None".
'-------------------------------------------------------------------------

   DEFSNG A-Z

'-------------------------------------------------------------------------

   V = ROUNDOFF!(Value!, 2)          ' Rounds to 2 sig figures

   SELECT CASE V

     CASE IS < .00095
       FF$ = FORMATS$(V, " <0.001  ;N\eg\ativ\e \Argu\m\ent;  Non\e   ")
     CASE IS < .0095
       FF$ = FORMATS$(V, "  0.0000 ")
     CASE IS < .095
       FF$ = FORMATS$(V, "  0.000  ")
     CASE IS < .95
       FF$ = FORMATS$(V, "  0.00   ")
     CASE IS < 9.5
       FF$ = FORMATS$(V, "  0.0    ")
     CASE IS < 99.5
       FF$ = FORMATS$(V, " 00.     ")
     CASE IS < 300
       FF$ = FORMATS$(V, "0.00E+00 ")
     CASE ELSE
       FF$ = "Not Operational"                  ' For any V over 300.
'--------------------------------Not used--------------
'    CASE IS < 1000
'      FF$ = FORMATS$(V, "        000.")
'    CASE IS < 10000
'      FF$ = FORMATS$(V, "       0000.")
'    CASE IS < 100000
'      FF$ = FORMATS$(V, "     00,000.")
'    CASE IS < 1000000
'      FF$ = FORMATS$(V, "    000,000.")
'    CASE IS < 10000000
'      FF$ = FORMATS$(V, "  0,000,000.")
'    CASE IS < 100000000
'      FF$ = FORMATS$(V, " 00,000,000.")
'     CASE ELSE
'       FF$ = FORMATS$(V, "000,000,000.")

   END SELECT

END FUNCTION '[redacted] FF$
```

```
'-------------------------------------------------------------------------
  SUB GetAlfa (FileName$, SN%(), UNITS%(), N1%)                '   8 Sep 93
'     Generates list of site numbers in alfa order from the sequence of sites
'     in the population data file for population centers.
'      FileName$     Input file name                                INPUT
'      SN%()         List of site numbers in alfa order             OUTPUT
'      UNITS()       List of units/site in alfa order               OUTPUT
'      N1%           Number operational of sites                    OUTPUT
'                      --- Those counted in pop data file.
'-------------------------------------------------------------------------
    DEFINT A-Z
'-------------------------------------------------------------------------
      MaxFelds = 10:  REDIM W$(MaxFelds)
      CALL OPENIN(FileName$, FLNum, HEADER$)
      I = 0
      DO UNTIL EOF(FLNum)
        CALL GETLINE(FLNum, COMSYMBOL$, L$)
        CALL PARSE2(L$, MaxFelds, DELIM$, NUMARGS%, W$())
        IF ASC(W$(1)) < 58 THEN
          I = I + 1: PRINT ".";
          SN(I) = VAL(W$(1))                    ' Site num index
          S$ = MID$(L$, 5, 17)                  ' Site name
          UNITS(SN(I)) = VAL(MID$(L$, 23, 1))   ' units at site
'         PRINT I; SN(I); S$; UNITS(SN(I))
        END IF
      LOOP
      PRINT
      N1 = I                                    ' Number of operational sites
      CLOSE FLNum:   ERASE W$
   PRINT N1
'   FOR I = 1 TO N1
'   PRINT I; SN(I)
'   NEXT
END SUB '[redacted] GetAlfa
'-------------------------------------------------------------------------
  SUB OPENIN (FileName$, FileNum%, HEADER$)                    '   19 Mar 93
'     Opens file in input text mode after checking for existence.
'     Assigns Freefile number to file.  Routine does not close file.
'     Displays file header line and length of file at terminal.
'      FileName$     Input file name                                INPUT
'      FileNum%      Input file number                              OUTPUT
'      Header$       Header for file                                OUTPUT
'-------------------------------------------------------------------------
    DEFINT A-Z
'-------------------------------------------------------------------------
      FileNum = FREEFILE
      IF EXIST%(FileName$) THEN
        OPEN FileName$ FOR INPUT AS #FileNum LEN = 1024
        LINE INPUT #FileNum, HEADER$
        PRINT HEADER$
        PRINT " LoF: "; LOF(FileNum); "Bytes ";
      ELSE
        CLS : LOCATE 10, 20: '  SON 1
        PRINT "File "; FileName$; " not found.":   END
      END IF
  END SUB '[redacted] OpenIN
```

```
'-------------------------------------------------------------------------
SUB SORT (N%, SArray$(), Start%, L%)                          ' 13 Jul 93
'     Bubble Sort of array of lines in table
'      N%          Array size                                 INPUT
'      SArray$()   String array for file lines                INPUT / OUTPUT
'      Start%      Start of key string                        INPUT
'      L%          Length of key string                       INPUT
'-------------------------------------------------------------------------
   DEFINT A-Z
'-------------------------------------------------------------------------
   LNUM! = 1E+34              ' Large Number
   LCS$ = "None"              ' Limiting concentration string when doses are zero
   DO
     Flag = TRUE
     FOR J = 1 TO N - 1
       IF S1! > S2! THEN
'         SWAP CB(J), CB(J + 1)
'         SWAP L(J), L(J + 1)
'         SWAP A(J), A(J + 1)
'         SWAP E(J), E(J + 1)
'         SWAP N(J), N$(J + 1)
         Flag = FALSE
       END IF
     NEXT
   LOOP WHILE Flag = FALSE

END SUB  '[redacted] SORT
```

```
'_____________________________________________________________________
SUB WRITESTR (FileNum%, DAT$, Flag$)                    '  7 Oct 94

'   Writes string DAT$ to binary file begining at MARKBYTE position in template file.
'   Returns new position in file after string as MARKBYTE.
'   File FileNum must be already opened in BINARY mode.

'      FileNum%      File number from open statement                    INPUT
'      DAT$          String to write to file                            INPUT
'      FLAG          Mode:  T = text; B = binary                        INPUT

'_____________________________________________________________________

   DEFINT A-Z

   DIM D AS STRING * 1
   DIM SP AS STRING * 1

  SHARED FM$
'_____________________________________________________________________

    IF Flag$ = "T" THEN
      FM$ = "Text"
      PRINT #FileNum, DAT$

    ELSEIF Flag$ = "B" THEN
      FM$ = "WordPerfect"
      SP$ = SPACE$(1)                   ' Put in "*" for test
      PUT #FileNum, , SP$
      L = LEN(DAT$)
      FOR K = 1 TO L
        D$ = MID$(DAT$, K, 1)
        PUT #FileNum, , D$
      NEXT
      PUT #FileNum, , Hrt               ' Put hard return at end
    ELSE
      BEEP:   PRINT "Write mode incorrect in SUB WRITESTR":    END
    END IF

END SUB  '[redacted] WRITESTR
```

Appendix C

Batch File Listings

APPENDIX C. BATCH FILE LISTINGS

Listings of the DOS batch programs described in this manual are listed in this appendix. A list of listings is given below.

C.1 RUNCPRD.BAT

```
:-- RUNCPRD.BAT ---  Runs & Prints CPRDA, CPRDL automatically   5 Apr 94 dAb
:--**** FOR 91  ***  For CPRD files in CPRD  (Bernoulli Disk).
:--                  Current directory is \Y91\RUN

:-------------------------------------------------------------------------------
@ECHO OFF
IF X%1 == X GOTO NOSITE

SET CPRD=F:
SET YR=91

:-------------------------------------------------------------------------------
:START
:--------------
IF NOT EXIST \Y%YR%\REL\REL%YR%S%1.DAT    GOTO NOREL
:PAUSE

IF NOT EXIST \DATA\POP\POP??S%1.DAT       GOTO NOPOP
COPY         \DATA\POP\POP??S%1.DAT       F:POP80S%1.DAT
:PAUSE

IF NOT EXIST \Y%YR%\CHI\CHI%YR%S%1.DA?        GOTO NOCHI
IF EXIST \Y%YR%\CHI\CHI%YR%S%1.DAG            COPY  \Y%YR%\CHI\CHI??S%1.DAG   F:
IF EXIST \Y%YR%\CHI\CHI%YR%S%1.DAE            COPY  \Y%YR%\CHI\CHI??S%1.DAE   F:
IF EXIST \Y%YR%\CHI\CHI%YR%S%1.DAM            COPY  \Y%YR%\CHI\CHI??S%1.DAM   F:

IF EXIST  \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OUG   COPY  \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OUG   F:
IF EXIST  \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OUE   COPY  \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OUE   F:
IF EXIST  \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OUM   COPY  \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OUM   F:

:------------------  Run Programs
ECHO         ---------------  Running Programs
E:BE BEEP /F440 /D10 /W3
::::PAUSE

IF EXIST  F:CHI%YR%S%1.DAG    \Y%YR%\PROGS\CPA  %1  G
IF EXIST  F:CHI%YR%S%1.DAE    \Y%YR%\PROGS\CPA  %1  E
IF EXIST  F:CHI%YR%S%1.DAM    \Y%YR%\PROGS\CPA  %1  M

                              \Y%YR%\PROGS\CPL  %1

:--------------  Print out Results  ---------

E:HPSET

IF EXIST F:SUM%YR%S%1.OUG       \Y%YR%\PROGS\CPRDPRNT  F:SUM%YR%S%1.OUG
IF EXIST F:SUM%YR%S%1.OUE       \Y%YR%\PROGS\CPRDPRNT  F:SUM%YR%S%1.OUE
IF EXIST F:SUM%YR%S%1.OUM       \Y%YR%\PROGS\CPRDPRNT  F:SUM%YR%S%1.OUM

IF EXIST F:LIQ%YR%S%1.OUT       \Y%YR%\PROGS\CPRDPRNT  F:LIQ%YR%S%1.OUT

IF EXIST F:AIR%YR%S%1.OUG       \Y%YR%\PROGS\CPRDPRNT  F:AIR%YR%S%1.OUG
IF EXIST F:AIR%YR%S%1.OUE       \Y%YR%\PROGS\CPRDPRNT  F:AIR%YR%S%1.OUE
IF EXIST F:AIR%YR%S%1.OUM       \Y%YR%\PROGS\CPRDPRNT  F:AIR%YR%S%1.OUM

::: IF EXIST F:SUM%YR%S%1.OUG       \Y%YR%\PROGS\CPRDUMP   F:SUM%YR%S%1.OUG
::: IF EXIST F:SUM%YR%S%1.OUE       \Y%YR%\PROGS\CPRDUMP   F:SUM%YR%S%1.OUE
::: IF EXIST F:SUM%YR%S%1.OUM       \Y%YR%\PROGS\CPRDUMP   F:SUM%YR%S%1.OUM

:-----------  Cleanup

ECHO+
ECHO COPYING SUM%YR%S%1.OUX, LIQ%YR%S%1.OUT, AIR%YR%S%1.OUX TO \Y%YR%\OUT\SUMMARY
ECHO+
 COPY F:*.OU?   \Y%YR%\OUT\SUMMARY
DEL F:?????S%1.DA?
DEL F:?????S%1.OU?
E:HPSET

SHIFT
IF X%1 == X GOTO EXIT
E:BE BEEP /F880 /D10 /W5 /R2
GOTO START

:NOSITE
BEEP
ECHO *******  You forgot site number  **************
ECHO+
ECHO     You can enter multiple sites at one time on command line.  Format:
ECHO+
ECHO           RUNCPRD 01 02 03 04 05 06 07 08 09
ECHO+
GOTO END

:NOPOP
BEEP
```

```
ECHO *********  No POP File for site %1  ***********
GOTO EXIT

:NOCHI
BEEP
ECHO *********  No CHI File for site %1  ***********
GOTO EXIT

:NOREL
BEEP
ECHO *********  No REL File for site %1  ***********

:EXIT
SET CPRD=
SET YR=
E:BE BEEP /F440 /D20 /W7
:END
ECHO+
:  EOF ------------------------------------------------------------
```

C.2 RUNAG.BAT

```
:-- RUNAG.BAT ---  Runs AG automatically                    4 APR 94  dAb
:--**** FOR 91  ***  For CPRD files in CPRD  (Bernoulli Disk)
:--                  Current directory is \Y91\RUN
:--                  For XOQ input of JFD

:-------------------------------------------------------------------------------
@ECHO OFF
IF X%1 == X GOTO NOSITE

SET CPRD=F:
SET YR=91

:-------------------------------------------------------------------------------

IF NOT EXIST \Y%YR%\XOQIN\XOQ%YR%S%1.IN%8                          GOTO NOJFD
:: IF NOT EXIST \Y%YR%\JFDAG\JFD%YR%S%1.IN%8                        GOTO NOJFD

IF NOT EXIST \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OU%8                    GOTO NOSUM
COPY \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OU%8   F:SUM%YR%S%1.OU%8

ECHO         ---------------  Running Program
E:LMARG 8

\Y%YR%\PROGS\AG  %1 %2 %3 %4 %8
\Y%YR%\PROGS\AG  %1 %5 %6 %7 %8

IF EXIST F:SUM%YR%S%1.OU%8      \Y%YR%\PROGS\CPRDPRNT F:SUM%YR%S%1.OU%8

:-----------  Cleanup

ECHO+
ECHO COPYING SUM%YR%S%1.OU%8 TO \Y%YR%\OUT\SUMMARY
ECHO+
 COPY F:?????S%1.OU%8   \Y%YR%\OUT\SUMMARY
DEL  F:?????S%1.OU%8
::  CALL LP9 \Y%YR%\JFDAG\JFD%YR%S%1.IN%8
\Y%YR%\PROGS\CPRDUMP  \Y%YR%\OUT\SUMMARY\SUM%YR%S%1.OU%8
GOTO EXIT

:NOJFD
BEEP
ECHO+
ECHO    No XOQ%YR%S%1.IN%8 FILE FOUND IN \Y%YR%\XOQIN\
:: ECHO    No JFD%YR%S%1.IN%8 FILE FOUND IN \Y%YR%\JFDAG\
ECHO+
GOTO EXIT

:NOSUM
BEEP
ECHO+
ECHO    No SUM%YR%S%1.OU%8 FILE FOUND IN \Y%YR%\OUT\SUMMARY\
ECHO+
GOTO EXIT

:NOSITE
BEEP
ECHO *******  You forgot site number etc.  *********
ECHO+
ECHO+
ECHO    RUNAG SiteNum Loc Distance(m) Direction  Loc Distance(m) Direction RelType
ECHO                      Loc is either SB or R
ECHO                      RelType is either E or M
GOTO END

:EXIT
SET CPRD=
SET YR=
:::E:BE BEEP /F880 /D10 /W5 /R2
ECHO+
:END
:  EOF ------------------------------------------------------
```

C.3 · RUNXOQ.BAT

```
:   RUNXOQ.BAT   Runs XOQ2 and prints input and output files      11 NOV 94
:                SET sets year of release.
:
:  Note: %1 is site number   %2 is release case  :  G  E or M
:
:  ex.    RUNXOQ 59  G

:      Run from current directory:  \Y91\CHI

:-------------------------------------------------------------------------
@ECHO OFF
CLS
IF X%1 == X GOTO NOSITE
IF X%2 == X GOTO NOSITE

SET CPRD=F:
SET YR=92

:-----------  F11 and F12 temporary key assignments
ECHO ^[[0;133;"\Y%YR%\XOQIN\XOQ%YR%S%1.IN%2";13p
ECHO ^[[0;134;"CHI%YR%S%1.DA%2";13p
ECHO+
ECHO         RUNXOQ Batch File for running XOQ2 for Creating CPRD CHI files
ECHO+
ECHO    XOQ2 will run to completion creating output file F:XOQ%1.OU%2.
ECHO    The CHI%YR%S%1.DA%2 file will be written to the \Y%YR%\CHI directory.
ECHO    Output file F:XOQ%1.OU%2 will be copied to \Y%YR%\OUT\XOQ.
ECHO    Input XOQ and CHI files will be printed.   Takes about 1.5 minutes.
ECHO+
ECHO+              Invisible Prompt input !!!!!
ECHO+
ECHO XOQ%YR%S%1.IN%2  ^Q↵
ECHO CHI%YR%S%1.DA%2  ^Q↵
ECHO+
ECHO    Enter input file F11 and then output file F12. (DO NOT HIT ENTER KEY!):
ECHO+

IF EXIST \Y%YR%\CHI\CHI%YR%S%1.DA%2      ERASE \Y%YR%\CHI\CHI%YR%S%1.DA%2 > NUL
IF EXIST F:XOQ%1.OU%2                 ERASE F:XOQ%1.OU%2  > NUL

ECHO      Running XOQ2 ........
ECHO+
\XOQ\XOQ2    >        F:XOQ%1.OU%2
ECHO      Run Completed
ECHO+

IF ERRORLEVEL 1 ECHO    Error in XOQ2 Run
IF ERRORLEVEL 1 GOTO RESET
E:BE BEEP /F880 /D1 /W1

XCOPY F:XOQ%1.OU%2     \Y%YR%\OUT\XOQ
ERASE F:XOQ%1.OU%2

CALL \RUN\CHIPRN \Y%YR%\XOQIN\XOQ%YR%S%1.IN%2

CALL \RUN\CHIPRN \Y%YR%\CHI\CHI%YR%S%1.DA%2

E:BE BEEP /F440 /D9 /W7
ECHO         Completed  ****************************
ECHO+

:RESET
ECHO ^[[0;133;0;133p
ECHO ^[[0;134;0;134p
GOTO END

:NOSITE
BEEP
ECHO  ----------  You forgot site number AND/OR Release type: G E or M
:END
```

Appendix D

Data File Listings

APPENDIX D. DATA FILE LISTINGS

This appendix displays listings of all of the generic data files used with the system. Since each site-specific file other than the SSD.DAT file is similar for each site, only one of each type is listed as an example. A list of listings is given below.

D.1 ADULT.DAT

ADULT.DAT ADULT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE) CPRD 20 SEP 1991

	--MREM/HOUR PER-- PCI/M^3	PCI/M^2	-------INHALATION (MREM PER PCI INHALED)-------						---------INGESTION (MREM PER PCI INGESTED)----------					
ISOTOPE	AIR SUB	GRD CON												
	BODY	BODY	BODY	GI-LLI	THYROID	BONE	LIVER	LUNG	BODY	GI-LLI	THYROID	BONE	LIVER	LUNG
H3	.0E+00	.0E+00	1.58E-07	1.58E-07	1.58E-07	.00E+00	1.58E-07	1.58E-07	1.05E-07	1.05E-07	1.05E-07	.00E+00	1.05E-07	1.05E-07
BE10	2.5E-10	3.4E-12	4.96E-06	1.67E-05	.00E+00	1.98E-04	3.06E-05	2.22E-04	7.94E-08	2.68E-05	.00E+00	3.18E-06	4.91E-07	.00E+00
C14	1.4E-11	.0E+00	4.26E-07	4.26E-07	4.26E-07	2.27E-06	4.26E-07	4.26E-07	5.68E-07	5.68E-07	5.68E-07	2.84E-06	5.68E-07	5.68E-07
N13	8.5E-07	7.6E-09	6.27E-09	6.27E-09	6.27E-09	6.27E-09	6.27E-09	6.27E-09	8.36E-09	8.36E-09	8.36E-09	8.36E-09	8.36E-09	8.36E-09
F18	8.2E-07	6.8E-09	5.19E-08	9.24E-09	.00E+00	4.71E-07	.00E+00	.00E+00	6.92E-08	1.85E-08	.00E+00	6.24E-07	.00E+00	.00E+00
NA22	1.8E-06	1.6E-08	1.30E-05	1.30E-05	1.30E-05	1.30E-05	1.30E-05	1.30E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05	1.74E-05
NA24	3.5E-06	2.5E-08	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06
AR41	1.0E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	8.06E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
SC46	1.7E-06	1.3E-08	3.11E-05	3.23E-05	.00E+00	5.51E-05	1.07E-04	.00E+00	3.11E-09	5.21E-05	.00E+00	5.51E-09	1.07E-08	.00E+00
CR51	2.4E-08	2.2E-10	1.25E-08	4.15E-07	7.44E-09	.00E+00	.00E+00	1.80E-06	2.66E-09	6.69E-07	1.59E-09	.00E+00	.00E+00	3.53E-09
MN54	7.0E-07	5.8E-09	7.87E-07	9.67E-06	.00E+00	.00E+00	4.95E-06	1.75E-04	8.72E-07	1.40E-05	.00E+00	.00E+00	4.57E-06	.00E+00
MN56	1.5E-06	1.1E-08	2.29E-11	2.53E-06	.00E+00	.00E+00	1.55E-10	1.18E-06	2.04E-08	3.67E-06	.00E+00	.00E+00	1.15E-07	.00E+00
FE55	3.5E-11	.0E+00	4.93E-07	7.54E-07	.00E+00	3.07E-06	2.12E-06	9.01E-06	4.43E-07	1.09E-06	.00E+00	2.75E-06	1.90E-06	1.06E-06
FE59	1.0E-06	8.0E-09	1.32E-06	2.35E-05	.00E+00	1.47E-06	3.47E-06	1.27E-04	3.91E-06	3.40E-05	.00E+00	4.34E-06	1.02E-05	2.85E-06
CO57	1.0E-07	9.1E-10	8.39E-08	3.93E-06	.00E+00	.00E+00	8.65E-08	4.62E-05	2.91E-07	4.44E-06	.00E+00	.00E+00	1.75E-07	.00E+00
CO58	8.2E-07	7.0E-09	2.59E-07	1.33E-05	.00E+00	.00E+00	1.98E-07	1.16E-04	1.67E-06	1.51E-05	.00E+00	.00E+00	7.45E-07	.00E+00
CO60	2.0E-06	1.7E-08	1.85E-06	3.56E-05	.00E+00	.00E+00	1.44E-06	7.46E-04	4.72E-06	4.02E-05	.00E+00	.00E+00	2.14E-06	.00E+00
NI57	1.9E-06	1.6E-08	3.90E-09	3.49E-05	.00E+00	2.53E-08	6.12E-09	1.15E-05	7.61E-07	3.93E-05	.00E+00	4.93E-06	1.14E-06	.00E+00
NI63	.0E+00	.0E+00	1.81E-06	1.67E-06	.00E+00	5.40E-05	3.93E-06	2.23E-05	4.36E-06	1.88E-06	.00E+00	1.30E-04	9.01E-06	.00E+00
NI65	4.8E-07	3.7E-09	1.14E-11	1.54E-06	.00E+00	1.92E-10	2.62E-11	7.00E-07	3.13E-08	1.74E-06	.00E+00	5.28E-07	6.86E-08	.00E+00
CU64	1.7E-07	1.5E-09	7.69E-11	6.12E-06	.00E+00	.00E+00	1.83E-10	8.48E-07	3.91E-08	7.10E-06	.00E+00	.00E+00	8.33E-08	.00E+00
ZN65	4.9E-07	4.0E-09	5.82E-06	6.68E-06	.00E+00	4.05E-06	1.29E-05	1.08E-04	6.96E-06	9.70E-06	.00E+00	4.84E-06	1.54E-05	.00E+00
ZN69M+D	3.4E-07	2.9E-09	2.24E-10	1.71E-05	.00E+00	1.02E-09	2.45E-09	2.38E-06	3.73E-08	2.49E-05	.00E+00	1.70E-07	4.08E-07	.00E+00
AS76	1.4E-06	3.3E-09	1.67E-09	6.24E-05	.00E+00	.00E+00	1.86E-09	1.11E-05	4.44E-08	9.76E-05	.00E+00	.00E+00	4.94E-08	.00E+00
BR82	2.4E-06	1.9E-08	1.69E-06	1.30E-06	.00E+00	.00E+00	.00E+00	.00E+00	2.26E-06	2.59E-06	.00E+00	.00E+00	.00E+00	.00E+00
KR83M	8.6E-12	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	5.19E-10	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR85M	1.3E-07	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	2.91E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR85	1.8E-09	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	2.41E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR87	6.8E-07	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	1.53E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR88+D	1.7E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	3.13E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR89	1.9E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	2.13E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
RB88	5.6E-07	3.5E-09	2.41E-08	4.18E-19	.00E+00	.00E+00	4.84E-08	.00E+00	3.21E-08	8.36E-19	.00E+00	.00E+00	6.05E-08	.00E+00
RB89+D	2.1E-06	1.5E-08	2.12E-08	1.16E-21	.00E+00	.00E+00	3.20E-08	.00E+00	2.82E-08	2.33E-21	.00E+00	.00E+00	4.01E-08	.00E+00
SR89+D	2.1E-09	5.6E-13	1.09E-06	4.37E-05	.00E+00	3.80E-05	.00E+00	1.75E-04	8.84E-06	4.94E-05	.00E+00	3.08E-04	.00E+00	.00E+00
SR90+D	2.4E-10	.0E+00	7.62E-04	9.02E-05	.00E+00	1.24E-02	.00E+00	1.20E-03	1.86E-03	2.19E-04	.00E+00	7.58E-03	.00E+00	.00E+00
SR91+D	8.9E-07	7.1E-09	3.13E-10	2.39E-05	.00E+00	7.74E-09	.00E+00	4.56E-06	2.29E-07	2.70E-05	.00E+00	5.67E-06	.00E+00	.00E+00
SR92+D	1.1E-06	9.0E-09	3.64E-11	5.38E-06	.00E+00	8.43E-10	.00E+00	2.06E-06	9.30E-08	4.26E-05	.00E+00	2.15E-06	.00E+00	.00E+00
Y90	6.1E-09	2.2E-12	7.01E-09	6.32E-05	.00E+00	2.61E-07	.00E+00	2.12E-05	2.58E-10	1.02E-04	.00E+00	9.62E-09	.00E+00	.00E+00
Y91M+D	4.6E-07	3.8E-09	1.27E-12	1.66E-10	.00E+00	3.26E-11	.00E+00	2.40E-07	3.52E-12	2.67E-10	.00E+00	9.09E-11	.00E+00	.00E+00
ZR95+D	6.8E-07	5.0E-09	2.91E-06	1.88E-05	.00E+00	1.34E-05	4.30E-06	2.21E-04	6.60E-09	3.09E-05	.00E+00	3.04E-08	9.75E-09	.00E+00
ZR97+D	6.9E-07	5.5E-09	1.13E-09	6.54E-05	.00E+00	1.21E-08	2.45E-09	9.84E-06	1.55E-10	1.05E-04	.00E+00	1.68E-09	3.39E-10	.00E+00
NB95	6.4E-07	5.1E-09	5.26E-07	1.30E-05	.00E+00	1.76E-06	9.77E-07	6.31E-05	1.86E-09	2.10E-05	.00E+00	6.22E-09	3.46E-09	.00E+00
NB97	5.6E-07	4.6E-09	2.56E-12	3.02E-08	.00E+00	2.78E-11	7.03E-12	3.00E-07	4.82E-12	4.87E-08	.00E+00	5.22E-11	1.32E-11	.00E+00
MO99+D	2.2E-07	1.9E-09	2.87E-09	3.10E-05	.00E+00	.00E+00	1.51E-08	1.14E-05	8.20E-07	9.99E-06	.00E+00	.00E+00	4.31E-06	.00E+00
TC99M	1.1E-07	9.6E-10	4.63E-12	5.20E-07	.00E+00	1.29E-13	3.64E-13	9.55E-08	8.89E-09	4.13E-07	.00E+00	2.47E-10	6.98E-10	3.42E-10
RU103+D	4.1E-07	3.6E-09	8.23E-08	1.38E-05	.00E+00	1.91E-07	.00E+00	6.31E-05	7.97E-08	2.16E-05	.00E+00	1.85E-07	.00E+00	.00E+00
RU106+D	1.7E-07	1.5E-09	1.09E-06	1.14E-04	.00E+00	8.64E-06	.00E+00	1.17E-03	3.48E-07	1.78E-04	.00E+00	2.75E-06	.00E+00	.00E+00
AG110M+D	2.2E-06	1.8E-08	7.43E-07	3.78E-05	.00E+00	1.35E-06	1.25E-06	5.79E-04	8.79E-08	6.04E-05	.00E+00	1.60E-07	1.48E-07	.00E+00
CD115M	2.9E-08	2.7E-10	7.95E-07	4.80E-05	.00E+00	.00E+00	2.46E-05	1.76E-04	5.87E-08	7.74E-05	.00E+00	.00E+00	1.84E-06	.00E+00
CD115	2.7E-08	2.4E-10	2.04E-09	2.34E-05	.00E+00	.00E+00	6.10E-08	7.01E-06	2.17E-09	3.77E-05	.00E+00	.00E+00	6.57E-08	.00E+00

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SN125+D 7.3E-08 5.7E-10 7.03E-08 6.81E-05 2.59E-08 1.16E-06 3.12E-08 7.37E-05 3.78E-07 1.04E-04 1.39E-07 8.33E-06 1.68E-07  .00E+00
SB124   1.6E-06 1.3E-08 1.55E-06 5.08E-05 9.44E-09 3.90E-06 7.36E-08 3.10E-04 1.11E-06 7.95E-05 6.79E-09 2.80E-06 5.29E-08 2.18E-06
SB125+D 3.6E-07 3.1E-09 1.58E-06 1.26E-05 6.75E-09 6.67E-06 7.44E-08 2.18E-04 4.26E-07 1.97E-05 1.82E-09 1.79E-06 2.00E-08 1.38E-06
TE132+D 1.8E-07 1.7E-09 2.02E-08 6.37E-05 2.37E-08 3.25E-08 2.69E-08 3.60E-05 1.53E-06 7.71E-05 1.80E-06 2.52E-06 1.63E-06  .00E+00
TE133M+D1.8E-06 1.5E-08 4.17E-12 5.49E-08 6.27E-12 7.24E-12 5.40E-12 5.51E-07 2.60E-08 6.64E-08 3.91E-08 4.62E-08 2.70E-08  .00E+00
I131+D  3.1E-07 2.8E-09 2.56E-06 7.85E-07 1.49E-03 3.15E-06 4.47E-06  .00E+00 3.41E-06 1.57E-06 1.95E-03 4.16E-06 5.95E-06  .00E+00
I132    2.0E-06 1.7E-08 1.45E-07 5.08E-08 1.43E-05 1.45E-07 4.07E-07  .00E+00 1.90E-07 1.02E-07 1.90E-05 2.03E-07 5.43E-07  .00E+00
I133+D  4.4E-07 3.7E-09 5.65E-07 1.11E-06 2.69E-04 1.08E-06 1.85E-06  .00E+00 7.53E-07 2.22E-06 3.63E-04 1.42E-06 2.47E-06  .00E+00
I134    2.0E-06 1.6E-08 7.69E-08 1.26E-10 3.73E-06 8.05E-08 2.16E-07  .00E+00 1.03E-07 2.51E-10 4.99E-06 1.06E-07 2.88E-07  .00E+00
I135+D  1.5E-06 1.2E-08 3.21E-07 6.56E-07 5.60E-05 3.35E-07 8.73E-07  .00E+00 4.28E-07 1.31E-06 7.65E-05 4.43E-07 1.16E-06  .00E+00
XE131M  1.0E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 1.40E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE133M  2.9E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 1.89E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE133   3.4E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 1.57E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE135M  3.6E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 2.22E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE135   2.1E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 4.05E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE137   1.6E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 1.74E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE138+D 1.0E-06  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 2.44E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
CS134   1.3E-06 1.2E-08 9.10E-05 1.30E-06  .00E+00 4.66E-05 1.06E-04 1.22E-05 1.21E-04 2.59E-06  .00E+00 6.22E-05 1.48E-04 1.59E-05
CS136   1.9E-06 1.5E-08 1.38E-05 1.46E-06  .00E+00 4.88E-06 1.83E-05 1.50E-06 1.85E-05 2.92E-06  .00E+00 6.51E-06 2.57E-05 1.96E-06
CS137+D 4.7E-07 4.2E-09 5.35E-05 1.05E-06  .00E+00 5.98E-05 7.76E-05 9.40E-06 7.14E-05 2.11E-06  .00E+00 7.97E-05 1.09E-04 1.23E-05
CS138   1.8E-06 2.1E-08 4.05E-08 2.33E-13  .00E+00 4.14E-08 7.76E-08 6.07E-09 5.40E-08 4.65E-13  .00E+00 5.52E-08 1.09E-07 7.91E-09
CS139+D 8.0E-07 6.3E-09 1.39E-08 5.49E-31  .00E+00 2.56E-08 3.63E-08 2.84E-09 1.85E-08 1.10E-30  .00E+00 3.41E-08 5.08E-08 3.70E-09
BA139   3.7E-08 2.4E-09 3.42E-12 1.12E-07  .00E+00 1.17E-10 8.32E-14 4.70E-07 2.84E-09 1.72E-07  .00E+00 9.70E-08 6.91E-11 3.92E-11
BA140+D 2.2E-07 2.1E-09 3.21E-07 2.73E-05  .00E+00 4.88E-06 6.13E-09 1.59E-04 1.33E-06 4.18E-05  .00E+00 2.03E-05 2.55E-08 1.46E-08
LA140   1.9E-06 1.5E-08 5.73E-09 5.73E-05  .00E+00 4.30E-08 2.17E-08 1.70E-05 3.33E-10 9.25E-05  .00E+00 2.50E-09 1.26E-09  .00E+00
LA141   2.3E-09 2.5E-10 2.71E-11 7.31E-06  .00E+00 5.34E-10 1.66E-10 1.35E-06 1.62E-11 1.18E-05  .00E+00 3.19E-10 9.90E-11  .00E+00
CE141   5.9E-08 5.5E-10 1.91E-07 1.50E-05  .00E+00 2.49E-06 1.69E-06 4.52E-05 7.18E-10 2.42E-05  .00E+00 9.36E-09 6.33E-09  .00E+00
CE144+D 4.0E-08 3.2E-10 2.30E-05 1.02E-04  .00E+00 4.29E-04 1.79E-04 9.72E-04 2.62E-08 1.65E-04  .00E+00 4.88E-07 2.04E-07  .00E+00
EU152   1.3E-05 7.4E-09 4.76E-05 1.59E-05  .00E+00 2.38E-04 5.41E-05 3.43E-04 3.90E-08 2.56E-05  .00E+00 1.95E-07 4.44E-08  .00E+00
EU154   4.6E-05 7.8E-09 6.48E-05 3.40E-05  .00E+00 7.40E-04 9.10E-05 5.84E-04 5.38E-08 5.48E-05  .00E+00 6.15E-07 7.56E-08  .00E+00
W187    3.8E-07 3.1E-09 3.10E-10 1.94E-05  .00E+00 1.06E-09 8.85E-10 3.63E-06 3.01E-08 2.82E-05  .00E+00 1.03E-07 8.61E-08  .00E+00
TH232+D 1.8E-06 1.6E-08 9.04E-02 3.17E-05  .00E+00 1.99E+00 1.12E-01 5.96E-01 1.50E-04 5.12E-05  .00E+00 1.79E-03 1.00E-04  .00E+00
NP239   1.1E-07 9.5E-10 1.55E-09 1.49E-05  .00E+00 2.87E-08 2.82E-09 4.70E-06 6.45E-11 2.40E-05  .00E+00 1.19E-09 1.17E-10  .00E+00
 *** NOTE:  H3 INHALATION DFS INCREASED 50% TO INCLUDE SKIN ABSORPTION.  ***
,    Noble gas air sub factors from RG 1.109, p.21
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D.2 TEEN.DAT

TEEN.DAT TEEN CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE) CPRD 20 SEP 1991

	--MREM/HOUR PER-- PCI/M^3 AIR SUB	PCI/M^2 GRD CON	--------INHALATION (MREM PER PCI INHALED)--------						---------INGESTION (MREM PER PCI INGESTED)----------					
ISOTOPE	BODY	BODY	BODY	GI-LLI	THYROID	BONE	LIVER	LUNG	BODY	GI-LLI	THYROID	BONE	LIVER	LUNG
H3	.0E+00	.0E+00	1.59E-07	1.59E-07	1.59E-07	.00E+00	1.59E-07	1.59E-07	1.06E-07	1.06E-07	1.06E-07	.00E+00	1.06E-07	1.06E-07
BE10	2.5E-10	3.4E-12	7.09E-06	1.77E-05	.00E+00	2.78E-04	4.33E-05	3.84E-04	1.13E-07	2.84E-05	.00E+00	4.48E-06	6.94E-07	.00E+00
C14	1.4E-11	.0E+00	6.09E-07	6.09E-07	6.09E-07	3.25E-06	6.09E-07	6.09E-07	8.12E-07	8.12E-07	8.12E-07	4.06E-06	8.12E-07	8.12E-07
N13	8.5E-07	7.6E-09	8.65E-09	8.65E-09	8.65E-09	8.65E-09	8.65E-09	8.65E-09	1.15E-08	1.15E-08	1.15E-08	1.15E-08	1.15E-08	1.15E-08
F18	8.2E-07	6.8E-09	7.10E-08	3.89E-08	.00E+00	6.52E-07	.00E+00	.00E+00	9.47E-08	7.78E-08	.00E+00	8.64E-07	.00E+00	.00E+00
NA22	1.8E-06	1.6E-08	1.76E-05	1.76E-05	1.76E-05	1.76E-05	1.76E-05	1.76E-05	2.34E-05	2.34E-05	2.34E-05	2.34E-05	2.34E-05	2.34E-05
NA24	3.5E-06	2.5E-08	1.72E-06	1.72E-06	1.72E-06	1.72E-06	1.72E-06	1.72E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06
AR41	1.0E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	1.44E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
SC46	1.7E-06	1.3E-08	4.18E-05	2.98E-05	.00E+00	7.24E-05	1.41E-04	.00E+00	4.18E-09	4.80E-05	.00E+00	7.24E-09	1.41E-08	.00E+00
CR51	2.4E-08	2.2E-10	1.69E-08	3.75E-07	9.37E-09	.00E+00	.00E+00	2.62E-06	3.60E-09	6.05E-07	2.00E-09	.00E+00	.00E+00	5.14E-09
MN54	7.0E-07	5.8E-09	1.05E-06	8.35E-06	.00E+00	.00E+00	6.39E-06	2.48E-04	1.17E-06	1.21E-05	.00E+00	.00E+00	5.90E-06	.00E+00
MN56	1.5E-06	1.1E-08	3.15E-11	7.18E-06	.00E+00	.00E+00	2.12E-10	1.90E-06	2.81E-08	1.04E-05	.00E+00	.00E+00	1.58E-07	.00E+00
FE55	3.5E-11	.0E+00	6.93E-07	7.99E-07	.00E+00	4.18E-06	2.98E-06	1.55E-05	6.25E-07	1.16E-06	.00E+00	3.78E-06	2.68E-06	1.70E-06
FE59	1.0E-06	8.0E-09	1.79E-06	2.23E-05	.00E+00	1.99E-06	4.62E-06	1.91E-04	5.29E-06	3.24E-05	.00E+00	5.87E-06	1.37E-05	4.32E-06
CO57	1.0E-07	9.1E-10	1.15E-07	3.93E-06	.00E+00	.00E+00	1.18E-07	7.33E-05	3.99E-07	4.44E-06	.00E+00	.00E+00	2.38E-07	.00E+00
CO58	8.2E-07	7.0E-09	3.47E-07	1.19E-05	.00E+00	.00E+00	2.59E-07	1.68E-04	2.24E-06	1.34E-05	.00E+00	.00E+00	9.72E-07	.00E+00
CO60	2.0E-06	1.7E-08	2.48E-06	3.24E-05	.00E+00	.00E+00	1.89E-06	1.09E-03	6.33E-06	3.66E-05	.00E+00	.00E+00	2.81E-06	.00E+00
NI57	1.9E-06	1.6E-08	5.28E-09	3.60E-05	.00E+00	3.44E-08	8.19E-09	1.76E-05	1.03E-06	4.06E-05	.00E+00	6.72E-06	1.52E-06	.00E+00
NI63	.0E+00	.0E+00	2.47E-06	1.77E-06	.00E+00	7.25E-05	5.43E-06	3.84E-05	6.00E-06	1.99E-06	.00E+00	1.77E-04	1.25E-05	.00E+00
NI65	4.8E-07	3.7E-09	1.59E-11	4.59E-06	.00E+00	2.73E-10	3.66E-11	1.17E-06	4.36E-08	5.19E-06	.00E+00	7.49E-07	9.57E-08	.00E+00
CU64	1.7E-07	1.5E-09	1.06E-10	7.68E-06	.00E+00	.00E+00	2.54E-10	1.39E-06	5.41E-08	8.92E-06	.00E+00	.00E+00	1.15E-07	.00E+00
ZN65	4.9E-07	4.0E-09	7.80E-06	5.83E-06	.00E+00	4.82E-06	1.67E-05	1.55E-04	9.33E-06	8.47E-06	.00E+00	5.76E-06	2.00E-05	.00E+00
ZN69M+D	3.4E-07	2.9E-09	3.11E-10	2.14E-05	.00E+00	1.44E-09	3.39E-09	3.92E-06	5.19E-08	3.11E-05	.00E+00	2.40E-07	5.66E-07	.00E+00
AS76	3.2E-07	3.2E-09	2.36E-09	7.25E-05	.00E+00	.00E+00	2.62E-09	1.89E-05	6.27E-08	1.13E-04	.00E+00	.00E+00	6.94E-08	.00E+00
BR82	2.4E-06	1.9E-08	2.28E-06	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	3.04E-06	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR83M	8.6E-12	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	9.97E-10	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR85M	1.3E-07	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	5.46E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR85	1.8E-09	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	4.63E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR87	6.8E-07	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	2.82E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR88+D	1.7E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	5.81E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR89	1.9E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	3.85E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
RB88	5.6E-07	3.5E-09	3.40E-08	3.65E-15	.00E+00	.00E+00	6.82E-08	.00E+00	4.54E-08	7.30E-15	.00E+00	.00E+00	8.52E-08	.00E+00
RB89+D	2.1E-06	1.5E-08	2.91E-08	4.22E-17	.00E+00	.00E+00	4.40E-08	.00E+00	3.89E-08	8.43E-17	.00E+00	.00E+00	5.50E-08	.00E+00
SR89+D	2.1E-09	5.6E-13	1.56E-06	4.64E-05	.00E+00	5.43E-05	.00E+00	3.02E-04	1.26E-05	5.24E-05	.00E+00	4.40E-04	.00E+00	.00E+00
SR90+D	2.4E-10	.0E+00	8.35E-04	9.56E-05	.00E+00	1.35E-02	.00E+00	2.06E-03	2.05E-03	2.33E-04	.00E+00	8.30E-03	.00E+00	.00E+00
SR91+D	8.9E-07	7.1E-09	4.39E-10	3.24E-05	.00E+00	1.10E-08	.00E+00	7.59E-06	3.21E-07	3.66E-05	.00E+00	8.07E-06	.00E+00	.00E+00
SR92+D	1.1E-06	9.0E-09	5.08E-11	1.49E-05	.00E+00	1.19E-09	.00E+00	3.43E-06	1.30E-07	7.77E-05	.00E+00	3.05E-06	.00E+00	.00E+00
Y90	6.1E-09	2.2E-12	1.00E-08	6.99E-05	.00E+00	3.73E-07	.00E+00	3.66E-05	3.69E-10	1.13E-04	.00E+00	1.37E-08	.00E+00	.00E+00
Y91M+D	4.6E-07	3.8E-09	1.77E-12	3.77E-09	.00E+00	4.63E-11	.00E+00	4.00E-07	4.93E-12	6.09E-09	.00E+00	1.29E-10	.00E+00	.00E+00
ZR95+D	6.8E-07	5.0E-09	3.94E-06	1.86E-05	.00E+00	1.82E-05	5.73E-06	3.36E-04	8.94E-09	3.00E-05	.00E+00	4.12E-08	1.30E-08	.00E+00
ZR97+D	6.9E-07	5.5E-09	1.57E-09	7.88E-05	.00E+00	1.72E-08	3.40E-09	1.62E-05	2.16E-10	1.27E-04	.00E+00	2.37E-09	4.69E-10	.00E+00
NB95	6.4E-07	5.1E-09	7.08E-07	1.21E-05	.00E+00	2.32E-06	1.29E-06	9.39E-05	2.51E-09	1.95E-05	.00E+00	8.22E-09	4.56E-09	.00E+00
NB97	5.6E-07	4.6E-09	3.55E-12	2.71E-07	.00E+00	3.92E-11	9.72E-12	4.91E-07	6.68E-12	4.37E-07	.00E+00	7.37E-11	1.83E-11	.00E+00
MO99+D	2.2E-07	1.9E-09	4.03E-09	3.36E-05	.00E+00	.00E+00	2.11E-08	1.92E-05	1.15E-06	1.08E-05	.00E+00	.00E+00	6.03E-06	.00E+00
TC99M	1.1E-07	9.6E-10	6.24E-12	7.66E-07	.00E+00	1.73E-13	4.83E-13	1.44E-07	1.20E-08	6.08E-07	.00E+00	3.32E-10	9.26E-10	5.14E-10
RU103+D	4.1E-07	3.6E-09	1.12E-07	1.36E-05	.00E+00	2.63E-07	.00E+00	9.79E-05	1.09E-07	2.13E-05	.00E+00	2.55E-07	.00E+00	.00E+00
RU106+D	1.7E-07	1.5E-09	1.55E-06	1.20E-04	.00E+00	1.23E-05	.00E+00	2.01E-03	4.94E-07	1.88E-04	.00E+00	3.92E-06	.00E+00	.00E+00
AG110M+D	2.2E-06	1.8E-08	9.99E-07	3.41E-05	.00E+00	1.73E-06	1.64E-06	8.44E-04	1.18E-07	5.45E-05	.00E+00	2.05E-07	1.94E-07	.00E+00
CD115M	2.9E-08	2.7E-10	1.14E-06	5.10E-05	.00E+00	.00E+00	3.48E-05	3.03E-04	8.39E-08	8.23E-05	.00E+00	.00E+00	2.60E-06	.00E+00
CD115	2.7E-08	2.4E-10	2.90E-09	2.60E-05	.00E+00	.00E+00	8.64E-08	1.20E-05	3.09E-09	4.20E-05	.00E+00	.00E+00	9.31E-08	.00E+00

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SN125+D 7.3E-08 5.7E-10 9.99E-08 7.29E-05 3.45E-08 1.66E-06 4.42E-08 1.26E-04 5.37E-07 1.12E-04 1.86E-07 1.19E-05 2.37E-07  .00E+00
SB124   1.6E-06 1.3E-08 2.10E-06 4.98E-05 1.22E-08 5.38E-06 9.92E-08 4.81E-04 1.51E-06 7.80E-05 8.78E-09 3.87E-06 7.13E-08 3.38E-06
SB125+D 3.6E-07 3.1E-09 2.15E-06 1.24E-05 8.80E-09 9.23E-06 1.01E-07 3.42E-04 5.80E-07 1.93E-05 2.37E-09 2.48E-06 2.71E-08 2.18E-06
TE132+D 1.8E-07 1.7E-09 2.74E-08 5.79E-05 3.07E-08 4.50E-08 3.63E-08 5.61E-05 2.08E-06 7.00E-05 2.33E-06 3.49E-06 2.21E-06  .00E+00
TE133M+D1.8E-06 1.5E-08 5.71E-12 1.23E-07 8.18E-12 1.01E-11 7.33E-12 8.71E-07 3.56E-08 1.48E-07 5.11E-08 6.44E-08 3.66E-08  .00E+00
I131+D  3.1E-07 2.8E-09 3.30E-06 8.11E-07 1.83E-03 4.43E-06 6.14E-06  .00E+00 4.40E-06 1.62E-06 2.39E-03 5.85E-06 8.19E-06  .00E+00
I132    2.0E-06 1.7E-08 1.97E-07 1.59E-07 1.89E-05 1.99E-07 5.47E-07  .00E+00 2.62E-07 3.18E-07 2.46E-05 2.79E-07 7.30E-07  .00E+00
I133+D  4.4E-07 3.7E-09 7.78E-07 1.29E-06 3.65E-04 1.52E-06 2.56E-06  .00E+00 1.04E-06 2.58E-06 4.76E-04 2.01E-06 3.41E-06  .00E+00
I134    2.0E-06 1.6E-08 1.05E-07 2.55E-09 4.94E-06 1.11E-07 2.90E-07  .00E+00 1.39E-07 5.10E-09 6.45E-06 1.46E-07 3.87E-07  .00E+00
I135+D  1.5E-06 1.2E-08 4.36E-07 8.69E-07 7.76E-05 4.62E-07 1.18E-06  .00E+00 5.82E-07 1.74E-06 1.01E-04 6.10E-07 1.57E-06  .00E+00
XE131M  1.0E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00 .00E+00 2.70E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE133M  2.9E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00 .00E+00 3.59E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE133   3.4E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00 .00E+00 2.99E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE135M  3.6E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00 .00E+00 3.88E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE135   2.1E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00 .00E+00 7.55E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE137   1.6E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00 .00E+00 3.33E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE138+D 1.0E-06  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00 .00E+00 4.38E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
CS134   1.3E-06 1.2E-08 6.86E-05 1.22E-06  .00E+00 6.28E-05 1.41E-04 1.83E-05 9.14E-05 2.45E-06  .00E+00 8.37E-05 1.97E-04 2.39E-05
CS136   1.9E-06 1.5E-08 1.71E-05 1.36E-06  .00E+00 6.44E-06 2.42E-05 2.22E-06 2.27E-05 2.72E-06  .00E+00 8.59E-06 3.38E-05 2.90E-06
CS137+D 4.7E-07 4.2E-09 3.89E-05 1.06E-06  .00E+00 8.38E-05 1.06E-04 1.51E-05 5.19E-05 2.12E-06  .00E+00 1.12E-04 1.49E-04 1.97E-05
CS138   1.8E-06 2.1E-08 5.58E-08 3.38E-11  .00E+00 5.82E-08 1.07E-07 9.84E-09 7.45E-08 6.76E-11  .00E+00 7.76E-08 1.49E-07 1.28E-08
CS139+D 8.0E-07 6.3E-09 1.97E-08 1.66E-23  .00E+00 3.65E-08 5.12E-08 4.86E-09 2.63E-08 3.33E-23  .00E+00 4.87E-08 7.17E-08 6.34E-09
BA139   3.7E-08 2.4E-09 4.87E-12 8.06E-07  .00E+00 1.67E-10 1.18E-13 8.08E-07 4.05E-09 1.24E-06  .00E+00 1.39E-07 9.78E-11 6.74E-11
BA140+D 2.2E-07 2.1E-09 4.40E-07 2.86E-05  .00E+00 6.84E-06 8.38E-09 2.54E-04 1.83E-06 4.38E-05  .00E+00 2.84E-05 3.48E-08 2.34E-08
LA140   1.9E-06 1.5E-08 7.82E-09 6.09E-05  .00E+00 5.99E-08 2.95E-08 2.68E-05 4.55E-10 9.82E-05  .00E+00 3.48E-09 1.71E-09  .00E+00
LA141   2.3E-09 2.5E-10 3.87E-11 1.54E-05  .00E+00 7.63E-10 2.35E-10 2.31E-06 2.31E-11 2.48E-05  .00E+00 4.55E-10 1.40E-10  .00E+00
CE141   5.9E-08 5.5E-10 2.71E-07 1.58E-05  .00E+00 3.55E-06 2.37E-06 7.67E-05 1.02E-09 2.54E-05  .00E+00 1.33E-08 8.88E-09  .00E+00
CE144+D 4.0E-08 3.2E-10 3.28E-05 1.08E-04  .00E+00 6.11E-04 2.53E-04 1.67E-03 3.74E-08 1.75E-04  .00E+00 6.96E-07 2.88E-07  .00E+00
EU152   1.3E-05 7.4E-09 6.30E-05 1.35E-05  .00E+00 2.96E-04 7.19E-05 5.01E-04 5.20E-08 2.17E-05  .00E+00 2.45E-07 5.90E-08  .00E+00
EU154   4.6E-05 7.8E-09 8.60E-05 3.34E-05  .00E+00 9.43E-04 1.23E-04 9.12E-04 7.19E-08 5.39E-05  .00E+00 7.91E-07 1.02E-07  .00E+00
W187    3.8E-07 3.1E-09 4.29E-10 2.21E-05  .00E+00 1.50E-09 1.22E-09 5.92E-06 4.17E-08 3.22E-05  .00E+00 1.46E-07 1.19E-07  .00E+00
TH232+D 1.8E-06 1.6E-08 9.21E-02 3.36E-05  .00E+00 2.03E+00 1.14E-01 8.60E-01 1.63E-04 5.43E-05  .00E+00 1.88E-03 1.05E-04  .00E+00
NP239   1.1E-07 9.5E-10 2.21E-09 1.65E-05  .00E+00 4.23E-08 3.99E-09 8.11E-06 9.22E-11 2.67E-05  .00E+00 1.76E-09 1.66E-10  .00E+00
/*** NOTE:  H3 INHALATION DFS INCREASED 50% TO INCLUDE SKIN ABSORPTION.  ***
'    Noble gas air sub factors from RG 1.109, p.21
EOF ----------
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D.3 CHILD.DAT

CHILD.DAT CHILD CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE) CPRD 20 SEP 1991

ISOTOPE	--MREM/HOUR PER-- PCI/M^3 AIR SUB BODY	PCI/M^2 GRD CON BODY	INHALATION (MREM PER PCI INHALED) BODY	GI-LLI	THYROID	BONE	LIVER	LUNG	INGESTION (MREM PER PCI INGESTED) BODY	GI-LLI	THYROID	BONE	LIVER	LUNG
H3	.0E+00	.0E+00	3.05E-07	3.05E-07	3.05E-07	.00E+00	3.05E-07	3.05E-07	2.03E-07	2.03E-07	2.03E-07	.00E+00	2.03E-07	2.03E-07
BE10	2.5E-10	3.4E-12	2.12E-05	1.72E-05	.00E+00	8.43E-04	9.83E-05	7.41E-04	3.39E-07	2.75E-05	.00E+00	1.35E-05	1.57E-06	.00E+00
C14	1.4E-11	.0E+00	1.82E-06	1.82E-06	1.82E-06	9.70E-06	1.82E-06	1.82E-06	2.42E-06	2.42E-06	2.42E-06	1.21E-05	2.42E-06	2.42E-06
N13	8.5E-07	7.6E-09	2.33E-08	2.33E-08	2.33E-08	2.33E-08	2.33E-08	2.33E-08	3.10E-08	3.10E-08	3.10E-08	3.10E-08	3.10E-08	3.10E-08
F18	8.2E-07	6.8E-09	1.85E-07	3.37E-07	.00E+00	1.88E-06	.00E+00	.00E+00	2.47E-07	6.74E-07	.00E+00	2.49E-06	.00E+00	.00E+00
NA22	1.8E-06	1.6E-08	4.41E-05	4.41E-05	4.41E-05	4.41E-05	4.41E-05	4.41E-05	5.88E-05	5.88E-05	5.88E-05	5.88E-05	5.88E-05	5.88E-05
NA24	3.5E-06	2.5E-08	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06
AR41	1.0E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	1.68E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
SC46	1.7E-06	1.3E-08	1.04E-04	2.45E-05	.00E+00	1.97E-04	2.70E-04	.00E+00	1.04E-08	3.95E-05	.00E+00	1.97E-08	2.70E-08	.00E+00
CR51	2.4E-08	2.2E-10	4.17E-08	2.93E-07	2.31E-08	.00E+00	.00E+00	4.59E-06	8.90E-09	4.72E-07	4.94E-09	.00E+00	.00E+00	9.02E-09
MN54	7.0E-07	5.8E-09	2.57E-06	6.19E-06	.00E+00	.00E+00	1.16E-05	4.26E-04	2.85E-06	8.98E-06	.00E+00	.00E+00	1.07E-05	.00E+00
MN56	1.5E-06	1.1E-08	8.43E-11	3.33E-05	.00E+00	.00E+00	4.48E-10	3.55E-06	7.54E-08	4.84E-05	.00E+00	.00E+00	3.34E-07	.00E+00
FE55	3.5E-11	.0E+00	2.10E-06	7.75E-07	.00E+00	1.28E-05	6.80E-06	3.00E-05	1.89E-06	1.13E-06	.00E+00	1.15E-05	6.10E-06	3.45E-06
FE59	1.0E-06	8.0E-09	4.51E-06	1.91E-05	.00E+00	5.59E-06	9.04E-06	3.43E-04	1.33E-05	2.78E-05	.00E+00	1.65E-05	2.67E-05	7.74E-06
CO57	1.0E-07	9.1E-10	2.88E-07	3.58E-06	.00E+00	.00E+00	2.44E-07	1.37E-04	9.98E-07	4.04E-06	.00E+00	.00E+00	4.93E-07	.00E+00
CO58	8.2E-07	7.0E-09	8.55E-07	9.29E-06	.00E+00	.00E+00	4.79E-07	2.99E-04	5.51E-06	1.05E-05	.00E+00	.00E+00	1.80E-06	.00E+00
CO60	2.0E-06	1.7E-08	6.12E-06	2.60E-05	.00E+00	.00E+00	3.55E-06	1.91E-03	1.56E-05	2.93E-05	.00E+00	.00E+00	5.29E-06	.00E+00
NI57	1.9E-06	1.6E-08	1.34E-08	3.50E-05	.00E+00	9.78E-08	1.62E-08	3.17E-05	2.62E-06	3.95E-05	.00E+00	1.91E-05	3.02E-06	.00E+00
NI63	.0E+00	.0E+00	7.56E-06	1.71E-06	.00E+00	2.22E-04	1.25E-05	7.43E-05	1.83E-05	1.94E-06	.00E+00	5.38E-04	2.88E-05	.00E+00
NI65	4.8E-07	3.7E-09	4.44E-11	2.27E-05	.00E+00	8.08E-10	7.99E-11	2.21E-06	1.22E-07	2.56E-05	.00E+00	2.22E-06	2.09E-07	.00E+00
CU64	1.7E-07	1.5E-09	2.90E-10	9.92E-06	.00E+00	.00E+00	5.39E-10	2.59E-06	1.48E-07	1.15E-05	.00E+00	.00E+00	2.45E-07	.00E+00
ZN65	4.9E-07	4.0E-09	1.90E-05	4.41E-06	.00E+00	1.15E-05	3.06E-05	2.69E-04	2.27E-05	6.41E-06	.00E+00	1.37E-05	3.65E-05	.00E+00
ZN69M+D	3.4E-07	2.9E-09	8.59E-10	2.71E-05	.00E+00	4.26E-09	7.28E-09	7.36E-06	1.43E-07	3.94E-05	.00E+00	7.10E-07	1.21E-06	.00E+00
AS76	3.2E-07	3.3E-09	6.83E-09	8.16E-05	.00E+00	.00E+00	5.82E-09	3.62E-05	1.81E-07	1.28E-04	.00E+00	.00E+00	1.55E-07	.00E+00
BR82	2.4E-06	1.9E-08	5.66E-06	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	7.55E-06	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR83M	8.6E-12	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	1.22E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR85M	1.3E-07	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	6.58E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR85	1.8E-09	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	5.66E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR87	6.8E-07	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	3.38E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR88+D	1.7E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	6.99E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR89	1.9E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	4.55E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
RB88	5.6E-07	3.5E-09	9.90E-08	4.66E-09	.00E+00	.00E+00	1.52E-07	.00E+00	1.32E-07	9.32E-09	.00E+00	.00E+00	.00E+00	.00E+00
RB89+D	2.1E-06	1.5E-08	7.83E-08	5.11E-10	.00E+00	.00E+00	9.33E-08	.00E+00	1.04E-07	1.02E-09	.00E+00	.00E+00	1.90E-07	.00E+00
SR89+D	2.1E-09	5.6E-13	4.66E-06	4.52E-05	.00E+00	1.62E-04	.00E+00	5.83E-04	3.77E-05	5.11E-05	.00E+00	.00E+00	1.17E-07	.00E+00
SR90+D	2.4E-10	.0E+00	1.74E-03	9.28E-05	.00E+00	2.73E-02	.00E+00	3.99E-03	4.31E-03	2.29E-04	.00E+00	1.32E-03	.00E+00	.00E+00
SR91+D	8.9E-07	7.1E-09	1.24E-09	4.70E-05	.00E+00	3.28E-08	.00E+00	1.44E-05	9.06E-07	5.30E-05	.00E+00	1.70E-02	.00E+00	.00E+00
SR92+D	1.1E-06	9.0E-09	1.42E-10	6.55E-05	.00E+00	3.54E-09	.00E+00	6.49E-06	3.62E-07	1.71E-04	.00E+00	2.40E-05	.00E+00	.00E+00
Y90	6.1E-09	2.2E-12	2.99E-08	7.24E-05	.00E+00	1.11E-06	.00E+00	7.07E-05	1.10E-09	1.17E-04	.00E+00	9.03E-06	.00E+00	.00E+00
Y91M+D	4.6E-07	3.8E-09	4.98E-12	4.64E-07	.00E+00	1.37E-10	.00E+00	7.60E-07	1.39E-11	7.48E-07	.00E+00	4.11E-08	.00E+00	.00E+00
ZR95+D	6.8E-07	5.0E-09	1.00E-05	1.65E-05	.00E+00	5.13E-05	1.13E-05	6.03E-04	2.27E-08	2.66E-05	.00E+00	3.82E-10	.00E+00	.00E+00
ZR97+D	6.9E-07	5.5E-09	4.32E-09	9.49E-05	.00E+00	5.07E-08	7.34E-09	3.06E-05	5.96E-10	1.53E-04	.00E+00	1.16E-07	2.55E-08	.00E+00
NB95	6.4E-07	5.1E-09	1.77E-06	1.00E-05	.00E+00	6.35E-06	2.48E-06	1.66E-04	6.26E-09	1.62E-05	.00E+00	6.99E-09	1.01E-09	.00E+00
NB97	5.6E-07	4.6E-09	9.74E-12	7.52E-06	.00E+00	1.16E-10	2.08E-11	9.23E-07	1.83E-11	1.21E-05	.00E+00	2.25E-08	8.76E-09	.00E+00
MO99+D	2.2E-07	1.9E-09	1.15E-08	3.42E-05	.00E+00	.00E+00	4.66E-08	3.66E-05	3.29E-06	1.10E-05	.00E+00	2.17E-10	3.92E-11	.00E+00
TC99M	1.1E-07	9.6E-10	1.56E-11	1.30E-06	.00E+00	4.81E-13	9.41E-13	2.57E-07	3.00E-08	1.03E-06	.00E+00	.00E+00	1.33E-05	.00E+00
RU103+D	4.1E-07	3.6E-09	2.90E-07	1.21E-05	.00E+00	7.55E-07	.00E+00	1.79E-04	2.81E-07	1.89E-05	.00E+00	9.23E-10	1.81E-09	9.19E-10
RU106+D	1.7E-07	1.5E-09	4.57E-06	1.16E-04	.00E+00	3.68E-05	.00E+00	3.87E-03	1.46E-06	1.82E-04	.00E+00	7.31E-07	.00E+00	.00E+00
AG110M+D	2.2E-06	1.8E-08	2.47E-06	2.71E-05	.00E+00	4.56E-06	3.08E-06	1.48E-03	2.91E-07	4.33E-05	.00E+00	1.17E-05	.00E+00	.00E+00
CD115M	2.9E-08	2.7E-10	3.39E-06	4.97E-05	.00E+00	.00E+00	7.88E-05	5.86E-04	2.51E-07	8.01E-05	.00E+00	5.39E-07	3.64E-07	.00E+00
CD115	2.7E-08	2.4E-10	8.57E-09	2.72E-05	.00E+00	.00E+00	1.94E-07	2.32E-05	9.12E-09	4.38E-05	.00E+00	.00E+00	5.89E-06	.00E+00
												.00E+00	2.10E-07	.00E+00

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SN125+D 7.3E-08 5.7E-10 2.95E-07 7.17E-05 1.03E-07 4.95E-06 9.94E-08 2.43E-04 1.59E-06 1.10E-04 5.55E-07 3.55E-05 5.35E-07  .00E+00
SB124   1.6E-06 1.3E-08 5.41E-06 4.43E-05 3.41E-08 1.55E-05 2.00E-07 8.76E-04 3.89E-06 6.94E-05 2.45E-08 1.11E-05 1.44E-07 6.16E-06
SB125+D 3.6E-07 3.1E-09 5.59E-06 1.09E-05 2.46E-08 2.66E-05 2.05E-07 6.27E-04 1.50E-06 1.71E-05 6.63E-09 7.16E-06 5.52E-08 3.99E-06
TE132+D 1.8E-07 1.7E-09 7.12E-08 3.72E-05 8.58E-08 1.30E-07 7.36E-08 1.02E-04 5.40E-06 4.50E-05 6.51E-06 1.01E-05 4.47E-06  .00E+00
TE133M+D1.8E-06 1.5E-08 1.50E-11 4.77E-06 2.32E-11 2.93E-11 1.51E-11 1.60E-06 9.37E-08 5.77E-06 1.45E-07 1.87E-07 7.56E-08  .00E+00
I131+D  3.1E-07 2.8E-09 7.37E-06 7.68E-07 4.39E-03 1.30E-05 1.30E-05  .00E+00 9.83E-06 1.54E-06 5.72E-03 1.72E-05 1.73E-05  .00E+00
I132    2.0E-06 1.7E-08 5.07E-07 8.65E-07 5.23E-05 5.72E-07 1.10E-06  .00E+00 6.76E-07 1.73E-06 6.82E-05 8.00E-07 1.47E-06  .00E+00
I133+D  4.4E-07 3.7E-09 2.08E-06 1.48E-06 1.04E-03 4.48E-06 5.49E-06  .00E+00 2.77E-06 2.95E-06 1.36E-03 5.92E-06 7.32E-06  .00E+00
I134    2.0E-06 1.6E-08 2.69E-07 2.58E-07 1.37E-05 3.17E-07 5.84E-07  .00E+00 3.58E-07 5.16E-07 1.79E-05 4.19E-07 7.78E-07  .00E+00
I135+D  1.5E-06 1.2E-08 1.12E-06 1.20E-06 2.14E-04 1.33E-06 2.36E-06  .00E+00 1.49E-06 2.40E-06 2.79E-04 1.75E-06 3.15E-06  .00E+00
XE131M  1.0E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 3.30E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE133M  2.9E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 4.36E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE133   3.4E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 3.66E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE135M  3.6E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 4.48E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE135   2.1E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 9.09E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE137   1.6E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 4.07E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE138+D 1.0E-06  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 5.17E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
CS134   1.3E-06 1.2E-08 6.07E-05 1.04E-06  .00E+00 1.76E-04 2.74E-04 3.27E-05 8.10E-05 2.07E-06  .00E+00 2.34E-04 3.84E-04 4.27E-05
CS136   1.9E-06 1.5E-08 3.14E-05 1.13E-06  .00E+00 1.76E-05 4.62E-05 3.93E-06 4.18E-05 2.27E-06  .00E+00 2.35E-05 6.46E-05 5.13E-06
CS137+D 4.7E-07 4.2E-09 3.47E-05 9.78E-07  .00E+00 2.45E-04 2.23E-04 2.81E-05 4.62E-05 1.96E-06  .00E+00 3.27E-04 3.13E-04 3.67E-05
CS138   1.8E-06 2.1E-08 1.50E-07 7.29E-08  .00E+00 1.71E-07 2.27E-07 1.84E-08 2.01E-07 1.46E-07  .00E+00 2.28E-07 3.17E-07 2.40E-08
CS139+D 8.0E-07 6.3E-09 5.80E-08 7.23E-12  .00E+00 1.09E-07 1.15E-07 9.36E-09 7.74E-08 1.45E-11  .00E+00 1.45E-07 1.61E-07 1.22E-08
BA139   3.7E-08 2.4E-09 1.45E-11 1.56E-05  .00E+00 4.98E-10 2.66E-13 1.56E-06 1.20E-08 2.39E-05  .00E+00 4.14E-07 2.21E-10 1.30E-10
BA140+D 2.2E-07 2.1E-09 1.17E-06 2.75E-05  .00E+00 2.00E-05 1.75E-08 4.71E-04 4.85E-06 4.21E-05  .00E+00 8.31E-05 7.28E-08 4.34E-08
LA140   1.9E-06 1.5E-08 2.04E-08 6.10E-05  .00E+00 1.74E-07 6.08E-08 4.94E-05 1.19E-09 9.84E-05  .00E+00 1.01E-08 3.53E-09  .00E+00
LA141   2.3E-09 2.5E-10 1.15E-10 4.37E-05  .00E+00 2.28E-09 5.31E-10 4.48E-06 6.88E-11 7.05E-05  .00E+00 1.36E-09 3.17E-10  .00E+00
CE141   5.9E-08 5.5E-10 7.83E-07 1.53E-05  .00E+00 1.06E-05 5.28E-06 1.47E-04 2.94E-09 2.47E-05  .00E+00 3.97E-08 1.98E-08  .00E+00
CE144+D 4.0E-08 3.2E-10 9.77E-05 1.05E-04  .00E+00 1.83E-03 5.72E-04 3.23E-03 1.11E-07 1.70E-04  .00E+00 2.08E-06 6.52E-07  .00E+00
EU152   1.3E-05 7.4E-09 1.61E-04 1.14E-05  .00E+00 7.42E-04 1.37E-04 9.00E-04 1.33E-07 1.84E-05  .00E+00 6.15E-07 1.12E-07  .00E+00
EU154   4.6E-05 7.8E-09 2.27E-04 2.98E-05  .00E+00 2.74E-03 2.49E-04 1.66E-03 1.89E-07 4.81E-05  .00E+00 2.30E-06 2.07E-07  .00E+00
W187    3.8E-07 3.1E-09 1.17E-09 2.46E-05  .00E+00 4.41E-09 2.61E-09 1.11E-05 1.14E-07 3.57E-05  .00E+00 4.29E-07 2.54E-07  .00E+00
TH232+D 1.8E-06 1.6E-08 1.28E-01 3.27E-05  .00E+00 2.86E+00 1.47E-01 1.77E+00 3.01E-04 5.27E-05  .00E+00 3.08E-03 1.52E-04  .00E+00
NP239   1.1E-07 9.5E-10 6.35E-09 1.73E-05  .00E+00 1.26E-07 9.04E-09 1.57E-05 2.65E-10 2.79E-05  .00E+00 5.25E-09 3.77E-10  .00E+00
 *** NOTE:  H3 INHALATION DFS INCREASED 50% TO INCLUDE SKIN ABSORPTION.  ***
,    Noble gas air sub factors from RG 1.109, p.21
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D.4 INFANT.DAT

INFANT.DAT INFANT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE) CPRD 20 SEP 1991

	--MREM/HOUR PER-- PCI/M^3 AIR SUB	PCI/M^2 GRD CON	--------INHALATION (MREM PER PCI INHALED)--------						---------INGESTION (MREM PER PCI INGESTED)----------					
ISOTOPE	BODY	BODY	BODY	GI-LLI	THYROID	BONE	LIVER	LUNG	BODY	GI-LLI	THYROID	BONE	LIVER	LUNG
H3	.0E+00	.0E+00	4.62E-07	4.62E-07	4.62E-07	.00E+00	4.62E-07	4.62E-07	3.08E-07	3.08E-07	3.08E-07	.00E+00	3.08E-07	3.08E-07
BE10	2.5E-10	3.4E-12	2.65E-05	1.73E-05	.00E+00	9.49E-04	1.25E-04	1.49E-03	5.16E-07	2.78E-05	.00E+00	1.71E-05	2.49E-06	.00E+00
C14	1.4E-11	.0E+00	3.79E-06	3.79E-06	3.79E-06	1.89E-05	3.79E-06	3.79E-06	5.06E-06	5.06E-06	5.06E-06	2.37E-05	5.06E-06	5.06E-06
N13	8.5E-07	7.6E-09	4.39E-08	4.39E-08	4.39E-08	4.39E-08	4.39E-08	4.39E-08	5.85E-08	5.85E-08	5.85E-08	5.85E-08	5.85E-08	5.85E-08
F18	8.2E-07	6.8E-09	3.33E-07	6.10E-07	.00E+00	3.92E-06	.00E+00	.00E+00	4.43E-07	1.22E-06	.00E+00	5.19E-06	.00E+00	.00E+00
NA22	1.8E-06	1.6E-08	7.37E-05	7.37E-05	7.37E-05	7.37E-05	7.37E-05	7.37E-05	9.83E-05	9.83E-05	9.83E-05	9.83E-05	9.83E-05	9.83E-05
NA24	3.5E-06	2.5E-08	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
AR41	1.0E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	3.14E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
SC46	1.7E-06	1.3E-08	1.69E-04	2.19E-05	.00E+00	3.75E-04	5.41E-04	.00E+00	1.69E-08	3.53E-05	.00E+00	3.75E-08	5.41E-08	.00E+00
CR51	2.4E-08	2.2E-10	6.39E-08	2.55E-07	4.11E-08	.00E+00	.00E+00	9.17E-06	1.41E-08	4.11E-07	9.20E-09	.00E+00	.00E+00	1.79E-08
MN54	7.0E-07	5.8E-09	3.56E-06	5.04E-06	.00E+00	.00E+00	1.81E-05	7.14E-04	4.51E-06	7.31E-06	.00E+00	.00E+00	1.99E-05	.00E+00
MN56	1.5E-06	1.1E-08	1.58E-10	5.12E-05	.00E+00	.00E+00	1.10E-09	8.95E-06	1.41E-07	7.43E-05	.00E+00	.00E+00	8.18E-07	.00E+00
FE55	3.5E-11	.0E+00	2.38E-06	7.82E-07	.00E+00	1.41E-05	8.39E-06	6.21E-05	2.40E-06	1.14E-06	.00E+00	1.39E-05	8.98E-06	4.39E-06
FE59	1.0E-06	8.0E-09	6.77E-06	1.77E-05	.00E+00	9.69E-06	1.68E-05	7.25E-04	2.12E-05	2.57E-05	.00E+00	3.08E-05	5.38E-05	1.59E-05
CO57	1.0E-07	9.1E-10	4.58E-07	3.47E-06	.00E+00	.00E+00	4.65E-07	2.71E-04	1.87E-06	3.92E-06	.00E+00	.00E+00	1.15E-06	.00E+00
CO58	8.2E-07	7.0E-09	1.30E-06	7.95E-06	.00E+00	.00E+00	8.71E-07	5.55E-04	8.98E-06	8.97E-06	.00E+00	.00E+00	3.60E-06	.00E+00
CO60	2.0E-06	1.7E-08	8.41E-06	2.28E-05	.00E+00	.00E+00	5.73E-06	3.22E-03	2.55E-05	2.57E-05	.00E+00	.00E+00	1.08E-05	.00E+00
NI57	1.9E-06	1.6E-08	2.32E-08	3.37E-05	.00E+00	2.02E-07	3.64E-08	7.33E-05	4.54E-06	3.81E-05	.00E+00	3.95E-05	6.78E-06	.00E+00
NI63	.0E+00	.0E+00	8.29E-06	1.73E-06	.00E+00	2.42E-04	1.46E-05	1.49E-04	2.20E-05	1.95E-06	.00E+00	6.34E-04	3.92E-05	.00E+00
NI65	4.8E-07	3.7E-09	8.79E-11	3.58E-05	.00E+00	1.71E-09	2.03E-10	5.80E-06	2.42E-07	4.05E-05	.00E+00	4.70E-06	5.32E-07	.00E+00
CU64	1.7E-07	1.5E-09	5.53E-10	1.07E-05	.00E+00	.00E+00	1.34E-09	6.64E-06	2.82E-07	1.25E-05	.00E+00	.00E+00	6.09E-07	.00E+00
ZN65	4.9E-07	4.0E-09	2.22E-05	3.67E-05	.00E+00	1.38E-05	4.47E-05	4.62E-04	2.91E-05	5.33E-05	.00E+00	1.84E-05	6.31E-05	.00E+00
ZN69M+D	3.4E-07	2.9E-09	1.67E-09	2.92E-05	.00E+00	8.98E-09	1.84E-08	1.91E-05	2.79E-07	4.24E-05	.00E+00	1.50E-06	3.06E-06	.00E+00
AS76	3.2E-07	3.3E-09	1.40E-08	8.55E-05	.00E+00	.00E+00	1.51E-08	9.66E-05	3.72E-07	1.34E-04	.00E+00	.00E+00	4.01E-07	.00E+00
BR82	2.4E-06	1.9E-08	9.49E-06	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	1.27E-05	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR83M	8.6E-12	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	2.50E-09	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR85M	1.3E-07	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	1.31E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR85	1.8E-09	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	1.16E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR87	6.8E-07	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	6.59E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR88+D	1.7E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	1.38E-07	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
KR89	1.9E-06	.0E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	8.67E-08	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00	.00E+00
RB88	5.6E-07	3.5E-09	2.05E-07	2.42E-07	.00E+00	.00E+00	3.98E-07	.00E+00	2.73E-07	4.85E-07	.00E+00	.00E+00	4.98E-07	.00E+00
RB89+D	2.1E-06	1.5E-08	1.47E-07	4.87E-08	.00E+00	.00E+00	2.29E-07	.00E+00	1.97E-07	9.74E-08	.00E+00	.00E+00	2.86E-07	.00E+00
SR89+D	2.1E-09	5.6E-13	8.15E-06	4.57E-05	.00E+00	2.84E-04	.00E+00	1.45E-03	7.20E-05	5.16E-05	.00E+00	2.51E-03	.00E+00	.00E+00
SR90+D	2.4E-10	.0E+00	1.85E-03	9.36E-05	.00E+00	2.92E-02	.00E+00	8.03E-03	4.71E-03	2.31E-04	.00E+00	1.85E-02	.00E+00	.00E+00
SR91+D	8.9E-07	7.1E-09	2.47E-09	5.24E-05	.00E+00	6.83E-08	.00E+00	3.76E-05	1.81E-06	5.92E-05	.00E+00	5.00E-05	.00E+00	.00E+00
SR92+D	1.1E-06	9.0E-09	2.79E-10	1.00E-04	.00E+00	7.50E-09	.00E+00	1.70E-05	7.13E-07	2.07E-04	.00E+00	1.92E-05	.00E+00	.00E+00
Y90	6.1E-09	2.2E-12	6.30E-08	7.43E-05	.00E+00	2.35E-06	.00E+00	1.92E-04	2.33E-09	1.20E-04	.00E+00	8.69E-08	.00E+00	.00E+00
Y91M+D	4.6E-07	3.8E-09	9.90E-12	1.68E-06	.00E+00	2.91E-10	.00E+00	1.99E-06	2.76E-11	2.70E-06	.00E+00	8.10E-10	.00E+00	.00E+00
ZR95+D	6.8E-07	5.0E-09	1.45E-05	1.55E-05	.00E+00	8.24E-05	1.99E-05	1.25E-03	3.56E-08	2.50E-05	.00E+00	2.06E-07	5.02E-08	.00E+00
ZR97+D	6.9E-07	5.5E-09	8.36E-09	1.00E-04	.00E+00	1.07E-07	1.83E-08	7.88E-05	1.16E-09	1.62E-04	.00E+00	1.48E-08	2.54E-09	.00E+00
NB95	6.4E-07	5.1E-09	2.70E-06	9.05E-06	.00E+00	1.12E-05	4.59E-06	3.42E-04	1.00E-08	1.46E-05	.00E+00	4.20E-08	1.73E-08	.00E+00
NB97	5.6E-07	4.6E-09	1.88E-11	1.92E-05	.00E+00	2.44E-10	5.21E-11	2.37E-06	3.53E-11	3.09E-05	.00E+00	4.59E-10	9.79E-11	.00E+00
MO99+D	2.2E-07	1.9E-09	2.31E-08	3.48E-05	.00E+00	.00E+00	1.18E-07	9.63E-05	6.63E-06	1.12E-05	.00E+00	.00E+00	3.40E-05	.00E+00
TC99M	1.1E-07	9.6E-10	2.66E-11	1.45E-06	.00E+00	9.98E-13	2.06E-12	5.79E-07	5.10E-08	1.15E-06	.00E+00	1.92E-09	3.96E-09	2.07E-09
RU103+D	4.1E-07	3.6E-09	4.85E-07	1.15E-05	.00E+00	1.44E-06	.00E+00	3.94E-04	4.95E-07	1.80E-05	.00E+00	1.48E-06	.00E+00	.00E+00
RU106+D	1.7E-07	1.5E-09	7.77E-06	1.17E-04	.00E+00	6.20E-05	.00E+00	8.26E-03	3.01E-06	1.83E-04	.00E+00	2.41E-05	.00E+00	.00E+00
AG110M+D	2.2E-06	1.8E-08	3.57E-06	2.36E-05	.00E+00	7.13E-06	5.16E-06	2.62E-03	4.81E-07	3.77E-05	.00E+00	9.96E-07	7.27E-07	.00E+00
CD115M	2.9E-08	2.7E-10	6.19E-06	5.02E-05	.00E+00	.00E+00	1.73E-04	1.47E-03	4.93E-07	8.09E-05	.00E+00	.00E+00	1.42E-05	.00E+00
CD115	2.7E-08	2.4E-10	1.79E-08	2.78E-05	.00E+00	.00E+00	5.08E-07	6.28E-05	1.92E-08	4.49E-05	.00E+00	.00E+00	5.51E-07	.00E+00

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SN125+D 7.3E-08 5.7E-10 6.00E-07 7.26E-05 2.47E-07 1.01E-05 2.51E-07 6.43E-04 3.29E-06 1.11E-04 1.36E-06 7.41E-05 1.38E-06  .00E+00
SB124   1.6E-06 1.3E-08 8.56E-06 4.22E-05 7.18E-08 2.71E-05 3.97E-07 1.89E-03 6.63E-06 6.60E-05 5.68E-08 2.14E-05 3.15E-07 1.34E-05
SB125+D 3.6E-07 3.1E-09 7.78E-06 1.05E-05 4.45E-08 3.69E-05 3.41E-07 1.17E-03 2.53E-06 1.64E-05 1.54E-08 1.23E-05 1.19E-07 7.72E-06
TE132+D 1.8E-07 1.7E-09 1.26E-07 3.15E-05 1.99E-07 2.66E-07 1.69E-07 2.43E-04 9.61E-06 3.81E-05 1.52E-05 2.08E-05 1.03E-05  .00E+00
TE133M+D1.8E-06 1.5E-08 2.74E-11 1.59E-05 5.52E-11 6.13E-11 3.59E-11 3.92E-06 1.71E-07 1.93E-05 3.45E-07 3.91E-07 1.79E-07  .00E+00
I131+D  3.1E-07 2.8E-09 1.40E-05 7.56E-07 1.06E-02 2.71E-05 3.17E-05  .00E+00 1.86E-05 1.51E-06 1.39E-02 3.59E-05 4.23E-05  .00E+00
I132    2.0E-06 1.7E-08 8.99E-07 1.36E-06 1.21E-04 1.21E-06 2.53E-06  .00E+00 1.20E-06 2.73E-06 1.58E-04 1.66E-06 3.37E-06  .00E+00
I133+D  4.4E-07 3.7E-09 4.00E-06 1.54E-06 2.54E-03 9.46E-06 1.37E-05  .00E+00 5.33E-06 3.08E-06 3.31E-03 1.25E-05 1.82E-05  .00E+00
I134    2.0E-06 1.6E-08 4.75E-07 9.21E-07 3.18E-05 6.58E-07 1.34E-06  .00E+00 6.33E-07 1.84E-06 4.15E-05 8.69E-07 1.78E-06  .00E+00
I135+D  1.5E-06 1.2E-08 1.98E-06 1.31E-06 4.97E-04 2.76E-06 5.43E-06  .00E+00 2.64E-06 2.62E-06 6.49E-04 3.64E-06 7.24E-06  .00E+00
XE131M  1.0E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 6.77E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE133M  2.9E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 8.89E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE133   3.4E-08  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 7.41E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE135M  3.6E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 1.80E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE135   2.1E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 8.05E-09  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE137   1.6E-07  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 8.30E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
XE138+D 1.0E-06  .0E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00 9.78E-08  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00  .00E+00
CS134   1.3E-06 1.2E-08 5.32E-05 9.53E-07  .00E+00 2.83E-04 5.02E-04 5.69E-05 7.10E-05 1.91E-06  .00E+00 3.77E-04 7.03E-04 7.42E-05
CS136   1.9E-06 1.5E-08 3.78E-05 1.02E-06  .00E+00 3.45E-05 9.61E-05 8.40E-06 5.04E-05 2.05E-06  .00E+00 4.59E-05 1.35E-04 1.10E-05
CS137+D 4.7E-07 4.2E-09 3.25E-05 9.53E-07  .00E+00 3.92E-04 4.37E-04 5.09E-05 4.33E-05 1.91E-06  .00E+00 5.22E-04 6.11E-04 6.64E-05
CS138   1.8E-06 2.1E-08 2.84E-07 6.26E-07  .00E+00 3.61E-07 5.58E-07 4.67E-08 3.79E-07 1.25E-06  .00E+00 4.81E-07 7.82E-07 6.09E-08
CS139+D 8.0E-07 6.3E-09 1.22E-07 1.33E-08  .00E+00 2.32E-07 3.03E-07 2.53E-08 1.62E-07 2.66E-08  .00E+00 3.10E-07 4.24E-07 3.30E-08
BA139   3.7E-08 2.4E-09 3.07E-11 3.64E-05  .00E+00 1.06E-09 7.03E-13 4.25E-06 2.55E-08 5.58E-05  .00E+00 8.81E-07 5.84E-10 3.54E-10
BA140+D 2.2E-07 2.1E-09 2.07E-06 2.74E-05  .00E+00 4.00E-05 4.00E-08 1.14E-03 8.81E-06 4.20E-05  .00E+00 1.71E-04 1.71E-07 1.05E-07
LA140   1.9E-06 1.5E-08 3.68E-08 6.06E-05  .00E+00 3.61E-07 1.43E-07 1.20E-04 2.14E-09 9.57E-05  .00E+00 2.11E-08 8.32E-09  .00E+00
LA141   2.3E-09 2.5E-10 2.45E-10 5.96E-05  .00E+00 4.85E-09 1.40E-09 1.22E-05 1.46E-10 9.61E-05  .00E+00 2.89E-09 8.38E-10  .00E+00
CE141   5.9E-08 5.5E-10 1.42E-06 1.54E-05  .00E+00 1.98E-05 1.19E-05 3.69E-04 5.65E-09 2.48E-05  .00E+00 7.87E-08 4.80E-08  .00E+00
CE144+D 4.0E-08 3.2E-10 1.26E-04 1.06E-04  .00E+00 2.28E-03 8.65E-04 7.03E-03 1.67E-07 1.71E-04  .00E+00 2.98E-06 1.22E-06  .00E+00
EU152   1.3E-05 7.4E-09 1.72E-04 9.88E-06  .00E+00 7.83E-04 1.77E-04 1.48E-03 1.51E-07 1.59E-05  .00E+00 6.74E-07 1.79E-07  .00E+00
EU154   4.6E-05 7.8E-09 2.45E-04 2.84E-05  .00E+00 2.96E-03 3.46E-04 3.05E-03 2.20E-07 4.58E-05  .00E+00 2.64E-06 3.67E-07  .00E+00
W187    3.8E-07 3.1E-09 2.23E-09 2.54E-05  .00E+00 9.26E-09 6.44E-09 2.83E-05 2.17E-07 3.69E-05  .00E+00 9.03E-07 6.28E-07  .00E+00
TH232+D 1.8E-06 1.6E-08 2.29E-01 3.29E-05  .00E+00 3.00E+00 1.53E-01 2.09E+00 1.65E-04 5.31E-05  .00E+00 3.30E-03 1.63E-04  .00E+00
 *** NOTE:  H3 INHALATION DFS INCREASED 50% TO INCLUDE SKIN ABSORPTION.  ***
,    Noble gas air sub factors from RG 1.109, p.21
EOF ----------------------------------------------------------------------------------------------------------------------------
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D.5 AIRGAMMA.DAT

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AIRGAMMA.DAT  --  Gamma energies x Abundance and Dose factors          6 Sep 91
'   Gamma Energies x Abundances by Energy Group for Finite Plume.
'      Nobel gas values from GENII file GAMEN.DAT (13-May-90 RAP).
'   Dose factors in mrad/y or mrem/y per pCi/m3 from Reg Guide 1.109 rev.1 p 21.
'
'                 ---------------- Mev x abundance -------------     ---------- Dose Factors -----------
'No.  MeV -->        0.15     0.40     0.75     1.25     1.75     2.25      B-Air    B-Skin   G-Air    G-Body
 8    AR-41       0.00000 0.00000 0.00000 1.28273 0.00087 0.00000    3.28E-03 2.69E-03 9.30E-03 8.84E-03
26    KR-83M      0.00257 0.00000 0.00000 0.00000 0.00000 0.00000    2.88E-04 0.0      1.93E-05 7.56E-08
27    KR-85M      0.11498 0.04265 0.00012 0.00000 0.00000 0.00000    1.97E-03 1.46E-03 1.23E-03 1.17E-03
28    KR-85       0.00000 0.00000 0.00223 0.00000 0.00000 0.00000    1.95E-03 1.34E-03 1.72E-05 1.61E-05
29    KR-87       0.00002 0.19928 0.08334 0.02757 0.05791 0.42498    1.03E-02 9.73E-03 6.17E-03 5.92E-03
30    KR-88       0.05870 0.01545 0.13950 0.11115 0.22300 1.40675    2.93E-03 2.37E-03 1.52E-02 1.47E-02
31    KR-89       0.05026 0.08839 0.37700 0.28430 0.33461 0.69989    1.06E-02 1.01E-02 1.73E-02 1.66E-02
61    XE-131M     0.02010 0.00000 0.00000 0.00000 0.00000 0.00000    1.11E-03 4.76E-04 1.56E-04 9.15E-05
62    XE-133M     0.04145 0.00000 0.00000 0.00000 0.00000 0.00000    1.48E-03 9.94E-04 3.27E-04 2.51E-04
63    XE-133      0.04529 0.00000 0.00000 0.00000 0.00000 0.00000    1.05E-03 3.06E-04 3.53E-04 2.94E-04
64    XE-135M     0.00418 0.00000 0.42650 0.00000 0.00000 0.00000    7.39E-04 7.11E-04 3.36E-03 3.12E-03
65    XE-135      0.22665 0.00225 0.01904 0.00000 0.00000 0.00000    2.46E-03 1.86E-03 1.92E-03 1.81E-03
66    XE-137      0.00045 0.14038 0.00723 0.02363 0.01086 0.00516    1.27E-02 1.22E-02 1.51E-03 1.42E-03
67    XE-138      0.10170 0.12420 0.03183 0.06156 0.34422 0.46233    4.75E-03 4.13E-03 9.21E-03 8.83E-03
EOF ----------------------------------------------------------------------------------------------------
```

D.6 GENERIC.DAT

GENERIC2.DAT CPRD generic file of decay rates & transfer factors. 27 Nov 90 dAb

	Nuclide	Lambda (1/sec)	Bv -	Fm d/L	Ff d/kg	Saltwater Fish	Saltwater Invert	Saltwater Plant	Freshwater Fish	Freshwater Invert	Freshwater Plant
1	H3	1.78E-09	*	1.0E-02	1.2E-02	9.0E-01	9.3E-01	9.3E-01	9.0E-01	9.0E-01	9.0E-01
2	BE10	1.37E-14	4.2E-04	1.0E-04	1.0E-03	2.0E+02	2.0E+02	1.0E+03	2.0E+00	1.0E+01	2.0E+01
3	C14	3.83E-12	*	1.2E-02	3.1E-02	1.8E+03	1.4E+03	1.8E+03	4.6E+03	9.1E+03	4.6E+03
4	N13	1.16E-03	7.5E+00	2.2E-02	7.7E-02	6.0E+04	1.7E+04	1.0E+04	1.5E+05	1.5E+05	1.3E+04
5	F18	1.05E-04	6.5E-04	1.4E-02	1.5E-01	3.6E+00	3.6E+00	1.4E+00	1.0E+01	1.0E+02	2.0E+00
6	NA22	8.44E-09	5.2E-02	4.0E-02	3.0E-02	6.7E-02	1.9E-01	9.5E-01	1.0E+02	2.0E+02	5.0E+02
7	NA24	1.28E-05	5.2E-02	4.0E-02	3.0E-02	6.7E-02	1.9E-01	9.5E-01	1.0E+02	2.0E+02	5.0E+02
8	AR41	1.05E-04	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
9	SC46	9.58E-08	1.1E-03	5.0E-06	1.6E-02	2.0E+00	1.0E+04	1.0E+05	2.0E+00	1.0E+03	1.0E+04
10	CR51	2.89E-07	2.5E-04	2.2E-03	2.4E-03	4.0E+02	2.0E+03	2.0E+03	2.0E+02	2.0E+03	4.0E+03
11	MN54	2.57E-08	2.9E-02	2.5E-04	8.0E-04	5.5E+02	4.0E+02	5.5E+03	4.0E+02	9.0E+04	1.0E+04
12	MN56	7.47E-05	2.9E-02	2.7E-04	8.0E-04	5.5E+02	4.0E+02	5.5E+03	4.0E+02	9.0E+04	1.0E+04
13	FE55	8.14E-09	6.6E-04	1.2E-03	4.0E-02	3.0E+03	2.0E+04	7.3E+02	1.0E+02	3.2E+03	1.0E+03
14	FE59	1.80E-07	6.6E-04	1.2E-03	4.0E-02	3.0E+03	2.0E+04	7.3E+02	1.0E+02	3.2E+03	1.0E+03
15	CO57	2.97E-08	9.4E-03	1.0E-03	1.3E-02	1.0E+02	1.0E+03	1.0E+03	5.0E+01	2.0E+02	2.0E+02
16	CO58	1.12E-07	9.4E-03	1.0E-03	1.3E-02	1.0E+02	1.0E+03	1.0E+03	5.0E+01	2.0E+02	2.0E+02
17	CO60	4.17E-09	9.4E-03	1.0E-03	1.3E-02	1.0E+02	1.0E+03	1.0E+03	5.0E+01	2.0E+02	2.0E+02
18	NI57	5.35E-06	1.9E-02	6.7E-03	5.3E-03	1.0E+02	2.5E+02	2.5E+02	1.0E+02	1.0E+02	5.0E+01
19	NI63	2.20E-10	1.9E-02	6.7E-03	5.3E-03	1.0E+02	2.5E+02	2.5E+02	1.0E+02	1.0E+02	5.0E+01
20	NI65	7.64E-05	1.9E-02	6.7E-03	5.3E-03	1.0E+02	2.5E+02	2.5E+02	1.0E+02	1.0E+02	5.0E+01
21	CU64	1.52E-05	1.2E-01	1.4E-02	8.0E-03	6.7E+02	1.7E+03	1.0E+03	5.0E+01	4.0E+02	2.0E+03
22	ZN65	3.31E-08	4.0E-01	3.9E-02	3.0E-02	2.0E+03	5.0E+04	1.0E+03	2.0E+03	1.0E+04	2.0E+04
23	ZN69M+D	1.39E-05	4.0E-01	3.9E-02	3.0E-02	2.0E+03	5.0E+04	1.0E+03	2.0E+03	1.0E+04	2.0E+04
24	AS76	7.32E-06	1.0E-02	6.0E-03	2.0E-03	3.3E+02	3.3E+02	1.7E+03	1.0E+02	4.0E+01	3.0E+03
25	BR82	5.44E-06	7.6E-01	5.0E-02	2.6E-02	1.5E-02	3.1E+00	1.5E+00	4.2E+02	3.3E+02	5.0E+01
26	KR83M	1.04E-04	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
27	KR85M	4.31E-05	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
28	KR85	2.05E-09	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
29	KR87	1.52E-04	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
30	KR88+D	6.89E-05	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
31	KR89	3.64E-03	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
32	RB88	6.53E-04	1.3E-01	3.0E-02	3.1E-02	8.3E+00	1.7E+01	1.7E+01	2.0E+03	1.0E+03	1.0E+03
33	RB89+D	7.61E-04	1.3E-01	3.0E-02	3.1E-02	8.3E+00	1.7E+01	1.7E+01	2.0E+03	1.0E+03	1.0E+03
34	SR89+D	1.59E-07	1.7E-02	8.0E-04	6.0E-04	2.0E+00	2.0E+01	1.0E+01	3.0E+01	1.0E+02	5.0E+02
35	SR90+D	7.58E-10	1.7E-02	8.0E-04	6.0E-04	2.0E+00	2.0E+01	1.0E+01	3.0E+01	1.0E+02	5.0E+02
36	SR91+D	2.03E-05	1.7E-02	8.0E-04	6.0E-04	2.0E+00	2.0E+01	1.0E+01	3.0E+01	1.0E+02	5.0E+02
37	SR92+D	7.11E-05	1.7E-02	8.0E-04	6.0E-04	2.0E+00	2.0E+01	1.0E+01	3.0E+01	1.0E+02	5.0E+02
38	Y90	3.01E-06	2.6E-03	1.0E-05	4.6E-03	2.5E+01	1.0E+03	5.0E+03	2.5E+01	1.0E+03	5.0E+03
39	Y91M+D	2.32E-04	2.6E-03	1.0E-05	4.6E-03	2.5E+01	1.0E+03	5.0E+03	2.5E+01	1.0E+03	5.0E+03
40	ZR95+D	1.22E-07	1.7E-04	5.0E-06	3.4E-02	2.0E+02	8.0E+01	1.0E+03	3.3E+00	6.7E+00	1.0E+03
41	ZR97+D	1.14E-05	1.7E-04	5.0E-06	3.4E-02	2.0E+02	8.0E+01	1.0E+03	3.3E+00	6.7E+00	1.0E+03
42	NB95	2.29E-07	9.4E-03	2.5E-03	2.8E-01	3.0E+04	1.0E+02	5.0E+02	3.0E+04	1.0E+02	8.0E+02
43	NB97	1.57E-04	9.4E-03	2.5E-03	2.8E-01	3.0E+04	1.0E+02	5.0E+02	3.0E+04	1.0E+02	8.0E+02
44	MO99+D	2.92E-06	1.2E-01	7.5E-03	8.0E-03	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+03
45	TC99M	3.19E-05	2.5E-01	2.5E-02	4.0E-01	1.0E+01	5.0E+01	4.0E+03	1.5E+01	5.0E+00	4.0E+01
46	RU103+D	2.02E-07	5.0E-02	1.0E-06	4.0E-01	3.0E+00	1.0E+03	2.0E+03	1.0E+01	3.0E+02	2.0E+03
47	RU106+D	2.17E-08	5.0E-02	1.0E-06	4.0E-01	3.0E+00	1.0E+03	2.0E+03	1.0E+01	3.0E+02	2.0E+03
48	AG110M+D	3.19E-08	1.5E-01	5.0E-02	1.7E-02	3.3E+03	3.3E+02	2.0E+02	2.3E+00	7.7E+02	2.0E+02
49	CD115M	1.80E-07	3.0E-01	1.2E-04	5.3E-04	3.0E+03	2.5E+05	1.0E+03	2.0E+02	2.0E+03	1.0E+03
50	CD115	3.60E-06	3.0E-01	1.2E-04	5.3E-04	3.0E+03	2.5E+05	1.0E+03	2.0E+02	2.0E+03	1.0E+03
51	SN125+D	8.31E-07	2.5E-03	2.5E-03	8.0E-02	3.0E+03	1.0E+03	1.0E+02	3.0E+03	1.0E+03	1.0E+02
52	SB124	1.33E-07	1.1E-02	1.5E-03	4.0E-03	4.0E+01	5.0E+00	1.5E+03	1.0E+00	1.0E+01	1.5E+03

53	SB125+D	8.06E-09	1.1E-02	1.5E-03	4.0E-03	4.0E+01	5.0E+00	1.5E+03	1.0E+00	1.0E+01	1.5E+03
54	TE132+D	2.47E-06	1.3E+00	1.0E-03	7.7E-02	1.0E+01	1.0E+02	1.0E+03	4.0E+02	6.1E+03	1.0E+02
55	TE133M+D	2.09E-04	1.3E+00	1.0E-03	7.7E-02	1.0E+01	1.0E+02	1.0E+03	4.0E+02	6.1E+03	1.0E+02
56	I131+D	9.97E-07	2.0E-02	6.0E-03	2.9E-03	1.0E+01	5.0E+01	1.0E+03	1.5E+01	5.0E+00	4.0E+01
57	I132	8.42E-05	2.0E-02	6.0E-03	2.9E-03	1.0E+01	5.0E+01	1.0E+03	1.5E+01	5.0E+00	4.0E+01
58	I133+D	9.25E-06	2.0E-02	6.0E-03	2.9E-03	1.0E+01	5.0E+01	1.0E+03	1.5E+01	5.0E+00	4.0E+01
59	I134	2.20E-04	2.0E-02	6.0E-03	2.9E-03	1.0E+01	5.0E+01	1.0E+03	1.5E+01	5.0E+00	4.0E+01
60	I135+D	2.92E-05	2.0E-02	6.0E-03	2.9E-03	1.0E+01	5.0E+01	1.0E+03	1.5E+01	5.0E+00	4.0E+01
61	XE131M	6.69E-07	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
62	XE133M	3.61E-06	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
63	XE133	1.52E-06	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
64	XE135M	7.56E-04	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
65	XE135	2.10E-05	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
66	XE137	3.01E-03	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
67	XE138+D	8.14E-04	0.0E+00	0.0E+00	0.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00	1.0E+00
68	CS134	1.07E-08	1.0E-02	1.2E-02	4.0E-03	4.0E+01	2.5E+01	5.0E+01	2.0E+03	1.0E+03	5.0E+02
69	CS136	6.17E-07	1.0E-02	1.2E-02	4.0E-03	4.0E+01	2.5E+01	5.0E+01	2.0E+03	1.0E+03	5.0E+02
70	CS137+D	7.31E-10	1.0E-02	1.2E-02	4.0E-03	4.0E+01	2.5E+01	5.0E+01	2.0E+03	1.0E+03	5.0E+02
71	CS138	3.58E-04	1.0E-02	1.2E-02	4.0E-03	4.0E+01	2.5E+01	5.0E+01	2.0E+03	1.0E+03	5.0E+02
72	CS139+D	1.24E-03	1.0E-02	1.2E-02	4.0E-03	4.0E+01	2.5E+01	5.0E+01	2.0E+03	1.0E+03	5.0E+02
73	BA139	1.39E-04	5.0E-03	4.0E-04	3.2E-03	1.0E+01	1.0E+02	5.0E+02	4.0E+00	2.0E+02	5.0E+02
74	BA140+D	6.28E-07	5.0E-03	4.0E-04	3.2E-03	1.0E+01	1.0E+02	5.0E+02	4.0E+00	2.0E+02	5.0E+02
75	LA140	4.78E-06	2.5E-03	5.0E-06	2.0E-04	2.5E+01	1.0E+03	5.0E+03	2.5E+01	1.0E+03	5.0E+03
76	LA141	4.97E-05	2.5E-03	5.0E-06	2.0E-04	2.5E+01	1.0E+03	5.0E+03	2.5E+01	1.0E+03	5.0E+03
77	CE141	2.47E-07	2.5E-03	6.0E-04	1.2E-03	1.0E+01	6.0E+02	6.0E+02	1.0E+00	1.0E+03	4.0E+03
78	CE144+D	2.83E-08	2.5E-03	6.0E-04	1.2E-03	1.0E+01	6.0E+02	6.0E+02	1.0E+00	1.0E+03	4.0E+03
79	EU152	1.69E-09	2.5E-03	5.0E-06	4.8E-03	2.5E+01	1.0E+03	5.0E+03	2.5E+01	1.0E+03	5.0E+03
80	EU154	2.55E-09	2.5E-03	5.0E-06	4.8E-03	2.5E+01	1.0E+03	5.0E+03	2.5E+01	1.0E+03	5.0E+03
81	W187	8.06E-06	1.8E-02	5.0E-04	1.3E-03	3.0E+01	3.0E+01	3.0E+01	1.2E+03	1.0E+01	1.2E+03
82	TH232+D	1.57E-18	4.2E-03	5.0E-06	2.0E-04	1.0E+04	2.0E+03	3.0E+03	3.0E+01	5.0E+02	1.5E+03
83	NP239	3.42E-06	2.5E-03	5.0E-06	2.0E-04	1.0E+01	1.0E+01	6.0E+00	1.0E+01	4.0E+02	3.0E+02

*** NOTE: Terrestrial factors from NRC Reg. Guide 1.109 when available. Bioaccumulation factors from Reg. Guide 1.109.

D.7 SITEPOP.DAT

```
SITEPOP.DAT   1990  Data for Site Summaries ------ 8 Sep 93    dAb
'  Notes:    Number of units checked for 90 on 29 Jul 93
'            Data column number sensitive.
'            Remove sites not active !!
'-------------------------------------------------------------------------------------
'    Site                City                    Locations                  Water Body
'------------------  ----------------  ----------------------  ---------------
 21 ARKANSAS ONE      2 POPE COUNTY, AR      N 35.3100    W 93.2308     ARKANSAS RIVER
      Russelville                               20,000       10 km E
      Conway                                    26,000       76 km ESE
===
 05 BEAVER VALLEY     2 SHIPPINGPORT, PA     N 40.6219    W 80.4339     OHIO RIVER
      Pittsburgh-Beaver Valley CMSA          2,200,000       42 km ESE
      Youngstown-Warren MSA                    490,000       56 km NNW
      Stuebenville-Weirton MSA                 140,000       33 km SSW
      Wheeling MSA                             160,000       66 km SSW
      New Castle                                28,000       43 km N
===
 01 BIG ROCK POINT    1 CHARLEVOIX CNTY, MI  N 45.3592    W 85.1947     LAKE MICHIGAN
      Traverse City                             15,000       75 km SSW
      Petoskey                                   6,100       18 km E
===
 68 BRAIDWOOD         2 BRAIDWOOD, IL        N 41.2683    W 88.2133     KANKAKEE RIVER
      Chicago PMSA                           6,100,000       70 km NE
      Gary-Hammond PMSA                        600,000       70 km ENE
      Kankakee MSA                              96,000       32 km ESE
      Aurora-Elgin PMSA                        360,000       55 km N
      Joliet PMSA                              390,000       40 km NNE
===
 02 BROWNS FERRY      3 DECATUR, AL          N 34.7042    W 87.1186     TENNESSEE RIVER AT WHEELER LAKE
      Huntsville MSA                           240,000       49 km E
      Florence MSA                             110,000       52 km WNW
      Decatur                                   49,000       16 km SE
      Athens                                    17,000       17 km NE
      Cullman                                   13,000       64 km SSE
===
 17 BRUNSWICK         2 BRUNSWICK CNTY, NC   N 33.9583    W 78.0106     ATLANTIC OCEAN
      Wilmington MSA                           120,000       32 km NNE
      Whiteville                                 5,100       75 km WNW
===
 59 BYRON             2 BYRON, IL            N 42.1300    W 89.2550     ROCK RIVER
      Rockford MSA                             280,000       27 km NE
      Freeport                                  26,000       35 km NNW
      Belvidere                                 16,000       40 km NE
      Janesville-Beloit MSA                    140,000       67 km N
      De Kalb                                   35,000       48 km ESE
      Elgin                                     77,000       80 km E
===
 54 CALLAWAY          1 FULTON, MO           N 38.7618    W 91.7979     MISSOURI RIVER
      Columbia MSA                             110,000       48 km WNW
      Jefferson City                            35,000       40 km WSW
      Mexico                                    11,000       45 km NNW
      Washington                                11,500       69 km ESE
      Fulton                                    10,000       19 km NW
===
 40 CALVERT CLIFFS    2 LUSBY, MD            N 38.4347    W 76.4419     CHESAPEAKE BAY
      Washington, DC-MD-VA MSA               3,900,000       73 km NW
      Bowie                                     38,000       71 km NNW
      Annapolis                                 33,000       61 km N
      Salisbury                                 21,000       75 km E
===
 62 CATAWBA           2 CLOVER, SC           N 34.9950    W 81.2450     CATAWBA RIVER
      Charlotte-Gastonia MSA                 1,100,000       29 km NE
      Kannapolis                                30,000       64 km NE
      Rock Hill                                 42,000       11 km S
      Spartanburg                               44,000       80 km W
===
 69 CLINTON           1 CLINTON, IL          N 40.1517    W 88.9533     CLINTON LAKE
      Decatur MSA                              120,000       32 km S
      Springfield MSA                          190,000       72 km SW
      Champaign-Urbana-Rantoul MSA             170,000       50 km E
      Bloomington-Normal MSA                   130,000       35 km NNW
===
 74 COMANCHE PEAK     1 GLEN ROSE, TX        N 32.2974    W 97.7850     SQUAW CREEK RES.
      Fort Worth-Arlington PMSA              1,300,000       70 km NE
      Hurst                                     34,000       80 km NE
      Cleburne                                  22,000       37 km ENE
      Weatherford                               15,000       52 km N
===
 41 COOK              2 BENTON HARBOR, MI    N 41.9761    W 86.5664     LAKE MICHIGAN
```

	Gary-Hammond PMSA		600,000	77 km SW	
	South Bend-Mishiwaka MSA		250,000	42 km SE	
	Elkhart-Goshen MSA		160,000	58 km SE	
	Michigan City		34,000	40 km SW	
===					
03	COOPER	1 NEMAHA COUNTY, NE	N 40.3619	W 95.6411	MISSOURI RIVER
	Nebraska City		6,500	40 km NNW	
	Red Oak		6,300	80 km NNE	
	Plattsmouth		6,400	76 km NNW	
	Shenandoah		5,600	51 km NNE	
===					
44	CRYSTAL RIVER	1 CRYSTAL RIVER, FL	N 28.3619	W 82.6989	GULF OF MEXICO
	Ocala		42,000	60 km ENE	
	Leesburg		15,000	80 km E	
	New Port Richey		14,000	79 km S	
===					
45	DAVIS-BESSE	1 PORT CLINTON, OH	N 41.5972	W 83.0864	LAKE ERIE
	Toledo MSA		610,000	38 km WNW	
	Dearborn		89,000	80 km N	
	Taylor		71,000	71 km N	
	Lorain		71,000	77 km ESE	
	Lincoln Park		42,000	73 km N	
	Findlay		36,000	77 km SW	
	Sandusky		30,000	35 km ESE	
===					
56	DIABLO CANYON	2 AVILA BEACH, CA	N 35.2111	W120.8522	PACIFIC OCEAN
	San Luis Obispo		42,000	19 km ENE	
	Atascudero		23,000	34 km NNE	
	Lompoc		38,000	74 km SSE	
	Morro Bay		9,700	18 km N	
===					
04	DRESDEN	3 GRUNDY COUNTY, IL	N 41.3897	W 88.2711	ILLINOIS RIVER
	Chicago PMSA		6,100,000	75 km NE	
	Gary-Hammond PMSA		600,000	80 km ENE	
	Kankakee MSA		96,000	45 km SE	
	Aurora-Elgin PMSA		360,000	41 km N	
	Joliet PMSA		390,000	22 km NE	
===					
18	DUANE ARNOLD	1 CEDAR RAPIDS, IA	N 42.1006	W 91.7772	CEDAR RIVER
	Cedar Rapids MSA		170,000	17 km SE	
	Waterloo-Cedar Falls SMSA		150,000	66 km NW	
	Iowa City MSA		96,000	52 km SSE	
	Marion		20,000	16 km ESE	
===					
46	FARLEY	2 DOTHAN, AL	N 31.2228	W 85.1126	CHATTAHOOCHEE RIVER
	Dothan MSA		130,000	27 km W	
	Enterprise		20,000	71 km W	
	Ozark		13,000	56 km WNW	
	Eufaula		13,000	75 km N	
	Bainbridge		11,000	62 km SE	
===					
63	FERMI	1 LAGOONA BEACH, MI	N 41.9781	W 83.2594	LAKE ERIE
	Detroit PMSA		4,400,000	24-80 km NNW	
	Toledo MSA		610,000	40 km SW	
	Ann Arbor PMSA		280,000	48 km NW	
	Sandusky		30,000	72 km SE	
	Monroe		23,000	13 km WSW	
===					
19	FITZPATRICK	1 OSWEGO, NY	N 43.5239	W 76.3983	LAKE ONTARIO
	Syracuse MSA		660,000	56 km SSE	
	Rome		44,000	80 km ESE	
	Auburn		31,000	66 km SSW	
	Watertown		29,000	64 km NE	
	Kingston		23,000	79 km N	
===					
23	FORT CALHOUN	1 WASHINGTON CNTY, NE	N 41.5208	W 96.0767	MISSOURI RIVER
	Omaha MSA		620,000	32 km SSE	
	Council Bluffs		54,000	34 km SE	
	Freemont		24,000	36 km WSW	
	Bellevue		31,000	44 km SSE	
===					
33	GINNA	1 ONTARIO, NY	N 43.2778	W 77.3089	LAKE ONTARIO
	Rochester MSA		1,000,000	27 km WSW	
	Auburn		31,000	71 km ESE	
	Oswego		19,000	67 km ENE	
	Batavia		16,000	78 km WSW	
	Geneva		14,000	52 km SSE	
===					
53	GRAND GULF	1 PORT GIBSON, MS	N 32.0270	W 91.2530	MISSISSIPPI RIVER
	Vicksburg		21,000	40 km NNE	
	Tallulah		9,000	45 km NNW	
	Natches		19,000	60 km SSW	
	Brookhaven		10,000	76 km SSE	

22	HADDAM NECK	1 HADDAM NECK, CT	N 41.4819	W 72.4992	CONN. R. TO LONG ISL. SOUND
	Hartfd-New Brit.-Middletn-Bristol NECMA		1,100,000	35 km NNW	
	Springfield NECMA		600,000	70 km N	
	New Haven-Waterbury-Meriden NECMA		800,000	40 km WSW	
	Bridgeport-Stamford-Norwalk-Danbury NECMA		830,000	66 km WSW	
	New London-Norwich NECMA		250,000	35 km ESE	
70	HARRIS	1 NEWHILL, NC	N 35.6	W 79.0	CAPE FEAR RIVER
	Raleigh-Durham MSA		740,000	32 km NE	
	Fayetteville MSA		270,000	60 km SSE	
	Burlington MSA		108,000	64 km NW	
	Chapel Hill		39,000	32 km NNW	
	Sanford		14,000	22 km SW	
20	HATCH	2 BAXLEY, GA	N 31.9342	W 82.3444	ALTAMAHA RIVER
	Waycross		16,000	80 km S	
	Statesboro		16,000	78 km NE	
	Hinesville		22,000	171 km SW	
	Douglas		10,000	67 km SW	
	Vidalia		11,000	32 km N	
65	HOPE CREEK	1 SALEM COUNTY, NJ	N 39.5733	W 75.4667	DELAWARE RIVER AND BAY
	Philadelphia PMSA		4,900,000	64 km NNE	
	Wilmington PMSA		580,000	30 km N	
	Vineland-Millville-Bridgeton PMSA		140,000	38 km E	
25	INDIAN POINT	3 BUCHANAN, NY	N 41.2714	W 73.9525	HUDSON RIVER
	New York PMSA		8,500,000	57 km S	
	Newark PMSA		1,800,000	62 km S	
	Nassau-Suffok PMSA		2,600,000	70 km SSE	
	Jersey City PMSA		550,000	61 km S	
	Bergen-Passaic PMSA		1,300,000	44 km SSW	
27	KEWAUNEE	1 CARLTON, WI	N 44.3431	W 87.5361	LAKE MICHIGAN
	Greenbay MSA		190,000	44 km NW	
	Appleton-Oshkosh-Neenah MSA		320,000	72 km W	
	Sheboygan MSA		100,000	65 km SSW	
	Manitowoc		33,000	29 km SSW	
07	LACROSSE	1 GENOA, WI	N 43.5583	W 91.2306	MISSISSIPPI RIVER
	La Crosse MSA		98,000	27 km N	
	Winona		25,000	64 km WNW	
50	LASALLE	2 SENECA, IL	N 41.2439	W 88.6708	ILLINOIS RIVER
	Joliet PMSA		390,000	59 km NNE	
	Aurora-Elgin PMSA		360,000	65 km NNE	
	Kankakee MSA		96,000	69 km ESE	
	Dekalb		35,000	77 km N	
	Naperville		85,000	73 km NE	
55	LIMERICK	2 POTTSTOWN, PA	N 40.2242	W 75.5875	SCHUYLKILL RIVER
	Philadelphia PMSA		4,900,000	40 km ESE	
	Allentown-Bethlehem-Easton PMSA		690,000	42 km ENE	
	Reading MSA		340,000	34 km WNW	
	Lancaster MSA		420,000	68 km WSW	
	Wilmington PMSA		580,000	56 km S	
	Trenton PMSA		330,000	71 km E	
28	MAINE YANKEE	1 LINCOLN COUNTY, ME	N 43.9506	W 69.6961	ATLANTIC OCEAN
	Portland NECMA		240,000	56 km WSW	
	Lewiston-Auburn NECMA		110,000	45 km WNW	
	Augusta		21,000	41 km N	
	Biddeford		21,000	80 km SW	
	Waterville		17,000	67 km N	
49	McGUIRE	2 CORNELIUS, NC	N 35.4322	W 80.9483	LAKE NORMAN ON CATAWBA RIVER
	Charlotte-Gastonia-Rock Hill MSA		1,200,000	25 km S	
	Kannapolis		30,000	30 km E	
	Salisbury		23,000	51 km ENE	
	Hickory		28,000	49 km NW	
08	MILLSTONE	3 WATERFORD, CT	N 41.3086	W 72.1681	NIANTIC BAY
	Hartfd-New Brit.-Middletn-Bristol NECMA		1,100,000	67 km NW	
	New Haven-Waterbury-Meriden NECMA		800,000	64 km W	
	New London-Norwich NECMA		250,000	8 km NNE	
	Providence-Pawtucket-Woonsocket NECMA		920,000	78 km NE	
09	MONTICELLO	1 MONTICELLO, MN	N 45.3333	W 93.8483	MISSISSIPPI RIVER
	Minneapolis-St. Paul MSA		2,500,000	60 km SE	
	St. Cloud MSA		190,000	36 km NW	
	Bloomington		66,000	72 km SE	
	Edina		46,000	63 km SE	

	Richfield		36,000	67 km SE	
===					
10	NINE MILE POINT	2 OSWEGO, NY	N 43.5222	W 76.4100	LAKE ONTARIO
	Syracuse MSA		660,000	56 km SSE	
	Auburn		31,000	67 km NE	
	Watertown		29,000	64 km NE	
	Oswego		19,000	11 km SW	
===					
47	NORTH ANNA	2 LOUISA COUNTY, VA	N 38.0608	W 77.7906	LAKE ANNA
	Richmond-Petersburg MSA		870,000	66 km SSE	
	Charlottesville MSA		130,000	63 km W	
	Fredericksburg		19,000	40 km NE	
	Culpeper		8,600	54 km NNW	
	Ashland		5,900	41 km SE	
===					
29	OCONEE	3 OCONEE COUNTY, SC	N 34.7917	W 82.8986	HARTWELL RESERVOIR ON KEOWEE RIVER
	Greenville-Spartenburg MSA		640,000	46 km E	
	Anderson		26,000	39 km SE	
	Easley		15,000	27 km E	
	Greer		10,000	64 km ENE	
===					
11	OYSTER CREEK	1 OYSTER CREEK, NJ	N 38.8142	W 74.2064	BARNEGAT BAY
	New Brunswick-Sayreville PMSA		630,000	77 km N	
	Long Branch-Asbury Park PMSA		510,000	57 km NNE	
	Trenton PMSA		320,000	66 km SSW	
	Atlantic City MSA		320,000	55 km SSW	
	Camden		87,000	79 km W	
===					
30	PALISADES	1 COVERT TOWNSHIP, MI	N 42.3222	W 86.3153	LAKE MICHIGAN
	Kalamazoo MSA		220,000	61 km E	
	Elkhart-Goshen MSA		160,000	76 km SSE	
	Holland		31,000	53 km NNE	
	Benton Harbor MSA		160,000	25 km SSW	
===					
58	PALO VERDE	3 WINTERSBURG, AZ	N 33.4200	W112.8683	NONE
	Phoenix MSA		2,100,000	64 km E	
	Avondale		16,200	49 km E	
===					
12	PEACH BOTTOM	2 YORK COUNTY, PA	N 39.7589	W 76.2692	SUSQUEHANNA RIVER
	Baltimore MSA		2,400,000	60 km SSW	
	Harrisburg-Lebanon-Carlisle MSA		590,000	77 km NNW	
	Wilmington MSA		580,000	62 km E	
	Lancaster MSA		420,000	31 km N	
	York MSA		420,000	45 km NW	
===					
66	PERRY	1 NORTH PERRY, OH	N 41.8008	W 81.1433	LAKE ERIE
	Cleveland PMSA		1,800,000	53 km SW	
	Akron PMSA		660,000	80 km SSW	
	Warren		51,000	70 km SE	
	Ashtabula		22,000	35 km NE	
	Painesville		16,000	11 km SW	
===					
13	PILGRIM	1 PLYMOUTH, MA	N 41.9444	W 70.5794	CAPE COD BAY
	Bos-Lawrence-Salem-Lowell-Brcktn NECMA		3,800,000	61 km NW	
	Providence-Pawtucket-Woonsocket NECMA		920,000	70 km W	
	New Bedford-Fall River-Attleboro NECMA		510,000	45 km SSW	
===					
31	POINT BEACH	2 MANITOWOC CNTY, WI	N 44.2808	W 87.5361	LAKE MICHIGAN
	Greenbay		96,000	47 km NW	
	Appleton-Oshkosh-Neenah MSA		320,000	72 km W	
	Sheboygan		50,000	60 km SSW	
	Manitowoc		33,000	24 km SSW	
===					
32	PRAIRIE ISLAND	2 RED WING, MN	N 44.6219	W 92.6331	MISSISSIPPI RIVER
	Minneapolis-St. Paul MSA		2,200,000	63 km NW	
	Rochester MSA		98,000	68 km SSE	
	Owatonna		19,000	77 km SW	
	Faribault		16,000	63 km SW	
	Red Wing		14,000	10 km SE	
===					
14	QUAD CITIES	2 ROCK ISLAND, IL	N 41.7261	W 90.3100	MISSISSIPPI RIVER
	Davenport-Rock Island-Moline MSA		350,000	30 km SW	
	Muscatine		23,000	70 km WSW	
	Sterling		15,000	52 km E	
	Dixon		15,000	70 km E	
	Kewanee		13,000	62 km SSE	
===					
43	RANCHO SECO	1 SACRAMENTO CNTY, CA	N 38.3444	W121.1200	COSUMNES AND MOKELUMNE RIVERS
	Sacramento MSA		1,500,000	42 km NW	
	Stockton MSA		480,000	45 km SSW	
	Modesto MSA		370,000	79 km S	
	Antioch		62,000	71 km WSW	
	Davis		46,000	58 km WNW	

67	RIVER BEND	1	ST. FRANCISVILLE, LA	N 30.7572	W 91.3317	MISSISSIPPI RIVER
	Baton Rouge MSA			530,000	38 km SSE	
	Denham Springs			8,400	39 km SE	
24	ROBINSON	1	HARTSVILLE, SC	N 34.4858	W 80.1586	LAKE ROBINSON
	Florence MSA			110,000	42 km ESE	
	Sumter			42,000	56 km SSW	
	Monroe			16,000	74 km NNW	
	Lancaster			8,900	66 km WNW	
16	SAINT LUCIE	2	FORT PIERCE, FL	N 27.3486	W 80.2464	ATLANTIC OCEAN
	West Palm Beach			68,000	73 km SSE	
	Ft. Pierce MSA			250,000	14 km NW	
	Riviera Beach			28,000	65 km SSE	
	Vero Beach			34,000	36 km NNW	
	Palm Beach			10,000	72 km SSE	
26	SALEM	2	SALEM, NJ	N 39.4628	W 75.5358	DELAWARE RIVER ESTUARY
	Philadelphia PMSA			4,900,000	63 km NNE	
	Wilmington PMSA			580,000	32 km NNW	
	Vineland-Millville-Bridgeton PMSA			140,000	48 km E	
34	SAN ONOFRE	3	CAMP PENDLETON, CA	N 33.3703	W117.5569	PACIFIC OCEAN
	San Diego PMSA			2,500,000	68 km SSE	
	Anaheim-Santa Ana PMSA			2,400,000	62 km NW	
	Long Beach			430,000	75 km NW	
	Huntington Beach			180,000	61 km N	
	Riverside			230,000	68 km N	
	Pomona			130,000	79 km NNW	
73	SEABROOK	1	SEABROOK, NH	N 42.8983	W 70.8483	ATLANTIC OCEAN
	Boston-Lawrence-Salem-Lowell-Brockton NECMA			3,800,000	64 km SSW	
	Portsmouth-Dover-Rochester NECMA			350,000	22 km NNE	
	Manchester-Nashua NECMA			340,000	51 km W	
	Concord			36,000	66 km WNW	
48	SEQUOYAH	2	HAMILTON COUNTY, TN	N 35.2233	W 85.0878	TENNESSEE RIVER
	Chattanooga MSA			430,000	28 km SW	
	Cleveland			30,000	21 km SE	
	East Ridge			21,000	27 km SSW	
	Dalton			22,000	50 km S	
	Athens			12,000	53 km ENE	
72	SOUTH TEXAS	2	PALACIOS, TX	N 28.7000	W 96.2133	COLORADO RIVER
	Bay City			18,000	19 km NNE	
	Lake Jackson			23,000	67 km ENE	
	Freeport			11,000	72 km ENE	
	Angleton			17,000	74 km NE	
51	SUMMER	1	JENKINSVILLE, SC	N 34.2958	W 81.3203	PARR RESERVOIR AND BROAD RIVER
	Columbia MSA			450,000	42 km SE	
	Rock Hill			42,000	75 km NNE	
	Greenwood			21,000	78 km W	
	Union			9,800	54 km NNW	
	Laurens			9,700	68 km WNW	
35	SURRY	2	SURRY COUNTY, VA	N 37.1656	W 76.6983	JAMES RIVER ESTUARY
	Norfolk-Virginia Beach-Newport News MSA			1,400,000	50 km SE	
	Richmond-Petersburg MSA			870,000	77 km WNW	
	Williamsburg			12,000	12 km N	
52	SUSQUEHANNA	2	BERWICK, PA	N 41.1000	W 76.1500	SUSQUEHANNA RIVER
	Williamsport MSA			120,000	73 km WNW	
	Allentown-Bethlehem MSA			690,000	79 km SE	
	Scranton-Wilkes-Barre MSA			730,000	35 km NE	
	Hazleton			25,000	21 km SE	
36	THREE MILE ISLAND	2	THREE MILE ISLAND, PA	N 40.1531	W 76.7250	SUSQUEHANNA RIVER
	Harrisburg-Lebanon-Carlisle MSA			590,000	18 km NW	
	Reading MSA			340,000	71 km ENE	
	Lancaster MSA			420,000	38 km ESE	
	York MSA			420,000	21 km S	
42	TROJAN	1	PRESCOTT, OR	N 46.0408	W122.8844	COLUMBIA RIVER
	Portland-Vancouver MSA			1,500,000	60 km SSE	
	Longview			31,000	12 km NNW	
	Astoria			10,000	72 km WNW	
	Forest Grove			14,000	58 km SSW	
	Centralia			12,000	75 km N	
37	TURKEY POINT	2	DADE COUNTY, FL	N 25.4350	W 80.3314	BISCAYNE BAY

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      Miami-Hialeah PMSA                          1,900,000       41 km NNE
      Fort Lauderdale-Hollywood-
          Pompano Beach PMSA                      1,300,000       79 km NNE
      Homestead                                      29,000       16 km W
      Key Largo                                      11,000       42 km S
===
 15 VERMONT YANKEE     1 VERNON, VT              N 42.7803    W 72.5158      CONNECTICUT RIVER AT VERNON POND
      Springfield NECMA                             600,000       70 km S
      Worcester-Fitchburg-Leominster NECMA          710,000       80 km SE
      Pittsfield NECMA                              140,000       71 km SW
      Keene                                          22,000       26 km NE
      Brattleboro                                    12,000       10 km NNW
===
 71 VOGTLE             2 WAYNESBORO, GA          N 33.1419    W 81.7647      SAVANNA RIVER
      Augusta MSA                                   400,000       40 km NNW
      Fort Gordon                                     9,100       48 km NW
      Aiken                                          20,000       45 km N
      Statesboro                                     16,000       76 km S
===
 60 WATERFORD          1 TAFT, LA                N 29.9953    W 90.4728      MISSISSIPPI RIVER AND GULF
      New Orleans MSA                             1,200,000       32 km E
      Metairie                                      150,000       26 km E
      Kenner                                         72,000       16 km E
      Marrero                                        37,000       32 km ESE
      Houma                                          30,000       51 km SSW
===
 57 WNP-2              1 RICHLAND, WA            N 46.2833    W119.2916      COLUMBIA RIVER
      Richland-Kennewick-Pasco MSA                  150,000       20 km SSE
      Moses Lake                                     11,000       73 km N
===
 61 WOLF CREEK         1 BURLINGTON, KS          N 39.0267    W 84.7233      NEOSHO RIVER
      Chanute                                         9,500       62 km SSE
      Emporia                                        26,000       42 km WNW
      Ottawa                                         11,000       58 km NW
===
 38 YANKEE ROWE        1 ROWE, MA                N 42.7281    W 72.9289      DEERFIELD RIVER
      Springfield NECMA                             600,000       74 km SSE
      Albany-Schenectady-Troy MSA                   870,000       68 km W
      Pittsfield NECMA                              140,000       41 km W
      Amherst                                        35,000       51 km SE
===
 39 ZION               2 ZION, IL                N 42.4456    W 87.8022      LAKE MICHIGAN
      Chicago PMSA                                6,100,000       66 km S
      Milwaukee-Racine MSA                        1,600,000       65 km N
      Kenosha                                       130,000       14 km N
      Waukesha                                       57,000       71 km NNW
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END ------------------------------------------------------------------------
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SSDMOD.DAT ** SITE SPECIFIC DATA ** CPRD PROJECT ** Modified CMX Version UPDATED 29 Jul 94 dAb

					Liquid Pop						Liquid Indiv. Mixing				Air Pop.					
			River	D.Wat	Fish			Invert			D.Wat	Fish	Invert	Shore						
			cfs	M1	Fexposr	C2	M2	C3	M3		M1MI	M2MI	M3MI	M4MI	V2	FPM	FPB	PROD(1)	PROD(2)	PROD(3)
'1	2	3 4 5	6	7	8	9	10	11	12		13	14	15	16	17	18	19	20	21	22
1	BIG.ROCK.POINT	MI F L 0		0.0012	1	5.0E+05	0.067	0	0		0.0012	0.067	0	0.067	0.5	0.5	0.5	6.88E+07	2.87E+08	4.46E+07
2	BROWNS.FERRY	AL F R	45000	CMX	1	2.2E+05	CMX	0	0		CMX	CMX	0	CMX	1.0	0.7	0.7	1.69E+07	5.73E+07	8.64E+07
3	COOPER	NE F R	31000	CMX	0.5	5000	CMX	0	0		0.2	0.1	0	0.2	1.0	0.6	0.6	9.69E+07	7.17E+07	1.98E+08
4	DRESDEN	IL F R	13700	CMX	0	GENERIC	CMX	0	0		0.0078	0.01	0	0.01	1.0	0.5	0.5	1.13E+08	1.76E+08	1.88E+08
5	BEAVER.VALLEY	PA F R	30000	0.0017	1	410	CMX	0	0		0.0017	0.33	0	0.33	1.0	0.5	0.5	5.32E+07	5.27E+08	5.44E+07
6	HUMBOLDT.BAY	CA S B	0	0	0	4.0E+04	0.001	0.005	0.002		0	0	0	0	0.5	1.0	1.0	4.78E+07	2.32E+08	5.00E+07
7	LACROSSE	WI F R	28000	0	0.5	GENERIC	CMX	0	0		0	0.0485	0	0.0485	1.0	0.5	0.5	7.20E+07	1.17E+09	1.02E+08
8	MILLSTONE	CT S B	0	0	1	1.22E+6	0.025	8.87E+5	0.025		0	0.33	0.33	0.14	0.6	0.6	0.6	3.20E+07	4.37E+08	2.04E+07
9	MONTICELLO	MN F R	4600	0	0	0	0	0	0		0	0	0	0	1.0	0.5	0.5	1.23E+08	3.97E+08	1.05E+08
10	NINE.MILE.POINT	NY F L	0	0.01	1	7.3E+05	0.0033	0	0		0.025	1.0	0	0.083	0.7	0.5	0.5	7.63E+07	7.00E+08	3.30E+07
11	OYSTER.CREEK	NJ S C	0	0	1	2.1	0.01	0.96	0.01		0	1	1	1	0.5	0.6	0.6	7.36E+07	2.69E+08	2.40E+07
12	PEACH.BOTTOM	PA F R	36000	CMX	0.001	GENERIC	CMX	0	0		0.11	0.56	0	0.18	0.95	0.6	0.6	5.32E+07	5.27E+08	5.44E+07
13	PILGRIM	MA S B	0	0	1	2.6E+04	0.001	3.1E+04	0.002		0	0.2	0.2	1	0.3	0.6	0.6	2.01E+07	2.56E+08	1.64E+07
14	QUAD.CITIES	IL F R	47000	CMX	0.5	2.1E+06	CMX	0	0		CMX	0.38	0	0.38	1.0	0.5	0.5	1.13E+08	1.76E+08	1.88E+08
15	VERMONT.YANKEE	VT F R	10000	CMX	0.5	GENERIC	CMX	0	0		0.0356	0.0356	0	0.0356	1.0	0.4	0.4	4.37E+06	7.26E+08	2.67E+07
16	ST..LUCIE	FL S O	0	0	1	2.6E+05	0.005	2.7E+04	0.005		0	1	1	1	0.5	1.0	1.0	2.80E+07	1.12E+08	7.24E+07
17	BRUNSWICK	NC S O	0	0	1	2.1E+05	0.001	1.1E+05	0.002		0	1.0	1.0	1.0	0.3	0.7	0.7	2.56E+07	1.03E+08	5.78E+07
18	DUANE.ARNOLD	IA F R	3100	CMX	0	GENERIC	CMX	0	0		0	0	0	0	1.0	0.5	0.5	9.83E+07	2.56E+08	4.18E+08
19	FITZPATRICK	NY F L	0	0.003	1	7.3E+05	0.005	0	0		6.1E-03	0.083	0	0.056	0.7	0.5	0.5	7.63E+07	7.00E+08	3.30E+07
20	HATCH	GA F R	13000	CMX	1	6.3E+05	CMX	0	0		0	0.1	0	0.1	1.0	0.8	0.8	8.81E+06	7.04E+07	8.08E+07
21	ARKANSAS.ONE	AR F R	36000	CMX	1	1.4	CMX	0	0		1.0	1.0	0	1.0	1.0	0.7	0.7	5.77E+06	4.81E+07	7.17E+07
''22	HADDAM.NECK.FRSH	CT F C	0	1	1	1.15E6	0.018	0	0		0	1	0	1	0.7	0.6	0.6	3.20E+07	4.37E+08	2.04E+07
22	HADDAM.NECK.SALT	CT S O	0	0	1	0	0	7.45E5	2.86E-4		0	1	0	1	0.7	0.6	0.6	3.20E+07	4.37E+08	2.04E+07
23	FORT.CALHOUN	NE F R	27000	CMX	1	1.0E+04	CMX	0	0		0.0325	1.0	0	1.0	1.0	0.5	0.5	9.69E+07	7.17E+07	1.98E+08
24	ROBINSON	SC F L	0	0	0.1	1.8	0.2	0	0		0	1	0	1	1.0	0.8	0.8	7.45E+06	5.73E+07	5.01E+07
25	INDIAN.POINT	NY F R	20000	CMX	0.001	GENERIC	CMX	0	0		0	0.2	0.2	0.2	0.8	0.5	0.5	7.63E+07	7.00E+08	3.30E+07
26	SALEM	NJ S E	16500	CMX	1	3.6E+05	CMX	1.6E+05	CMX		0	1.0	1.0	1.0	0.9	0.6	0.6	7.36E+07	2.69E+08	2.40E+07
27	KEWAUNEE	WI F L	0	8.2E-3	1	1.1	0.01	0	0		0.019	1.0	0	1.0	0.5	0.5	0.5	7.20E+07	1.17E+09	1.02E+08
28	MAINE.YANKEE	ME S O	0	0	1	GENERIC	0.001	GENERIC	0.002		0	0.1	0.1	0.04	0.6	0.5	0.5	2.42E+08	6.56E+07	4.32E+06
29	OCONEE	SC F R	1100	0	0.01	GENERIC	CMX	0	0		0	1.0	0	1.0	1.0	0.7	0.7	7.45E+06	5.73E+07	5.01E+07
30	PALISADES	MI F L	0	3.5E-3	1	7.3	0.001	0	0		0.001	0.067	0	0.067	0.6	0.5	0.5	6.83E+07	2.87E+08	4.46E+07
31	POINT.BEACH	WI F L	0	2.6E-3	1	6.7E+04	0.013	0	0		0.01	0.20	0	0.20	0.5	0.5	0.5	7.20E+07	1.17E+09	1.02E+08
32	PRAIRIE.ISLAND	MN F R	15000	CMX	1	6.8E+05	CMX	0	0		0	0.3	0	0.3	1.0	0.5	0.5	1.23E+08	3.97E+08	1.05E+08
33	GINNA	NY F L	0	0.01	1	7.3E+05	0.01	0	0		0.05	1.0	0	1.0	0.6	0.5	0.5	7.63E+07	7.00E+08	3.30E+07
34	SAN.ONOFRE	CA S O	0	0	1	2.9E+04	1.0	2900	1.0		0	1.0	1.0	1.0	0.6	1.0	1.0	4.78E+07	2.32E+08	5.00E+07
35	SURRY	VA S E	25000	0	1	6.0E+05	CMX	1.1E+06	CMX		0	0.2	0.2	0.2	0.8	0.7	0.7	3.53E+07	1.50E+08	7.40E+07
36	TMI	PA F R	34000	CMX	0.025	GENERIC	CMX	0	0		CMX	0.2	0	0.2	1.0	0.5	0.5	5.32E+07	5.27E+08	5.44E+07
37	TURKEY.POINT	FL S B	0	0	1	0	0.001	0	0.002		0	0	0	1	0.4	1.0	1.0	2.80E+07	1.12E+08	7.24E+07
38	YANKEE.ROWE	MA F R	370	0	0.025	GENERIC	CMX	0	0		0	CMX	0	CMX	1.0	0.5	0.5	2.01E+07	2.56E+08	1.64E+07
39	ZION	IL F L	4E+5	1.67E-2	1	5.0E+06	CMX	0	0		1.67E-2	CMX	0	CMX	0.5	0.5	0.5	1.13E+08	1.76E+08	1.88E+08
40	CALVERT.CLIFFS	MD S B	0	0	1	1.0E+07	0.062	7.4E+06	0.062		0	1.0	1.0	1.0	0.6	0.6	0.6	4.50E+07	4.98E+08	6.17E+07
41	COOK	MI F L	0	0.025	1	1.5E+06	0.01	0	0		0.38	1.0	0	0.38	0.6	0.5	0.5	1.10E+08	2.29E+08	1.89E+08
42	TROJAN	OR F R	230000	CMX	1	1.0E+06	CMX	0	0		CMX	0.052	0	0.052	0.9	0.75	0.75	6.42E+07	3.71E+07	2.58E+07

1	2	3	4	5	River cfs 6	D.Wat M1 7	Fexposr 8	Fish C2 9	Fish M2 10	Invert C3 11	Invert M3 12	D.Wat M1MI 13	Fish M2MI 14	Invert M3MI 15	Shore M4MI 16	V2 17	FPM 18	FPB 19	PROD(1) 20	PROD(2) 21	PROD(3) 22
43	RANCHO.SECO	CA	F	C	0	0	0.01	7.3	0.0048	0	0	0	1.0	1.0	1.0	1.0	0.9	0.9	4.78E+07	2.32E+08	5.00E+07
44	CRYSTAL.RIVER	FL	S	O	0	0	1	3.2E+05	0.1	1.8E+05	0.1	1.0E-02	3.0E-01	0	1.0E-02	0.5	1.0	1.0	2.80E+07	1.12E+08	7.24E+07
45	DAVIS-BESSE	OH	F	L	0	1.6E-4	1	5.7E+06	1.8E-04	0	0	0.0175	0.1	0	0.1	0.6	0.5	0.5	6.89E+07	3.72E+08	1.15E+08
46	FARLEY	AL	F	R	12000	0	1	2.3E+05	CMX	0	0	0	0.2	0	0.2	0.95	0.8	0.8	1.69E+07	5.73E+07	8.64E+07
47	NORTH.ANNA	VA	F	L	0	0	1	7.3	0.001	0	0	0.68	1.0	0	1.0	0.9	0.7	0.7	3.53E+07	1.50E+08	7.40E+07
48	SEQUOYAH	TN	F	R	35000	CMX	1	3.8E+4	CMX	0	0	CMX	CMX	0	CMX	0.25	0.7	0.7	1.10E+07	1.64E+08	1.19E+08
49	MCGUIRE	NC	F	R	2604	1.43	1	1.3E+5	1.8	0	0	2.44	2.44	0	2.44	0.9	0.7	0.7	2.56E+07	1.03E+08	5.78E+07
50	LA.SALLE	IL	F	R	13700	CMX	0	GENERIC	CMX	0	0	CMX	CMX	0	CMX	0.9	0.5	0.5	1.13E+08	1.76E+08	1.88E+08
51	SUMMER	SC	F	R	6000	CMX	1	2.2	CMX	0	0	1.0	1.0	0	1.0	0.9	0.7	0.7	7.45E+06	5.73E+07	5.01E+07
52	SUSQUEHANNA	PA	F	R	13300	0.0033	1	4.33E4	0.0033	0	0	0.0031	0.0031	0	0.0031	0.9	0.6	0.6	5.32E+07	5.27E+08	5.44E+07
53	GRAND.GULF	MS	F	R	430000	CMX	1	7E5	CMX	7E3	CMX	0	0.5	0	0.5	0.9	0.8	0.8	4.36E+06	7.10E+07	9.88E+07
54	CALLAWAY	MO	F	R	80500	0	1	1000	CMX	0	0	0	0.011	0	0.011	0.9	0.6	0.6	3.29E+07	1.54E+08	1.94E+08
55	LIMERICK	PA	F	R	3010	4.8E-3	0	0	0	0	0	4.8E-3	0.013	0	0.013	0.9	0.6	0.6	5.32E+07	5.27E+08	5.44E+07
56	DIABLO.CANYON	CA	S	O	0	0	1	2E6	0.001	0	0	0	0.2	0.2	0.2	0.5	1.0	1.0	4.78E+07	2.32E+08	5.00E+07
57	WNP-2	WA	F	R	115000	2E-5	1	7500	CMX	0	0	2E-5	5E-4	0	5E-4	0.8	0.7	0.7	2.11E+08	1.22E+08	3.17E+07
58	PALO.VERDE	AZ	F	-	0	0	0	0	0	0	0	0	0	0	0	0.9	0.1	0.9	1.17E+07	2.29E+07	2.11E+07
59	BYRON	IL	F	R	4700	0	1	2.1E4	CMX	0	0	7.7E-04	CMX	0	CMX	0.9	0.5	0.5	1.13E+08	1.76E+08	1.88E+08
''60	WATERFORD.RIVR	LA	F	R	493000	CMX	1	4500	CMX	0	0	4.5E-03	1.0	0	1.0	0.6	1.0	1.0	1.76E+06	7.84E+07	6.10E+07
60	WATERFORD.GULF	LA	S	O	493000	0	0.1	9.1E5	CMX	5.1E6	CMX	0	0	0	0	0.6	1.0	1.0	1.76E+06	7.84E+07	6.10E+07
61	WOLF.CREEK	KS	F	R	1335	0	1	1.83	CMX	0	0	1.0	1.0	0	1.0	0.95	0.5	0.5	2.42E+08	6.52E+07	1.64E+08
62	CATAWBA	SC	F	R	4400	0	1	1.0E6	CMX	0	0	0.0265	1.0	0	1.0	0.9	0.75	0.75	7.45E+06	5.73E+07	5.01E+07
63	FERMI	MI	F	L	0	5.6E-4	1	8.9E6	0.001	0	0	0.013	0.2	0	0.2	0.6	0.5	0.5	6.83E+07	2.87E+08	4.46E+07
64	SHOREHAM	NY	S	S	0	0	1	2.9E5	0.001	3.6E5	0.1	0	0.113	0.113	0.113	0.5	0.6	0.6	7.63E+07	7.00E+08	3.30E+07
65	HOPE.CREEK	NJ	S	E	16500	0	1	3.6E5	CMX	1.6E5	CMX	0	0.05	0.05	0.05	0.8	0.6	0.6	7.36E+07	2.69E+08	2.40E+07
66	PERRY	OH	F	L	0	3.18E-3	1	GENERIC	0.0129	0	0	0.0311	0.0917	0	0.069	0.45	0.5	0.5	6.89E+07	3.72E+06	1.15E+08
67	RIVER.BEND	LA	F	R	419000	0	0.1	4.6	CMX	4.6	CMX	5.2E-07	0.0129	0.0129	0.0129	0.9	0.75	0.75	1.76E+06	7.84E+07	6.10E+07
68	BRAIDWOOD	IL	F	R	5630	0	0.1	1.83	CMX	0	0	0.043	CMX	0	CMX	0.9	0.5	0.5	1.13E+08	1.76E+08	1.88E+08
69	CLINTON	IL	F	L	0	0	0.1	1.83	0.25	0	0	0	1.0	0	1.0	0.9	0.5	0.5	1.13E+08	1.76E+08	1.88E+08
70	SHEARON.HARRIS	NC	F	R	3200	CMX	0.01	2.4	1.0	0	0	1.2E-3	0.016	0	0.016	0.9	0.72	0.72	2.56E+07	1.03E+08	5.78E+07
71	VOGTLE	GA	F	R	10150	0	0.1	1.83	CMX	0	0	CMX	0.083	0	0.083	0.8	0.75	0.75	8.81E+06	7.04E+07	8.08E+07
'----- South Texas Salt and fresh paths ---------------																					
'----- Colorado River ----------																					
72	SOUTH.TEXAS	TX	S	R	600	0	1	1.1E5	1	0	1	0	1.0	1.0	1.0	0.4	0.9	0.9	2.34E+07	4.34E+07	1.08E+08
'----- Matagordo Bay ----------																					
'72	SOUTH.TEXAS	TX	S	B	600	0	1	1.1E5	0.0061	8.9E6	0.0061	0	0.0061	0.0061	0.0061	0.4	0.9	0.9	2.34E+07	4.34E+07	1.08E+08
'---- Little Robins Area ------																					
'72	SOUTH.TEXAS	TX	F	R	600	0	1	0	33.	0	33.	0	33.	0	33	0.4	0.9	0.9	2.34E+07	4.34E+07	1.08E+08
73	SEABROOK	NH	S	O	0	0	1	5.7E4	0.29	0	0	0	0.025	0.025	0.025	0.4	0.5	0.5	2.71E+06	1.29E+08	7.91E+06
74	COMANCHE.PEAK	TX	F	L	0	0	0.1	1.83	1.0	0	0	1	1	0	1	0.9	0.75	0.75	2.34E+07	4.34E+07	1.08E+08

Column groups: 6–12 Liquid Pop (Fish: 8–10; Invert: 11–12); 13–16 Liquid Indiv. Mixing; 17–22 Air Pop.

' Notes:
' CMX = Complete MiXing in river or estuary: Pipeflow / Riverflow
' Mixing ratios for rivers & estuaries now given as fractions of PipeFlow if not CMX.
' GENERIC = Generic average consumption rates for population in kg/y.
' Pop fish & invert cons rates given as kg/y edible harvest when > 100 otherwise they are given as avg indiv rates in kg/y.
' Note Haddam Neck and Waterford should be run twice: For both salt and fresh water.
' South texas should be run 3 times. Dont forget to change the REL file in CPRD.SET.
EOF

D.9 CPRD.SET

```
NEWCPRD.SET  ---  New setup file for Programs in \Y91\PROG  29 JUL 94  dAb
'     This setup file for new G E M release types.

'--- Keyword --- Subdirectory ------- Files ----------------------

  YEAR          91
  DOSEfactors   \DATA\GENERIC\   INFANT.DAT  CHILD.DAT  TEEN.DAT  ADULT.DAT
  GAMMA         \DATA\GENERIC\   AIRGAMMA.DAT
  GENeric       \DATA\GENERIC\   GENERIC2.DAT
  JFD           \Y91\XOQIN\      XOQYYSnn.INx
' JFD           \Y91\JFDAG\      JFDYYSnn.INx
  SITEspecific  \DATA\GENERIC\   SSDMOD.DAT
  POPulation    F:               POP80Snn.DAT
  CHIoverq      F:               CHIYYSnn.DAx

  RELeases      \Y91\REL\        RELYYSnn.DAT     ' For all sites except South Texas
' RELeases      \Y91\REL\        RELYYS72.RIV     ' Special for South Texas Colo. River
' RELeases      \Y91\REL\        RELYYS72.BAY     ' Special for South Texas Matagorda Bay
' RELeases      \Y91\REL\        RELYYS72.LRA     ' Special for South Texas Little Robins Area

'-------------  Output files  -----------------------------------

  SUMmary       F:                SUMYYSnn.OUx
  AIRout        F:                AIRYYSnn.OUx
  LIQuidout     F:                LIQYYSnn.OUT

'---------------------  Notes -------------------------------------

'  This file must be in default subdirectory.

'   ------ Command line ----------------------    -- Examples ---

'   CPA SiteNum RelType [ NucNum SecNum ]             CPA 69 G 56 6   CPA 70 M

'   CPL SiteNum  [ NucNum ]                           CPL 69 56       CPL 70

'   AG Sitenum  Location Distance Direction RelType   AG 69 SB 300 SSE E

'   CPRDUMP FileSpec                                  CPRDUMP  F:SUM87S69.OUG

'   CPRDPRNT FileSpec                                 CPRDPRNT F:SUM87S69.OUG
'                                                              F:AIR87S69.OUG
'                                                              F:LIQ87S69.OUT

'  nn = SiteNum 01 to 73
'  x  = RelType for air releases: G, E, or M.
'  YY = Year of release
'  Location = SB or RES  (Site Boundary or RESidence)

EOF ------------------------------------------------------------------------
```

D.10 POPyySnn.DAT Example

```
POP78S01.DAT  ***  1970 POPULATION BIG ROCK PT 1   (KM) 45.3589   85.1958   CPRD75   8APR77 ERH
23300         DRINKING WATER POP  (1970)
   N            0          0          0          0          0          0          0          0          0          0
   NNE          0          0          0          0          0          0        234        185        282       4112
   NE           0          0          0          0          0        420        364       1184       1566       1699
   ENE          0          0          0          0          0       1662        985       1958       2927       7944
   E          311          0          0          0        619       7001       1791        663       1901       3551
   ESE          0          0          0          0        456        390        830         89       1864       1080
   SE           0          0          0        395          0        440       2969       1300       7197       1655
   SSE          0          0          0          0          0        487       2201        303       2957       1393
   S            0          0          0          0        350        474       1373       2459       2176       3587
   SSW          0          0          0          0        694          0        869        621       3618      30580
   SW           0          0        693       3546          0        325          0          0       3529       3167
   WSW          0          0          0          0          0          0          0          0          0          6
   W            0          0          0          0          0          0          0          0          0          0
   WNW          0          0          0          0          0          0          0          0          0          0
   NW           0          0          0          0          0          0          0          0         58          0
   NNW          0          0          0          0          0          0          0          0        161          0
```

CHI78S01.DAE Big Rock Point QA CHI File 2-80 km CPRD75 *** 18APR77 *** PJL NEW FORMAT Feb 92
9 FEB 61 - 8 FEB 63 85%

NO DECAY	UN DEPLETED		DILUTION FACTORS	(S*M**-3)						
N	2.468E-07	1.919E-07	1.351E-07	8.632E-08	5.190E-08	3.195E-08	1.964E-08	1.274E-08	8.075E-09	5.220E-09
NNE	1.520E-07	1.191E-07	8.449E-08	5.448E-08	3.309E-08	2.056E-08	1.275E-08	8.340E-09	5.326E-09	3.470E-09
NE	1.454E-07	1.170E-07	8.471E-08	5.557E-08	3.421E-08	2.146E-08	1.340E-08	8.817E-09	5.657E-09	3.700E-09
ENE	1.723E-07	1.336E-07	9.396E-08	6.002E-08	3.614E-08	2.229E-08	1.373E-08	8.933E-09	5.675E-09	3.679E-09
E	2.719E-07	2.053E-07	1.412E-07	8.814E-08	5.198E-08	3.150E-08	1.911E-08	1.227E-08	7.704E-09	4.936E-09
ESE	1.678E-07	1.240E-07	8.377E-08	5.140E-08	2.984E-08	1.784E-08	1.070E-08	6.797E-09	4.224E-09	2.680E-09
SE	1.602E-07	1.193E-07	8.099E-08	4.985E-08	2.899E-08	1.735E-08	1.040E-08	6.611E-09	4.107E-09	2.604E-09
SSE	1.778E-07	1.321E-07	8.968E-08	5.527E-08	3.220E-08	1.931E-08	1.160E-08	7.383E-09	4.595E-09	2.919E-09
S	1.791E-07	1.319E-07	8.895E-08	5.449E-08	3.159E-08	1.887E-08	1.130E-08	7.178E-09	4.458E-09	2.827E-09
SSW	1.518E-07	1.154E-07	7.967E-08	4.994E-08	2.953E-08	1.793E-08	1.090E-08	7.003E-09	4.398E-09	2.819E-09
SW	1.209E-07	9.326E-08	6.511E-08	4.120E-08	2.454E-08	1.498E-08	9.138E-09	5.890E-09	3.708E-09	2.382E-09
WSW	1.543E-07	1.195E-07	8.345E-08	5.271E-08	3.132E-08	1.907E-08	1.160E-08	7.463E-09	4.688E-09	3.004E-09
W	3.238E-07	2.551E-07	1.806E-07	1.156E-07	6.958E-08	4.282E-08	2.630E-08	1.705E-08	1.080E-08	6.969E-09
WNW	1.477E-07	1.180E-07	8.508E-08	5.567E-08	3.425E-08	2.150E-08	1.344E-08	8.855E-09	5.691E-09	3.729E-09
NW	1.258E-07	9.842E-08	6.959E-08	4.459E-08	2.687E-08	1.657E-08	1.019E-08	6.618E-09	4.195E-09	2.713E-09
NNW	1.302E-07	1.009E-07	7.079E-08	4.505E-08	2.699E-08	1.656E-08	1.015E-08	6.566E-09	4.150E-09	2.676E-09
2.260 DAY DECAY	UN DEPLETED		DILUTION FACTORS	(S*M**-3)						
N	2.454E-07	1.905E-07	1.337E-07	8.492E-08	5.062E-08	3.079E-08	1.860E-08	1.181E-08	7.262E-09	4.509E-09
NNE	1.512E-07	1.182E-07	8.365E-08	5.366E-08	3.233E-08	1.987E-08	1.213E-08	7.778E-09	4.829E-09	3.031E-09
NE	1.446E-07	1.161E-07	8.378E-08	5.466E-08	3.335E-08	2.067E-08	1.269E-08	8.171E-09	5.085E-09	3.195E-09
ENE	1.713E-07	1.325E-07	9.283E-08	5.894E-08	3.515E-08	2.139E-08	1.293E-08	8.216E-09	5.048E-09	3.130E-09
E	2.699E-07	2.033E-07	1.391E-07	8.626E-08	5.029E-08	3.000E-08	1.780E-08	1.112E-08	6.706E-09	4.076E-09
ESE	1.665E-07	1.227E-07	8.250E-08	5.024E-08	2.882E-08	1.694E-08	9.921E-09	6.120E-09	3.647E-09	2.188E-09
SE	1.590E-07	1.181E-07	7.978E-08	4.874E-08	2.801E-08	1.648E-08	9.656E-09	5.957E-09	3.550E-09	2.129E-09
SSE	1.766E-07	1.308E-07	8.841E-08	5.410E-08	3.116E-08	1.839E-08	1.081E-08	6.691E-09	4.004E-09	2.415E-09
S	1.777E-07	1.305E-07	8.760E-08	5.326E-08	3.052E-08	1.794E-08	1.050E-08	6.483E-09	3.869E-09	2.327E-09
SSW	1.504E-07	1.140E-07	7.829E-08	4.865E-08	2.838E-08	1.692E-08	1.001E-08	6.224E-09	3.730E-09	2.247E-09
SW	1.199E-07	9.217E-08	6.402E-08	4.017E-08	2.361E-08	1.415E-08	8.406E-09	5.243E-09	3.150E-09	1.901E-09
WSW	1.531E-07	1.182E-07	8.213E-08	5.146E-08	3.019E-08	1.806E-08	1.072E-08	6.681E-09	4.014E-09	2.425E-09
W	3.211E-07	2.521E-07	1.776E-07	1.128E-07	6.698E-08	4.048E-08	2.422E-08	1.520E-08	9.188E-09	5.577E-09
WNW	1.464E-07	1.166E-07	8.358E-08	5.421E-08	3.288E-08	2.024E-08	1.230E-08	7.823E-09	4.780E-09	2.929E-09
NW	1.248E-07	9.736E-08	6.851E-08	4.357E-08	2.594E-08	1.572E-08	9.442E-09	5.950E-09	3.615E-09	2.209E-09
NNW	1.292E-07	9.990E-08	6.982E-08	4.413E-08	2.616E-08	1.581E-08	9.487E-09	5.981E-09	3.642E-09	2.235E-09
8.000 DAY DECAY	DEPLETED		DILUTION FACTORS	(S*M**-3)						
N	2.446E-07	1.898E-07	1.332E-07	8.474E-08	5.070E-08	3.103E-08	1.893E-08	1.219E-08	7.638E-09	4.830E-09
NNE	1.508E-07	1.178E-07	8.339E-08	5.358E-08	3.240E-08	2.003E-08	1.234E-08	8.015E-09	5.069E-09	3.234E-09
NE	1.446E-07	1.162E-07	8.393E-08	5.491E-08	3.368E-08	2.103E-08	1.306E-08	8.529E-09	5.418E-09	3.469E-09
ENE	1.707E-07	1.320E-07	9.250E-08	5.883E-08	3.523E-08	2.159E-08	1.320E-08	8.511E-09	5.343E-09	3.383E-09
E	2.686E-07	2.020E-07	1.382E-07	8.578E-08	5.020E-08	3.017E-08	1.812E-08	1.150E-08	7.109E-09	4.433E-09
ESE	1.651E-07	1.213E-07	8.142E-08	4.954E-08	2.846E-08	1.682E-08	9.953E-09	6.234E-09	3.804E-09	2.342E-09
SE	1.580E-07	1.171E-07	7.907E-08	4.832E-08	2.785E-08	1.650E-08	9.776E-09	6.129E-09	3.742E-09	2.305E-09
SSE	1.751E-07	1.294E-07	8.730E-08	5.338E-08	3.079E-08	1.827E-08	1.084E-08	6.809E-09	4.166E-09	2.573E-09
S	1.761E-07	1.290E-07	8.637E-08	5.244E-08	3.008E-08	1.776E-08	1.050E-08	6.573E-09	4.010E-09	2.470E-09
SSW	1.500E-07	1.136E-07	7.808E-08	4.864E-08	2.855E-08	1.718E-08	1.032E-08	6.553E-09	4.047E-09	2.519E-09
SW	1.197E-07	9.207E-08	6.405E-08	4.032E-08	2.386E-08	1.445E-08	8.725E-09	5.559E-09	3.444E-09	2.149E-09
WSW	1.533E-07	1.185E-07	8.252E-08	5.192E-08	3.069E-08	1.856E-08	1.120E-08	7.126E-09	4.411E-09	2.750E-09
W	3.222E-07	2.534E-07	1.790E-07	1.143E-07	6.846E-08	4.188E-08	2.551E-08	1.637E-08	1.021E-08	6.415E-09

WNW	1.467E-07	1.169E-07	8.406E-08	5.480E-08	3.353E-08	2.090E-08	1.295E-08	8.436E-09	5.336E-09	3.396E-09
NW	1.247E-07	9.733E-08	6.860E-08	4.377E-08	2.623E-08	1.606E-08	9.794E-09	6.294E-09	3.933E-09	2.477E-09
NNW	1.289E-07	9.961E-08	6.966E-08	4.413E-08	2.628E-08	1.602E-08	9.731E-09	6.237E-09	3.890E-09	2.447E-09
RELATIVE DEPOSITION PER UNIT AREA (M**-2)										
N	3.718E-10	2.304E-10	1.330E-10	6.851E-11	3.293E-11	1.617E-11	8.201E-12	4.820E-12	3.534E-12	3.240E-12
NNE	2.477E-10	1.534E-10	8.856E-11	4.560E-11	2.192E-11	1.078E-11	5.473E-12	3.223E-12	2.371E-12	2.180E-12
NE	1.524E-10	9.433E-11	5.447E-11	2.805E-11	1.348E-11	6.628E-12	3.385E-12	2.068E-12	1.748E-12	1.843E-12
ENE	3.231E-10	2.003E-10	1.157E-10	5.957E-11	2.862E-11	1.404E-11	7.100E-12	4.109E-12	2.831E-12	2.409E-12
E	6.485E-10	4.018E-10	2.321E-10	1.195E-10	5.743E-11	2.819E-11	1.422E-11	8.062E-12	5.033E-12	3.700E-12
ESE	5.293E-10	3.282E-10	1.896E-10	9.764E-11	4.690E-11	2.301E-11	1.157E-11	6.484E-12	3.826E-12	2.546E-12
SE	4.858E-10	3.012E-10	1.740E-10	8.959E-11	4.304E-11	2.112E-11	1.063E-11	5.967E-12	3.555E-12	2.409E-12
SSE	5.747E-10	3.563E-10	2.058E-10	1.060E-10	5.092E-11	2.498E-11	1.257E-11	7.054E-12	4.184E-12	2.811E-12
S	4.404E-10	2.728E-10	1.575E-10	8.112E-11	3.899E-11	1.915E-11	9.656E-12	5.445E-12	3.296E-12	2.293E-12
SSW	2.106E-10	1.305E-10	7.540E-11	3.883E-11	1.865E-11	9.154E-12	4.619E-12	2.638E-12	1.710E-12	1.335E-12
SW	1.692E-10	1.049E-10	6.058E-11	3.119E-11	1.499E-11	7.358E-12	3.716E-12	2.130E-12	1.402E-12	1.119E-12
WSW	1.498E-10	9.271E-11	5.353E-11	2.756E-11	1.325E-11	6.516E-12	3.311E-12	1.950E-12	1.435E-12	1.320E-12
W	1.480E-10	9.170E-11	5.296E-11	2.727E-11	1.311E-11	6.438E-12	3.297E-12	2.069E-12	1.914E-12	2.170E-12
WNW	8.857E-11	5.489E-11	3.171E-11	1.633E-11	7.845E-12	3.852E-12	1.960E-12	1.183E-12	9.615E-13	9.810E-13
NW	1.184E-10	7.345E-11	4.244E-11	2.186E-11	1.050E-11	5.144E-12	2.601E-12	1.527E-12	1.126E-12	1.042E-12
NNW	1.535E-10	9.510E-11	5.493E-11	2.828E-11	1.359E-11	6.674E-12	3.383E-12	1.983E-12	1.440E-12	1.307E-12

SPECIFIC POINTS OF INTEREST (Big rock point 1989 factors)

RELEASE ID	TYPE OF LOCATION	DIRECTION FROM SITE	DISTANCE (MILES)	DISTANCE (METERS)	X/Q (s/m3)	X/Q (s/m3)	X/Q (s/m3)	D/Q (1/m2)
A	Site-Boundary	E	.57	917.	5.23E-08	5.22E-08	5.16E-08	1.45E-09
A	Residence	E	1.40	2253.	6.11E-08	6.09E-08	5.97E-08	7.64E-10
A	Garden	E	1.40	2253.	6.11E-08	6.09E-08	5.97E-08	7.64E-10
A	Pasture COW	E	2.50	4022.	4.33E-08	4.31E-08	4.17E-08	3.97E-10

EOF **********

D.12 RELyySnn.DAT Example

REL78S01.DAT *** 1978 RELEASES TO AIR AND WATER FROM COMMERCIAL POWER REACTORS *** New format - Feb 92 ***
dAb
01, BIG ROCK POINT, 1.034, 9.66E10, 4.01E+5

NO.	NUCLIDE	AIR (Ci/year) G	AIR (Ci/year) E	AIR (Ci/year) M	WATER (Ci/year)	RECIRC
1	H3	0.0	8.32E+00	0.0	4.05E+00	1.0
4	N13	0.0	4.01E+03	0.0	0.00E+00	1.0
10	CR51	0.0	1.23E-05	0.0	0.00E+00	1.0
11	MN54	0.0	3.13E-03	0.0	5.86E-03	1.0
14	FE59	0.0	0.00E+00	0.0	2.10E-04	1.0
16	CO58	0.0	0.00E+00	0.0	1.19E-04	1.0
17	CO60	0.0	3.90E-04	0.0	2.34E-02	1.0
25	BR82	0.0	7.62E-03	0.0	0.00E+00	1.0
26	KR83M	0.0	4.85E+02	0.0	0.00E+00	1.0
27	KR85M	0.0	8.05E+02	0.0	0.00E+00	1.0
28	KR85	0.0	4.00E+00	0.0	0.00E+00	1.0
29	KR87	0.0	1.77E+03	0.0	0.00E+00	1.0
30	KR88+D	0.0	1.31E+03	0.0	0.00E+00	1.0
31	KR89	0.0	4.34E+02	0.0	0.00E+00	1.0
34	SR89+D	0.0	0.00E+00	0.0	5.87E-04	1.0
35	SR90+D	0.0	0.00E+00	0.0	3.67E-04	1.0
45	TC99M	0.0	1.47E-01	0.0	0.00E+00	1.0
56	I131+D	0.0	2.87E-03	0.0	0.00E+00	1.0
58	I133+D	0.0	2.35E-02	0.0	0.00E+00	1.0
60	I135+D	0.0	1.20E-01	0.0	0.00E+00	1.0
61	XE131M	0.0	4.00E+00	0.0	0.00E+00	1.0
62	XE133M	0.0	3.61E+01	0.0	0.00E+00	1.0
63	XE133	0.0	3.87E+02	0.0	0.00E+00	1.0
64	XE135M	0.0	1.09E+03	0.0	0.00E+00	1.0
65	XE135	0.0	2.82E+03	0.0	0.00E+00	1.0
66	XE137	0.0	7.19E+02	0.0	0.00E+00	1.0
67	XE138+D	0.0	5.13E+03	0.0	0.00E+00	1.0
68	CS134	0.0	1.78E-05	0.0	2.25E-02	1.0
70	CS137+D	0.0	3.12E-04	0.0	1.64E-01	1.0
74	BA140+D	0.0	4.00E-03	0.0	0.00E+00	1.0
75	LA140	0.0	4.00E-03	0.0	8.09E-05	1.0
83	NP239	0.0	2.28E-04	0.0	0.00E+00	1.0

EOF ----------

D.13 XOQyySnn.INx Example

```
000000000000
BIG ROCK POINT     XOQ Input file for 1992      E
    7    7    0   15    4    1    0
 71.3 101. 2.26 -8.0  0.0
  0.0  0.0  0.0  0.0  0.0  0.0  0.0
'-------------------------------------------------------------------------------
' BIG ROCK POINT 1992 JFD, 71.3M
'   N  NNE   NE  ENE    E  ESE   SE  SSE    S  SSW   SW  WSW    W  WNW   NW  NNW
A
    3    4    1    0    0    0    0    0    0    0    1    0    5    3    3    1
    7    8    1    0    0    0    0    0    0    0    2    1   11    6    6    2
    2    1    0    0    0    0    0    0    0    0    1    4    3    3    4    0
    1    0    1    0    0    0    0    0    0    0    0    1    1    1    1    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
B
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    7    5    0    0    0    0    0    0    0    0    6    2    7    4    7    5
    2    2    0    0    0    0    0    0    0    1    6    7    8   11    7    3
    0    2    1    0    0    0    0    0    0    0    1    2    1    2    4    1
    1    0    0    0    0    0    0    0    0    0    0    0    2    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
C
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    3    7    3    0    0    0    0    0    0    3    3    2    7    3    3    7
    5   11    0    0    0    0    0    0    0    6   11   21   28   23   15    6
    5    3    2    0    0    0    0    0    0    0   10   15   26   17    9    4
    0    1    1    0    0    0    0    0    0    0    3    4    4    7    1    1
    0    0    0    0    0    0    0    0    0    0    1    0    0    5    2    1
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
D
    0    0    0    0    0    0 2775    0    0    0    0    0    0    0    0    0
   13   17    3    0    0    0    0    0    0    4    1    2    7    8   10    5
   34   39   20    0    0    0    0    0    0   24   17   32   37   32   31   14
   27   17   13    0    0    0    0    0    0   37   28   90   77   37   28   37
   13    6    1    0    0    0    0    0    0   43   69   67   34   28   22   33
    3    5    0    0    0    0    0    0    0   15   18   31   20   36   34   21
    0    0    0    0    0    0    0    0    0    0    3    5   16   37   32    4
E
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    3    4    3    0    0    0    0    0    0    2    0    1    3    1    0    1
   49   37   52    0    0    0    0    0    0   24   25   16   11    9   16   29
   67   64   83    0    0    0    0    0    0   87   48   56   18   22   20   59
  128   85   73    0    0    0    0    0    0  198   87   94   50   39   41  132
   88   36   25    0    0    0    0    0    0  121   95   84   31   25   49  119
   83   40    2    0    0    0    0    0    0   22   49   62   52   42   85  105
F
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    1    0    0    0    0    0    0    0    0    0    0    0    0    0
    6    5   16    0    0    0    0    0    0    6    5    2    1    1    2    2
   48   36   26    0    0    0    0    0    0   37   12    9    5    2    2   10
  101   40   40    0    0    0    0    0    0   88   12    8    2    6   12   40
   83   28   17    0    0    0    0    0    0   58    2    2    3    9    6   37
   53   19    6    0    0    0    0    0    0    9    0    1    2    4    9   11
G
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0    0
    0    0    1    0    0    0    0    0    0    0    0    1    0    0    0    0
    5    1    4    0    0    0    0    0    0   16    0    0    0    0    0    2
   40   20   12    0    0    0    0    0    0   37    0    0    1    0    1    7
   35   15    8    0    0    0    0    0    0   27    0    0    0    0    3   10
   19    3    2    0    0    0    0    0    0    3    0    0    0    1    0    2
'-------------------------------------------------------------------------------
```

```
  -1.  0.4  1.5    3    5  7.5   10   16
    1    1    1    1
 Site-Boundary
   13  917
 Residence
   13 2253
 Garden
   13 2253
 Pasture
   13 4022
 Big Rock Point                                          1992       01  E
 20.4 1.08 -73.  0.0  0.0 73.0  0.0
A   0    0    0
Big Rock Point   ¦  4-NOV-94 dAb     ¦ 01-JAN-92 31-DEC-92  00
NOTES:  Elev release 73 m --  71 m met
```

Appendix E

Output File Listings

APPENDIX E. OUTPUT FILE LISTINGS

This appendix displays listings of typical output files generated by the CPRD programs. Since each site-specific file is similar for each site, only one of each type is listed as an example. A list of listings is given below.

Appendix E

E.1 Dump of SUMyySnn.OUx Output File Example

```
Dump of SUM91S01.OUE

 1  CPRDA was last run: 13:52   06-APR-94  from  VERSION OF  5-Apr-94  with Command Line: 01  E   Site: 1  BIG.ROCK.POINT    MI
 2  CPRDL was last run: 13:52   06-APR-94  from  VERSION OF  5-Apr-94  with Command line: 01   Site: 1  BIG.ROCK.POINT    MI
 3
 4
 5  SSDMOD.DAT  **  SITE SPECIFIC DATA  **  CPRD PROJECT  **  Modified CMX Version          UPDATED 24 Aug 93 dAb
 6  POP82S01.DAT  1981 POPULATION BIG ROCK POINT   (km)  45.3592   85.1947    CPRD  23-JUL-85  dAB
 7   CHI91S01.DAE    Big Rock Point    |  AIR TRANSPORT FACTORS (2-80km)    14-OCT-93   dAb    |
 8   01-JAN-91 TO 31-DEC-91      0% Data recovery   NOTES:  Elev release 73 m --  70 m met
 9  REL91S01.DAT *** 91 RELEASE FILE - CPRD *** 11:03   16-NOV-93  dAb
10   GENERIC2.DAT    CPRD generic file of decay rates & transfer factors.  27 Nov 90 dAb
11   INFANT.DAT     INFANT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)  CPRD  20 SEP 1991
12   CHILD.DAT      CHILD CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)   CPRD  20 SEP 1991
13   TEEN.DAT       TEEN CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)    CPRD  20 SEP 1991
14   ADULT.DAT      ADULT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)   CPRD  20 SEP 1991
15   SSDMOD.DAT  **  SITE SPECIFIC DATA  **  CPRD PROJECT  **  Modified CMX Version          UPDATED 24 Aug 93 dAb
16   POP82S01.DAT  1981 POPULATION BIG ROCK POINT   (km)  45.3592   85.1947    CPRD  23-JUL-85  dAB
17   REL91S01.DAT *** 91 RELEASE FILE - CPRD *** 11:03   16-NOV-93  dAb
18   GENERIC2.DAT    CPRD generic file of decay rates & transfer factors.  27 Nov 90 dAb
19   INFANT.DAT     INFANT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)  CPRD  20 SEP 1991
20   - ES FRESH FISH Avg. Cons(kg/y)= 0.0000     -- ES FRESH INVERT Avg. Cons(kg/y)= 0.0000
21   CHILD.DAT      CHILD CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)   CPRD  20 SEP 1991
22   - ES FRESH FISH Avg. Cons(kg/y)= 1.1063     -- ES FRESH INVERT Avg. Cons(kg/y)= 0.0000
23   TEEN.DAT       TEEN CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)    CPRD  20 SEP 1991
24   - ES FRESH FISH Avg. Cons(kg/y)= 2.6148     -- ES FRESH INVERT Avg. Cons(kg/y)= 0.0000
25   ADULT.DAT      ADULT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)   CPRD  20 SEP 1991
26   - ES FRESH FISH Avg. Cons(kg/y)= 3.4697     -- ES FRESH INVERT Avg. Cons(kg/y)= 0.0000
27   7070          DRINKING WATER
28
29   Appl-Water  5.01E-06  6.96E-03  4.07E-05   7.00E-03   0.23%    5.56E-06. 1.14E-02   1.14E-02   0.11%  Teen    Liver
30    Site-Boundary    917      E  5.54E-08  5.53E-08  5.47E-08  1.68E-09
31    Residence       2253      E  6.24E-08  6.23E-08  6.10E-08  8.29E-10
32    Garden          2253      E  6.24E-08  6.23E-08  6.10E-08  8.29E-10
33    Pasture         4022      E  4.70E-08  4.68E-08  4.55E-08  4.13E-10
34    6.2E-06 1.1E-04 1.1E-06 6.7E-06 7.1E-04 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 2.5E-05 4.8E-03 7.9E-05 8.4E-05 2.2E-05
35    1.1E-05 1.2E-04 1.9E-06 1.1E-05 9.9E-04 6.0E-05 9.6E-04 4.4E-04 1.1E-04 4.5E-05 2.0E-05 2.0E-03 4.9E-05 4.7E-05 1.6E-05
36    1.3E-05 1.0E-04 1.7E-06 1.3E-05 1.8E-03 5.7E-05 6.2E-04 2.1E-04 6.6E-05 2.9E-05 1.9E-05 1.0E-03 2.1E-05 2.9E-05 1.0E-05
37    1.3E-05 8.3E-05 1.4E-06 1.2E-05 1.0E-03 5.3E-05 7.4E-04 1.5E-04 4.9E-05 2.4E-05 1.8E-05 6.5E-04 1.3E-05 2.0E-05 8.6E-06
38    D-Water      0.0012     5.0E-06     1.8E-05     2.6E-07     6.3E-06     6.0E-06
39    Fish         0.0670     7.0E-03     4.8E-03     5.3E-07     7.0E-03     1.1E-02
40    Invert       0.0000     0.0E+00     0.0E+00     0.0E+00     0.0E+00     0.0E+00
41    Shore        0.0670     4.1E-05     0.0E+00     0.0E+00     0.0E+00     0.0E+00
42    INFANT        3.3E-07      2.8E-07      1.9E-08      6.0E-07      7.2E-07
43    CHILD         8.2E-03      4.6E-03      1.2E-06      4.0E-02      4.4E-02
44    TEEN          1.3E-02      1.0E-02      9.9E-07      2.4E-02      3.7E-02
45    ADULT         1.4E-01      9.4E-02      7.9E-06      1.4E-01      2.2E-01
46   TOTAL          1.6E-01      1.1E-01      1.0E-05      2.0E-01      3.0E-01
47   INFANT         7.1E-04  7.1E-04  8.0E-04  7.1E-04  7.1E-04  7.3E-04
48   CHILD          7.9E-03  7.9E-03  8.9E-03  7.9E-03  7.9E-03  8.2E-03
49   TEEN           5.8E-03  5.8E-03  6.2E-03  5.8E-03  5.8E-03  6.2E-03
50   ADULT          3.5E-02  3.5E-02  3.7E-02  3.5E-02  3.5E-02  3.6E-02
51   TOTAL          5.0E-02  5.0E-02  5.2E-02  4.9E-02  5.0E-02  5.2E-02
52   PRODUCE : 1.          MILK : 6.4          MEAT : 1.6
53     1  0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 3.74E-08
54     2  0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 1.94E-05 1.87E-04 2.01E-04 5.27E-05 5.69E-04
55     3  0.00E+00 0.00E+00 0.00E+00 2.83E-05 9.79E-05 3.33E-04 2.03E-04 2.37E-04 3.20E-04 1.02E-04
56     4  0.00E+00 1.83E-04 3.38E-04 2.89E-04 0.00E+00 2.19E-03 1.16E-03 4.44E-04 4.88E-04 5.95E-04
57     5  1.84E-04 2.73E-04 5.78E-04 7.56E-04 1.45E-03 4.46E-03 1.42E-03 2.35E-04 1.64E-04 1.19E-04
58     6  1.47E-04 9.86E-05 2.47E-04 2.86E-04 4.92E-04 4.13E-04 1.69E-04 3.67E-05 1.36E-04 2.57E-05
59     7  5.18E-05 7.65E-05 1.35E-04 2.04E-04 2.76E-04 3.51E-04 9.04E-04 7.45E-05 5.08E-04 5.43E-05
60     8  8.25E-05 1.28E-04 3.46E-04 3.73E-04 3.99E-04 5.65E-04 1.25E-03 1.42E-04 3.85E-04 1.39E-04
61     9  5.77E-05 2.13E-04 5.29E-04 4.23E-04 4.16E-04 4.09E-04 1.06E-03 6.09E-04 7.39E-04 5.13E-04
62    10  9.59E-05 1.60E-04 3.18E-04 2.78E-04 5.20E-04 4.01E-04 4.66E-04 1.59E-04 3.97E-04 1.69E-03
63    11  1.40E-04 2.03E-03 5.09E-03 4.71E-03 1.10E-03 1.88E-04 3.23E-05 1.03E-04 3.28E-04 1.78E-04
64    12  0.00E+00 0.00E+00 0.00E+00 0.00E+00 4.67E-09 0.00E+00 0.00E+00 9.34E-08 0.00E+00 9.34E-09
65    13  0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
66    14  0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00
67    15  0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 6.54E-08 0.00E+00
68    16  0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 1.87E-07 9.34E-09
69    1.01  .5  .5  .5  6.88E+07  2.87E+08  4.46E+07  .492
70    1.01  F  L  9.16E+10   0   .0012 5.0E+05  .067  0  0   .3   .492   1
71
72   TOTAL POPULATION CONSIDERED: DRINKING WATER: 7140.7     AQUATIC FOOD: 169897.1
73    4.7E+00  0.0E+00  0.0E+00  1.1E-04  2.2E+02  6.6E-04  2.8E+01  3.2E+02
74   Appl-Air-Doses  6.07E-02  3.38E-02  3.39E-02   1.11E-04  0.00E+00  4.79E-03  4.90E-03 Infant  Thyroid
75    169897.1
76   E4= 2.14E-06   E5= 2.12E-06   E6= 2.07E-06   K1= 1.24E-08
77    2.732684E-09; 6.132978E-12; 4.653122E-09
78    2.5E-01  3.9E-02  0.0E+00  4.6E-03  7.1E-04  2.7E-02  5.3E-04  5.5E-05  0.0E+00  2.3E-04  2.6E-03
79    1.0E+00  1.0E+00  0.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00
80    9.0E-01  4.0E+02  0.0E+00  1.0E+02  5.0E+01  5.0E+01  2.0E+03  3.0E+01  0.0E+00  2.0E+03  2.0E+03
81    9.0E-01  9.0E+04  0.0E+00  3.2E+03  2.0E+02  2.0E+02  1.0E+04  1.0E+02  0.0E+00  1.0E+03  1.0E+03
82   Appl-Air-%          0.61%      0.17%      0.68%                                          0.03%
83    0.0E+00  0.0E+00  0.0E+00  9.4E-03  0.0E+00  2.0E-02  0.0E+00  0.0E+00
84    1.0E-02  1.2E-02  0.0E+00  1.0E-03  0.0E+00  6.0E-03  0.0E+00  0.0E+00
85    1.2E-02  3.1E-02  0.0E+00  1.3E-02  0.0E+00  2.9E-03  0.0E+00  0.0E+00
86   D. Irrad.       3.4E-02  3.4E-02  3.4E-02  3.4E-02  3.4E-02  3.4E-02
87   Inhal           1.2E-05  1.3E-05  1.1E-04  1.4E-06  1.2E-05  1.0E-03
88   V&P             5.9E-05  5.3E-05  0.0E+00  1.5E-04  4.9E-05  2.4E-05
89   M&M             1.6E-05  1.8E-05  4.8E-03  1.3E-05  2.0E-05  8.6E-06
90
91   Site-Boundary-Air-Gamma-&-Beta:   12:41   26-APR-94   1.54E-01   3.09E-02
92   Residence-Total-Body:   12:42   26-APR-94   3.67E-02
93
94
95
96
97
98
99
100
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E.2 Printout of SUMyySnn.OUx Example

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* * * * * * Site Liquid Dose Summary Report For  1  BIG.ROCK.POINT    MI * * * * * * * *

CPRDL was last run: 13:52   06-APR-94  from  VERSION OF  5-Apr-94  with Command line: 01   Site: 1  BIG.ROCK.POINT

---------------------------------------------------- Input Files ----------------------------------------------------

REL91S01.DAT *** 91 RELEASE FILE - CPRD *** 11:03   16-NOV-93  dAb
POP82S01.DAT  1981 POPULATION BIG ROCK POINT   (km)  45.3592   85.1947    CPRD  23-JUL-85  dAB
SSDM00.DAT  **  SITE SPECIFIC DATA  **  CPRD PROJECT  **  Modified CMX Version          UPDATED 24 Aug 93 dAb

GENERIC2.DAT   CPRD generic file of decay rates & transfer factors.  27 Nov 90 dAb
INFANT.DAT     INFANT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)  CPRD  20 SEP 1991
CHILD.DAT      CHILD CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)   CPRD  20 SEP 1991
TEEN.DAT       TEEN CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)    CPRD  20 SEP 1991
ADULT.DAT      ADULT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)   CPRD  20 SEP 1991

------------------------------------------------- Liquid Parameters -------------------------------------------------

Pop Factor=  1.01    D. Water Pop= 7,100.     Total 80-km Pop= 170,000.     Pop. Aquatic Food Exposure= 1
Water Types= F L    Pipe Flow (L/y)= 9.16E+10  (100. cfs)       River Flow (cfs)= 0     No River
Pop. Usage & Mixing:  D. Water= 7140.7 & 1.2E-03    Fish= 5.0E+05 & 0.067    Invert= 0 & 0.0    FSHORE= .3

Major Nukes     H-3     Mn-54    Fe-55    Fe-59    Co-58    Co-60    Zn-65    Sr-90    I-131    Cs-134   Cs-137
QREL (Ci/y) : 2.5E-01  3.9E-02  0.0E+00  4.6E-03  7.1E-04  2.7E-02  5.3E-04  5.5E-05  0.0E+00  2.3E-04  2.6E-03
Recirc.     : 1.0E+00  1.0E+00  0.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00  1.0E+00
Fish  (L/kg): 9.0E-01  4.0E+02  0.0E+00  1.0E+02  5.0E+01  5.0E+01  2.0E+03  3.0E+01  0.0E+00  2.0E+03  2.0E+03
Invert(L/kg): 9.0E-01  9.0E+04  0.0E+00  3.2E+03  2.0E+02  2.0E+02  1.0E+04  1.0E+02  0.0E+00  1.0E+03  1.0E+03

Infant: - ES FRESH FISH Avg. Cons(kg/y)= 0.0000    -- ES FRESH INVERT Avg. Cons(kg/y)= 0.0000
Child : - ES FRESH FISH Avg. Cons(kg/y)= 1.1063    -- ES FRESH INVERT Avg. Cons(kg/y)= 0.0000
Teen  : - ES FRESH FISH Avg. Cons(kg/y)= 2.6148    -- ES FRESH INVERT Avg. Cons(kg/y)= 0.0000
Adult : - ES FRESH FISH Avg. Cons(kg/y)= 3.4697    -- ES FRESH INVERT Avg. Cons(kg/y)= 0.0000


------------ LIQUID POP. DOSE COMMITMENTS  (PERSON-REM) -------------

             T. Body      GI         Thy        Bone       Liver

 INFANT      3.3E-07     2.8E-07    1.9E-08    6.0E-07    7.2E-07
 CHILD       8.2E-03     4.6E-03    1.2E-06    4.0E-02    4.4E-02
 TEEN        1.3E-02     1.0E-02    9.9E-07    2.4E-02    3.7E-02
 ADULT       1.4E-01     9.4E-02    7.9E-06    1.4E-01    2.2E-01

TOTAL        1.6E-01     1.1E-01    1.0E-05    2.0E-01    3.0E-01


---------------- LIQUID ADULT MI DOSE COMMITMENTS  (mrem) --------------

                Direct &
             Mixing  Ingestion   ---- Ingestion dose to any organ ----
  Path       Ratio   T. Body      GI         Thy        Bone       Liver

 D-Water     0.0012  5.0E-06    1.8E-05    2.6E-07    6.3E-06    6.0E-06
 Fish        0.0670  7.0E-03    4.8E-03    5.3E-07    7.0E-03    1.1E-02
 Invert      0.0000  0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
 Shore       0.0670  4.1E-05    0.0E+00    0.0E+00    0.0E+00    0.0E+00

 TOTAL               7.0E-03    4.8E-03    7.9E-07    7.0E-03    1.1E-02


           ---------- Total Body ----------   ---------- Max. Organ ----------
           D. Wat   Fish/Shell  Shore   Total    %DO    D. Wat  Fish/Shell  Total    %DO   Age   Organ

Appl-Water 5.01E-06 6.96E-03 4.07E-05 7.00E-03 0.23%  5.56E-06 1.14E-02 1.14E-02 0.11% Teen  Liver
```

Appendix E

```
          * * * * * * Site Air Dose Summary Report For  1  BIG.ROCK.POINT    MI  * * * * * * * *

CPRDA was last run: 13:52   06-APR-94  from  VERSION OF  5-Apr-94  with Command Line: 01  E   Site: 1  BIG.ROCK.POINT    MI

------------------------------------------------ Input Files ------------------------------------------------

REL91S01.DAT *** 91 RELEASE FILE - CPRD *** 11:03   16-NOV-93  dAb
POP82S01.DAT  1981 POPULATION BIG ROCK POINT   (km)  45.3592   85.1947    CPRD  23-JUL-85  dAB
 CHI91S01.DAE    Big Rock Point   | AIR TRANSPORT FACTORS (2-80km)    14-OCT-93   dAb    |
SSDMOD.DAT  **  SITE SPECIFIC DATA  **  CPRD PROJECT  **  Modified CMX Version          UPDATED 24 Aug 93 dAb

GENERIC2.DAT   CPRD generic file of decay rates & transfer factors.  27 Nov 90 dAb
INFANT.DAT    INFANT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)  CPRD  20 SEP 1991
CHILD.DAT     CHILD CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)   CPRD  20 SEP 1991
TEEN.DAT      TEEN CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)    CPRD  20 SEP 1991
ADULT.DAT     ADULT CHRONIC DOSE COMMITMENT FACTORS (50-YR DOSE COMMITMENT FROM ONE YR INTAKE)   CPRD  20 SEP 1991

---------------------------------------- Air Parameters ----------------------------------------

Pop Factor= 1.01   Pop= 169,897    Prod. Factor= .5   Pasture Factors= .5  .5
Productions= 6.88E+07  2.87E+08  4.46E+07   TW-h= .492

Met:  01-JAN-91 TO 31-DEC-91      0% Data recovery   NOTES:  Elev release 73 m --  70 m met
P/C Ratio:   PRODUCE : 1.        MILK : 6.4         MEAT : 1.6

Major Nukes    H-3      C-14     Ar-41    Co-60    Kr-88    I-131    Xe-133   Xe-135
QREL(Ci/y):  4.7E+00  0.0E+00  0.0E+00  1.1E-04  2.2E+02  6.6E-04  2.8E+01  3.2E+02
Bv       :   0.0E+00  0.0E+00  0.0E+00  9.4E-03  0.0E+00  2.0E-02  0.0E+00  0.0E+00
Fm  (d/L) :  1.0E-02  1.2E-02  0.0E+00  1.0E-03  0.0E+00  6.0E-03  0.0E+00  0.0E+00
Ff  (d/L) :  1.2E-02  3.1E-02  0.0E+00  1.3E-02  0.0E+00  2.9E-03  0.0E+00  0.0E+00

Sum Dil Factors (s/m3 or 1/m2):  E4= 2.14E-06   E5= 2.12E-06   E6= 2.07E-06   K1= 1.24E-08
Pop Weighted Avgs (man-s/m3 or man/m2):   E3=2.7E-09    K2=6.1E-12

  Location     meters          XQ1        XQ2        XQ3        DQ

 Site-Boundary   917     E  5.54E-08  5.53E-08  5.47E-08  1.68E-09
 Residence      2253     E  6.24E-08  6.23E-08  6.10E-08  8.29E-10
 Garden         2253     E  6.24E-08  6.23E-08  6.10E-08  8.29E-10
 Pasture        4022     E  4.70E-08  4.68E-08  4.55E-08  4.13E-10


------------ AIR POP. DOSE COMMITMENTS   (person-rem) ------------

              T. Body    GI       Thy      Bone     Liver    Lung

INFANT        7.1E-04  7.1E-04  8.0E-04  7.1E-04  7.1E-04  7.3E-04
CHILD         7.9E-03  7.9E-03  8.9E-03  7.9E-03  7.9E-03  8.2E-03
TEEN          5.8E-03  5.8E-03  6.2E-03  5.8E-03  5.8E-03  6.2E-03
ADULT         3.5E-02  3.5E-02  3.7E-02  3.5E-02  3.5E-02  3.6E-02

TOTAL         5.0E-02  5.0E-02  5.2E-02  4.9E-02  5.0E-02  5.2E-02

-------------------------------- AIR MI DOSE COMMITMENTS   (mrem) --------------------------------

                 Site Boundary      Residence  ---------- Max. Organ ----------
                 Gamma      Beta    T.Body     Inhal    Veg/Pro  Milk/Meat  Total    Age      Organ

Appl-Air-Doses  6.07E-02  3.38E-02  3.39E-02  1.11E-04  0.00E+00  4.79E-03  4.90E-03 Infant  Thyroid

Appl-Air-%       0.61%     0.17%     0.68%                                  0.03%

Site-Boundary-Air-Gamma-&-Beta:   20:27   13-APR-95   1.54E-01   3.09E-02
```

E.3 Printout of AIRyySnn.OUx Example

• • • F:AIR91S01.OUE ADULT AIR-DOSE FOR SITE: 1 BIG.ROCK.POINT • • • 20:19 13-APR-95

From CPRDA Run of: 13:51 06-APR-94 from VERSION OF 5-Apr-94

*** OPTION 1 -- Nuclide vs. Organ -- Summed over sectors (Man-Rem)

	T BODY	GI-LLI	THYROID	BONE	LIVER	LUNG	TBODY %
H3	1.8E-04	1.8E-04	1.8E-04	0.0E+00	1.8E-04	1.8E-04	0.5
CR51	7.8E-08	2.6E-07	7.7E-08	7.6E-08	7.6E-08	2.1E-07	0.0
MN54	1.8E-06	2.6E-06	1.7E-06	1.7E-06	2.0E-06	3.4E-06	0.0
FE59	1.6E-07	6.2E-07	1.0E-07	1.7E-07	2.5E-07	3.6E-07	0.0
CO58	3.6E-08	7.4E-08	3.2E-08	3.2E-08	3.4E-08	7.7E-08	0.0
CO60	1.1E-05	1.6E-05	1.0E-05	1.0E-05	1.0E-05	2.1E-05	0.0
ZN65	8.3E-07	1.0E-06	3.3E-07	6.8E-07	1.5E-06	6.5E-07	0.0
KR85M	4.6E-04	4.6E-04	4.6E-04	4.6E-04	4.6E-04	4.7E-04	1.3
KR87	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.3E-03	17.2
KR88+D	1.6E-02	1.6E-02	1.6E-02	1.6E-02	1.6E-02	1.6E-02	44.5
SR89+D	1.1E-06	7.4E-06	1.5E-10	3.9E-05	1.5E-10	5.4E-06	0.0
SR90+D	7.5E-06	8.9E-07	0.0E+00	3.7E-05	0.0E+00	7.5E-07	0.0
AG110M+D	2.5E-06	9.3E-06	2.5E-06	2.5E-06	2.5E-06	5.4E-06	0.0
I131+D	2.4E-06	1.2E-06	1.2E-03	2.8E-06	3.9E-06	3.4E-07	0.0
I133+D	9.9E-07	1.7E-06	3.2E-04	1.6E-06	2.5E-06	3.2E-07	0.0
I135+D	4.8E-08	7.4E-08	4.4E-06	4.9E-08	9.1E-08	2.3E-08	0.0
XE133	7.2E-05	7.2E-05	7.2E-05	7.2E-05	7.2E-05	7.8E-05	0.2
XE135M	7.7E-04	7.7E-04	7.7E-04	7.7E-04	7.7E-04	7.8E-04	2.2
XE135	4.2E-03	4.2E-03	4.2E-03	4.2E-03	4.2E-03	4.4E-03	12.0
XE138+D	7.7E-03	7.7E-03	7.7E-03	7.7E-03	7.7E-03	8.1E-03	22.0
CS137+D	1.4E-05	3.0E-06	2.7E-06	1.5E-05	2.0E-05	4.6E-06	0.0
BA140+D	4.8E-07	6.5E-06	3.2E-07	2.7E-06	3.3E-07	1.1E-05	0.0
TOTAL	3.5E-02	3.5E-02	3.7E-02	3.5E-02	3.5E-02	3.6E-02	

AIR -------- Sorted Total Body Contributors > 2.5 % ------- AIR

KR88+D	44
XE138+D	22
KR87	17
XE135	12
OTHER	4

E.4 Printout of LIQyySnn.OUT Example

* * * F:LIQ91S01.OUT ADULT LIQ-DOSE FOR SITE:1 BIG.ROCK.POINT * * * 20:20 13-APR-95

From CPRDL Run of: 13:52 06-APR-94 from VERSION OF 5-Apr-94

*** NUCLIDES VS. PATHWAYS (MAN-REM)

NUCLIDE	DRINKING WATER					AQUATIC FOODS					-TOTAL	BODY-
	T.BODY	GUT	THY.	BONE	LIVER	T.BODY	GUT	THY.	BONE	LIVER	TOTAL	%
H3	6.5E-07	6.5E-07	6.5E-07	0.0E+00	6.5E-07	7.2E-06	7.2E-06	7.2E-06	0.0E+00	7.2E-06	7.9E-06	0.0
CR51	3.3E-12	8.2E-10	2.0E-12	0.0E+00	0.0E+00	7.0E-09	1.8E-06	4.2E-09	0.0E+00	0.0E+00	7.0E-09	0.0
MN54	8.4E-07	1.3E-05	0.0E+00	0.0E+00	4.4E-06	4.1E-03	6.6E-02	0.0E+00	0.0E+00	2.2E-02	4.1E-03	3.0
FE59	4.3E-07	3.7E-06	0.0E+00	4.8E-07	1.1E-06	4.9E-04	4.2E-03	0.0E+00	5.4E-04	1.3E-03	4.9E-04	0.4
CO58	2.9E-08	2.6E-07	0.0E+00	0.0E+00	1.3E-08	1.7E-05	1.5E-04	0.0E+00	0.0E+00	7.5E-06	1.7E-05	0.0
CO60	3.1E-06	2.7E-05	0.0E+00	0.0E+00	1.4E-06	2.0E-03	1.7E-02	0.0E+00	0.0E+00	8.8E-04	2.0E-03	1.4
ZN65	9.0E-08	1.3E-07	0.0E+00	6.3E-08	2.0E-07	2.2E-03	3.1E-03	0.0E+00	1.5E-03	4.9E-03	2.2E-03	1.6
AS76	4.4E-12	9.6E-09	0.0E+00	0.0E+00	4.9E-12	1.2E-10	2.7E-07	0.0E+00	0.0E+00	1.4E-10	1.3E-10	0.0
SR89+D	2.0E-09	1.1E-08	0.0E+00	6.8E-08	0.0E+00	6.7E-07	3.8E-06	0.0E+00	2.3E-05	0.0E+00	6.7E-07	0.0
SR90+D	2.5E-06	3.0E-07	0.0E+00	1.0E-05	0.0E+00	9.4E-04	1.1E-04	0.0E+00	3.8E-03	0.0E+00	9.4E-04	0.7
MO99+D	3.7E-11	4.5E-10	0.0E+00	0.0E+00	2.0E-10	1.0E-09	1.2E-08	0.0E+00	0.0E+00	5.4E-09	1.1E-09	0.0
AG110M+D	1.5E-10	1.0E-07	0.0E+00	2.7E-10	2.5E-10	4.2E-09	2.9E-06	0.0E+00	7.6E-09	7.0E-09	4.3E-09	0.0
I133+D	3.6E-11	1.1E-10	1.7E-08	6.7E-11	1.2E-10	5.5E-11	1.6E-10	2.7E-08	1.0E-10	1.8E-10	9.1E-11	0.0
CS134	6.9E-07	1.5E-08	0.0E+00	3.6E-07	8.5E-07	1.7E-02	3.7E-04	0.0E+00	8.8E-03	2.1E-02	1.7E-02	12.4
CS137+D	4.5E-06	1.3E-07	0.0E+00	5.0E-06	6.8E-06	1.1E-01	3.3E-03	0.0E+00	1.2E-01	1.7E-01	1.1E-01	80.5
TOTAL	1.3E-05	4.6E-05	6.6E-07	1.6E-05	1.5E-05	1.4E-01	9.4E-02	7.3E-06	1.4E-01	2.2E-01	1.4E-01	100.0

LIQUID ---------- Sorted Total Body Contributors > 2.5 % ------- LIQUID

CS137+D	81
CS134	12
MN54	3
OTHER	4

E.5 AirGamma Results Printout

Air Gamma 7-May-94 Run at 20:27 13-APR-95

* * * * * * Big Rock Point * * * * * *

Finite and Semi-infinite Cloud Noble-Gas Gamma, Beta, Total-Body, and Skin Annual Doses using Hamawi's Routine

Command Line: 01 SB 917 E E

REL Header: REL91S01.DAT *** 91 RELEASE FILE - CPRD *** 11:03 16-NOV-93 dAb
Energy/DF Header: AIRGAMMA.DAT -- Gamma energies x Abundance and Dose factors 6 Sep 91
JFD Header: BIG ROCK POINT XOQ Input file for 1991 E

Receptor Location: _____ 917 m E SB

Met Recovery: 6336 hr Percent Recovery: 72.3 % Conversion Factor: 1.58E-04
Stack Height: 73 m Terrain Height: 0 m Sensor Level: 70 m
Bldg. Height: 0 m Stack Velocity: 20.4 m/s Inner. Diam: 1.08 m

Wind Level: 73 m Plume Rise Elevated release -- No wake correction
UBAR (Harmean): 4.5 m/s Transit Time: 203 s X/Q: 5.74E-08 s/m3
Elevated Only Release No Open Terrain Correction

		----Finite Plume Model ---- ---- Tall Stack (>80m) ----			----- Semi-Infinite Plume Model ----- -------- Short Stack & Ground -------			
Nuclide	Release Ci/y	Air Gamma mrad/y	T. Body mrem/y	Skin mrem/y	Air Gamma mrad/y	Air Beta mrad/y	T. Body mrem/y	Skin mrem/y
KR85M	6.8E+01	5.0E-04	3.4E-04	5.6E-04	1.5E-04	2.4E-04	1.0E-04	3.0E-04
KR87	3.6E+02	1.2E-02	8.1E-03	1.5E-02	3.9E-03	6.5E-03	2.6E-03	9.2E-03
KR88+D	2.2E+02	1.8E-02	1.2E-02	1.5E-02	6.0E-03	1.2E-03	4.0E-03	5.6E-03
XE133	2.8E+01	5.8E-05	4.0E-05	6.1E-05	1.8E-05	5.2E-05	1.0E-05	2.9E-05
XE135M	6.8E+02	1.1E-02	7.3E-03	9.2E-03	3.5E-03	7.8E-04	2.3E-03	3.5E-03
XE135	3.2E+02	3.7E-03	2.5E-03	3.9E-03	1.1E-03	1.4E-03	7.3E-04	1.9E-03
XE138+D	2.8E+03	1.1E-01	7.5E-02	1.0E-01	4.0E-02	2.1E-02	2.7E-02	4.9E-02
TOTAL		1.5E-01	1.1E-01	1.5E-01	5.5E-02	3.1E-02	3.7E-02	7.0E-02

Notes:

Doses are as per Reg. Guide 1.109 for both finite (Stack > 80 m) and semi-infinite plume models.
Analysis similar to XOQDOQ except decay constant of each nuclide used in calculating decay in transit.
Mixed (Split-H) Mode releases supported. Depletion not used, since all releases are Noble gases.
Any release under 1 meter is considered ground release; only Short-stack results are valid.
When option 1 selected, sensor level corrected to wind height. Minimum sensor level set to 3 m.
If wind height = 0, height corrected to 10 m for releases < 10 m, otherwise height set to release height.
Wake correction only for ground releases (height < 1 m); analysis uses bldg. height.
No plume rise when I.D. set to zero; Downwash occurs when velocity set to zero and I.D. > zero.
Dispersion coefficient (X/Q) shown above not corrected for decay.
Optional NRC open-terrain correction factor available in interactive mode. (Max. of 4 at <~1000 m).

Appendix F

Hardware and Software Requirements

APPENDIX F. HARDWARE AND SOFTWARE REQUIREMENTS

The present programs are written in Microsoft PDS Basic and where necessary were compiled for faster operation with the PDS 7.1 compiler. The programs run under IBM's operating system DOS 5.0 or later. A minimum system should have 640 Kbytes of memory and hard drive. A printer that can print 123 columns is required for printing of the output files.

The present system consists of a 16 MHz IBM PS/2 with 12 MByte of memory, an 80 MByte hard drive, dual Bernoulli 90 MByte drives, and a HP LaserJet 4 printer. A Bernoulli disk is used to keep all programs and files.

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10. SUPPLEMENTARY NOTES

S.P. Klementowicz, NRC Project Manager

11. ABSTRACT *(200 words or less)*

This manual describes a dose assessment system used to estimate the population or collective dose commitments received via both airborne and waterborne pathways by persons living within a 2- to 80-kilometer region of a commercial operating power reactor for a specific year of effluent releases. Computer programs, data files, and utility routines are included which can be used in conjunction with an IBM or compatible personal computer to produce the required dose commitments and their statistical distributions. In addition, maximum individual airborne and waterborne dose commitments are estimated and compared to 10 CFR Part 50, Appendix I, design objectives.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

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