Dominion

Calculation Cover Sheet

1.Type	2. Sub	3. Station	4. Unit	5. Status	6. System Code(s)
CALC	NFL		03	AC	N/A

7. Calculation Number	8. Rev.	9. Addendum
SM-1526	0	N/A

10. QA Cat ☐ SR ☒ NSQ ☐ NS

11. Critical Calculation ☐ Yes ☒ No

12. Calculation Title (Subject):
North Anna Power Station ESP ESBWR MACCS2 Model for Level 3 Application

13. Key Words: NAPS, MACCS2, Model, ESBWR, Level 3, ESP

14. DMIS Cross Reference: Yes ☐ No ☒
(If "Yes" list cross references in the Calculation Reference section using the appropriate DMIS code, doc type, and sub)

15. Initiating Document:

16. Originator:

17. Discipline:

18. Firm Name:

19. Vendor Code:

20. EDS Mark Number References:

Station	Unit	System	Prefix	Sequence	Component Code	Suffix

21. Purpose:
To calculate the risk incurred to the population during a severe accident for an advanced reactor design at the NAPS site. This calculation documents the preparation and execution of NAPS-ESBWR site-specific nput files for the severe accident consequence code MACCS2. MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment and is used for the quantification of Level 3 PSAs.

22. Conclusion:
The ESBWR offsite dose and economic impact has been calculated for eleven release categories to the population extending out to a 50 mile radius from the North Anna site. The resulting risk in terms of dose and dollars for the year 2030 population has been shown to be minimal relative to a conventional nuclear power plant design.

23. Affected Calculation(s):

Prepared By: Myron G. Matras	24b. Signature	24c. Date
Reviewed By: Thomas G. Hook	25b. Signature	25c. Date
Approved By: Thomas G. Hook	26b. Signature	26c. Date

(June 2005)

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1.0 Purpose

The purpose of this calculation is to calculate the consequences and the risk to population and land within a 50 mile radius of the North Anna site for a new General Electric reactor design, the Economic Simplified Boiling Water Reactor (ESBWR) model. The risk to the population is in terms of Person-Rem/year and the risk to the land and property is reported in terms of US dollars/year. This analysis will be done using the Reference 8 economic and population data

2.0 References

1) RF-Report, Chanin and M. L. Young, "Code Manual for MACCS2: Volume 1, User's Guide", SAND97-0594, May 1998.

2) RF-Report, Oak Ridge National Laboratory RISCC Computer Code Collection MACCS2 V.1.13.1, CCC-652 Code Package.

3) RF-Report, H. N. Jow, et al., "MELCOR Accident Consequence Code System (MACCS) Model Description", NUREG/CR-4691, SAND86-1562, Vol. 2 February 1990.

4) RF-Memo, Philip C. Knause, "Nuclear Relicensing Meteorological Data Documentation", December 29, 1999. (See Attachment II)

5) RF-Report, GE Report, GEDO-SR5-2006-0020, Information Regarding ESBWR Source Term Based on MAAP Runs, April 11, 2006.

6) RF-Report, R. J. Breeding, et al., "*Evaluation of Severe Accident Risks: Surry 1 Main Report*," NUREG/CR-4551, Vol. 3, Rev. 1, Part 1, October 1990

7) **Not Used.**

8) RF-Calc, SM-1242 Revision 0, MACCS2 Model for North Anna Level 3 Application, 2-28-2000.

9) RF-Report, J. L. Sprung, et al., "*Evaluation of Severe Accident Risks: Quantification of Major Input Parameters MACCS Input*," NUREG/CR 4551, Vol. 2, Rev. 1., Part 7, December 1990.

10) RF-Report, U. S. Bureau of Labor, "*Consumer Price Index-All Urban Consumers* ", Series Catalog: Series ID : CUUR0300SA0, 1999.

11) RF-Report, S. L. Humphreys, et al., "*SECPOP90: Sector Population, Land Fraction, and Economic Estimation Program,* " NUREG/CR-6525, September, 1997.

12) RF-Report, Bureau of the Census, "*Census of Population and Housing, 1990: Public Law (P. L.) 94-171, Data Technical Documentation*", CDROM set , 1991.

13) RF-Report, Statistical Information Staff, Population Division, U. S. Bureau of the Census, "*County Population Estimates for July 1, 1998 and Population Change for April 1, 1990 to July 1, 1998 (includes revised April 1, 1990 Census Population Counts),*" CO-98-002, Released to Internet, March 12, 1999. (in Appendix)

14) RF-Report, Statistical Information Staff, Population Division, U. S. Bureau of the Census, "*County Population Estimates for July 1, 1998 and Population Change for April 1, 1990 to July 1, 1998 (includes revised April 1, 1990 Census Population Counts),*" CO-98-002, Released to Internet, March 12, 1999. (in Appendix)

15) RF-Report, R. J. Breeding, et al., "*Evaluation of Severe Accident Risks: Quantificatioin of Major Input Parameters,*" NUREG/CR-4551, Vol. 2, Rev. 1, Part 7, December 1990.

16) RF-Report, U.S. Dept. of Agriculture, "*1997 Census of Agriculture,*" National Agricultural Statistics Service.

17) RF-Report, Virginia Power Nuclear Human Resources, Salary Administration Guide, 1999.

18) RF-Report, NRC Letter From Nitin Patel to David A. Christian, "Results of Review of the Supplement to the Early Site Permit (ESP) Application for the North Anna Site (TAC NOS. MC1126 and MC1128), March 2, 2006

3.0 Introduction

This calculation documents the preparation and execution of North Anna-ESBWR site-specific input files for the severe accident consequence code Melcor Accident Consequence Code System MACCS2 [References 1, 2 and 3]. MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment and is used for the quantification of Level 3 PSA's. The principal phenomena considered in MACCS2 are atmospheric transport, mitigative actions based on dose projections, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs.

To demonstrate the application of the Level 3 analysis, Level 2 PSA results for the ESBWR are used here as inputs. The Level 2 source term data is taken from the GE analysis (Ref. 5). The bulk of the North Anna ESBWR model was already developed in Reference 8 for NAPS Units 1 and 2. The ATMOS input file was revised here which was necessary to use the appropriate source term data for the ESBWR. The EARLY input file was also revised here to receive more output data and to specify the population evacuation fraction.

The Level 3 (MACCS2) model has been prepared using projected year 2030 demographic data from the North Anna UFSAR (See Attachment I). The population distribution is given for a 50 mile radius around the plant.

Three computer cases have been prepared and executed, the results including the offsite population dose and economic data, are shown in the Summary of Results section. This calculation represents a limited scope Level 3 PRA. The results are based on the internal events at-power only. No insights are derived and no analysis of the contributors to risk are performed.

4.0 Assumptions, Design Inputs and Key Parameter Uncertainties

4.1 Assumptions

1) The North Anna 50 mile population distribution for year 2030 is appropriate for this evaluation.

2) The GE ESBWR preliminary source term data is valid for this application.

3) The 1998 meteorological data for the Base Case is assumed to be a good representation for any given year.

4) The adjustment of economic data for farmland and non-farmland by using time weighted consumer price index data is appropriate.

4.2 Design Inputs

The bulk of the North Anna Units 1 and 2 model inputs from Reference 8 will be used for the ESBWR model here. This calculation will use the same North Anna 50 mile population data for year 2030 which was used in Reference 8. The radionuclide inventory and source term release fractions were taken from Reference 5. Meteorological data was obtained from the Dominion Electric Environmental Services Department (EES formerly EP&C) containing hourly meteorological data and seasonal mixing height data. Meteorological data for years 1996 through 1998 was provided (See Attachment II). Economic data was properly adjusted by using the current (1999) consumer price index.

4.3 Key Parameter Uncertainties

No parameter uncertainties were included in this calculation since only best estimate results are sought. Fluctuations on the meteorological data are shown by running sensitivities using three separate years of data.

5.0 Method of Analysis

The objective of this calculation is to calculate the total dose to a population within a 50 mile radius of the North Anna Power Station and the total dollar cost incurred to the decontamination of farmland and non-farmland including the cost of relocating a population that lives within this boundary.

The following steps will be used to perform this calculation.

1. Gather data that is specific to the North Anna Power Station. This data includes meteorological data, source term data, population data, economic data, watershed data and spatial coordinate data. Additional inputs are also required but will be discussed below.

2. The data are then entered into the five input files that are required and used by the MACCS2 code. These five input files are identified as ATMOS, EARLY, CHRONC, SITE and the MET data input files.

The Level 3 severe accident consequence analysis was carried out with the Melcor Accident Consequence Code System (MACCS2) code. MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment. The principal phenomena considered in MACCS are atmospheric transport, mitigative actions based on dose projections, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs. This analysis was performed with the MACCS2 version designated as Oak Ridge National Laboratory RSICC Computer Code Collection MACCS2 V.1.13.1, CCC-652 Code Package [1,2,3].

The sources and preparation of the input data are summarized in the following sections. The MACCS2 code is described in the technical reports provided with the code package.

6.0 ESBWR LEVEL 2 DATA

The ESBWR Level 2 data is taken from the General Electric ESBWR Submittal Document. This data includes the source term inventory, power level, release fractions, plume release start time, plume release height, delay and duration. The radionuclide core inventory, release fractions, plume release data and source term category frequencies were obtained from GE in Reference 5. A description of the eleven release categories and the corresponding frequencies are shown on Table 6-1 below. The balance of the input data was taken from Reference 8.

Table 6-1: ESBWR Source Term Category Frequencies

Release Category	Summary Description	Release Frequency (reactor year^{-1})
BYP	Containment is bypassed because of CIS failure with large (>12" diameter hole) opening in containment. Lower drywell debris bed covered.	<1E-12
BOC	Break outside of containment.	4E-12
CCID	Containment fails due to core concrete interaction; lower drywell debris bed uncovered.	2.9E-11
CCIW	Containment fails due to core concrete interaction; lower drywell debris bed covered.	2.9E-10
DCH	Direct containment heating (high pressure RPV failure) event damages containment	<1E-12

EVE	Ex-vessel steam explosion fails containment	2.5E-10
FR	Release through controlled (filtered) venting from suppression chamber	2.3E-10
OPVB	Containment fails due to failure of vapor suppression (vacuum breaker) function.	<1E-12
OPW1	Containment fails due to early (<24 hours) loss of containment heat removal.	<1E-12
OPW2	Containment fails due to late (>24 hours) loss of containment heat removal.	1.4E-11
TSL	Containment leakage at Technical Specification limit.	2.8E-8

7.0 MACCS2 MODEL Input Information

This section describes the preparation of the data required in the five MACCS2 input files. The bulk of the model is similar to that used for NAPS Units 1 and 2 as documented in Reference 8. There are a large number of input data values required. Many of these have been prepared and recommended as part of the code preparation. These values are used in this analysis except where plant-specific values are required. These are noted either in the text below if the preparation required is extensive or else directly by comments in the input file body. In this calculation file, such values that differ from Reference [2] are denoted by a listing of the applicable reference number.

The input files for MACCS2 covered in this document are described below. The actual file name given to the plant specific files used in the executable RUNIT.BAT file are shown in quotation marks.

A paper copy listing of four input files, except for the meteorological file are included in Attachment III. The complete list of input and output files are incorporated into the electronic version of this report in Attachment IV as objects that can be opened directly for use. The complete list of input and output files are also incorporated into a CD which will accompany this calculation in Records Management.

7.1 ATMOS User Input File: "EBATMOS.INP"

This file provides the main input for the ATMOS calculation phase of MACCS2. Most of the ESBWR changes to the original North Anna specific model in Reference 8 are made in this ATMOS input file.

ATMOS calculates the dispersion and deposition of material released "source terms" to the atmosphere as a function of downwind distance. It utilizes a Gaussian plume model with Pasquill-Gifford dispersion parameters. The phenomena that ATMOS treats are (1) building wake effects, (2) buoyant plume rise, (3) plume dispersion during transport, (4) wet and dry deposition, and (5) radioactive decay and ingrowth. At the midpoint of each spatial interval along the transport path, air and ground concentrations for all the radionuclides are calculated as well as miscellaneous information about plume size, height, and transport timing. These data are stored in common blocks which are used later by the EARLY and CHRONC modules of MACCS2.

Source Terms

The source term release fractions (RELFRC) for the MACCS2 element groups are shown below in Table 7-1 for 11 different source term categories (STC). The release fractions are taken from the GE ESBWR document [Reference 5].

Table 7-1: ESBWR Source Term Release Fractions

Source Term Category	Xe/Kr	I-Br	Cs-Rb	Te-Sb	SR	Co-Mo	LA	CE	BA
BOC	1.00E+00	8.50E-01	3.80E-01	9.06E-01	1.50E-02	7.20E-02	6.10E-04	3.43E-03	1.50E-02
BYP	9.80E-01	4.30E-01	3.70E-01	7.42E-01	1.60E-02	1.20E-01	5.30E-04	3.32E-03	2.90E-02
CCID	9.20E-01	5.30E-01	3.20E-01	5.95E-01	2.30E-06	5.10E-06	1.40E-07	1.40E-06	2.20E-05
CCIW	1.00E+00	7.30E-05	7.90E-03	1.54E-02	8.20E-08	5.90E-08	1.10E-08	7.49E-08	6.00E-08
DCH	9.00E-01	8.00E-01	1.50E-01	4.90E-01	3.20E-04	2.70E-04	3.20E-04	3.20E-04	3.20E-04
EVE	8.40E-01	2.50E-01	3.40E-01	6.90E-01	1.30E-02	1.10E-04	8.20E-04	6.25E-03	5.70E-03
FR	1.00E+00	9.80E-06	4.60E-05	2.53E-03	1.10E-08	1.90E-07	4.10E-10	1.51E-09	3.20E-08
OPVB	9.90E-01	2.80E-01	3.40E-02	1.10E-01	1.70E-03	1.20E-04	1.50E-04	3.11E-04	8.70E-04
OPW1	9.90E-01	6.00E-01	1.40E-01	3.70E-01	1.60E-03	4.30E-07	5.80E-06	1.81E-04	7.50E-04
OPW2	9.90E-01	3.80E-02	4.30E-02	1.57E-01	1.20E-03	2.00E-07	3.90E-06	1.40E-04	5.70E-04
TSL	2.00E-03	1.50E-04	5.50E-05	2.15E-04	2.10E-06	3.90E-05	7.30E-08	2.00E-07	7.70E-06

Other parameters associated with the release plume are shown in Table 7-2 below. They are assigned to each source term according to the STC number. Each release plume is assumed to have only one segment. The corresponding timing data is also shown below. The timing data as well as the height and energy level of each plume are taken from the GE ESBWR document [Reference 5].

Table 7-2: ESBWR Plume Characterization Data

STC	DALARM (S)	NUMREL	MAXRIS	REFTIM (s)	PLHEAT (w)	PLHITE (m)	PLDUR (s)	PDELAY (s)
BOC	1,200	1	1	0.0	0	49	9,000	2,100
BYP	1,200	1	1	0.0	0	49	7,800	1,800
CCID	21,100	1	1	0.0	0	49	36,000	53,100
CCIW	24,000	1	1	0.0	0	49	36,000	90,400
DCH	16,300	1	1	0.0	0	49	36,000	63,000
EVE	22,400	1	1	0.0	0	49	36,000	22,500
FR	9,800	1	1	0.0	0	49	36,000	102,600
OPVB	16,500	1	1	0.0	0	49	36,000	65,300
OPW1	16,600	1	1	0.0	0	49	36,000	91,500
OPW2	17,600	1	1	0.0	0	49	36,000	146,900
TSL	21,000	1	1	0.0	0	49	36,000	1,100

The scaling factor (CORSCA) was used to adjust the ESBWR core inventory for a power level of 4500 MWt. The core inventory is based on a conservative discharge exposure burnup provided by General Electric in Reference 5.

The initial values for sigma –y and sigma-z for the plumes are calculated using the Surry containment dimensions of approximately 40 m width and 50 m height from Table 4.2-1 in Reference 6.

7.2 EARLY User Input File: "EBEARLY.INP"

This file provides the main input for the EARLY calculation phase of MACCS2.

The EARLY file models the time period immediately following a radioactive release. This period is commonly referred to as the emergency phase. It may extend up to 1 week after the arrival of the first plume at any downwind spatial interval. The subsequent intermediate and long-term periods are treated by CHRONC. In the EARLY module the user may specify emergency response scenarios that include evacuation, sheltering, and dose-dependent relocation. The EARLY module has the capability for combining results from up to three different emergency response scenarios. This is accomplished by appending change records to the EARLY input file. The first emergency-response scenario is defined in the main body of the EARLY input file. Up to two additional emergency-response scenarios can be defined through change record sets positioned at the end of the file.

The emergency evacuation model has been modeled as a single evacuation zone extending out 10 miles from the plant. The average evacuation speed is estimated (see Table 4.2-1 Ref. 6) to be on the order of 4 mph (1.8 m/s). For the purposes of this analysis an average evacuation speed of 1.8 m/s is used with a 7200 second delay between the alarm and start of evacuation, with no sheltering for the base case.

7.3 CHRONC User Input File: "EBCHRONC.INP".

This file provides the main input for the CHRONC calculation phase of MACCS2. It calculates the long term dose impact on the population.

The CHRONC module simulates the events that occur following the emergency-phase time period modeled by EARLY. CHRONC calculates the total accumulated dose received by a population after the emergency phase or starting on about the 8th day up to 50 years of time. Various long term protective actions may be taken during this period to limit radiation doses to acceptable levels. CHRONC calculates the individual health effects that result from both (1) direct exposure to contaminated ground and from inhalation of resuspended materials as well as (2) indirect health effects caused by the consumption of contaminated food and water by individuals who could reside both on and off of the computational grid. CHRONC also calculates the economic costs of the long term protective actions as well as the cost of the emergency response actions that were modeled in the EARLY module.

Economic costs are the recommended MACCS values as given for the NUREG-1150 study [Reference 9] updated using recent Consumer Price Indexes from the Bureau of Labor [Reference 10]. Reference 9 uses economic values that are based on 1986 consumer price index. From Reference 10, values for the CPI of 108.9 for 1986 and 127.9 for 1990 were obtained. Therefore the unit costs from [Reference 9] have been multiplied by a factor of (127.9/108.9 =) 1.17 to represent revised North Anna region values.

Additionally from Reference 10 a value for the CPI of 158.9 for 1998 was obtained. Sensitivity unit costs from [Reference 9] have been multiplied by a factor of (158.9/108.9 =) 1.46 to represent current North Anna region values.

Applying the above CPI factors on the selected Reference 9 CHRONC input data yields the following.

Parameter	Ref. 9 Values		Multiplier	Adjusted New Values	
CHEVACST	27.00		1.46	40.00	
CHRELCST	27.00		1.46	40.00	
CHCDFRM0	562.5	1250.0	1.17	658.1	1463.0
CHCDFRM0	562.5	1250.0	1.46	821.3	1825.0
CHCDNFRM	3000.	8000.0	1.17	3510.0	9360.0
CHCDNFRM	3000.	8000.0	1.46	4380.0	11680.0
CHPOPCST	5000.		1.46	7300.0	

These CHRONC input parameters are defined as:
CHEVACST Daily cost for a person who is evacuated ($/Person-Day)
CHRELCST Daily cost for a person who is relocated ($/Person-Day)
CHCDFRM0 Cost of farm decontamination per farmland unit area ($/Hectare)
CHCDNFRM Cost of nonfarm decontamination per resident person ($/Person)
CHPOPCST Population relocation cost ($/Person)

The average cost of decontamination labor CHDLBCST (Dollars/Man-year) was obtained from Dominion Nuclear Human Resources Department [Reference 17]. This value is applicable in terms of 1999 dollars.

CHDLBCST 42000.0 (Dollars/Man-year)

The average farm wealth value CHVALWF ($/hectare) has been calculated by summing the appropriate county data from Reference 11 within the North Anna 50 mile radius and dividing by the total number of hectares. This value includes both publicly and privately owned grazing lands, farmland, farm buildings, and non-recoverable farm machinery, as well as any publicly owned infrastructure serving the farm industry. The average value is listed below.

CHVALWF 6979.0 ($/hectare)

The Average non-farm wealth value CHVALWNF ($/person) has been calculated by summing the appropriate county data from Reference 11 within the North Anna 50 mile radius and dividing by the total number of hectares. Nonfarm wealth includes all public and private property not associated with farming that would be unusable if the region was rendered either temporarily or permanently uninhabitable. The average value is listed below.

CHVALWNF 141,206.0 ($/person)

7.4 Meteorological Data File: "NMET.INP"

This file describes three year's (1996-1998) worth of hourly meteorological data for the plant as recorded at the site meteorological tower. The hourly data (wind direction, wind speed, stability category, and precipitation) were collected on-site at North Anna Power Station [Reference 4]. The wind direction and wind speed were recorded at vent height (tower upper elevation); the stability data were determined by a Delta T system measuring the temperature at 10 meters and at vent height; and precipitation was measured at ground level. The instruments were calibrated quarterly. The data were temporarily stored at the sites in dataloggers which were polled nightly to transfer the data to a personal computer at Innsbrook. The data were quality controlled each business day by EP&C personnel. Professional meteorologists resolved any unusual data situations. Each month, the data were transferred to the corporate mainframe computer and were converted to and stored in SAS datasets. SAS programs were written to produce the hourly data files in MACCS2 format. Several conversions were made in the data in order to provide them in the MACCS2 format:

The wind direction were recorded as direction "from" which the wind was blowing, and these were converted to direction "to".
Wind speed were recorded as miles per hour, and they were converted to tenths of meters per second.
Stability data were recorded as absolute Delta T values, and these were converted to stability categories of "1" to "7".
Precipitation was recorded as inches, and it was converted to hundredths of inches.

The mixing height data were derived from radiosonde measurements taken by the National Weather Service at their station near Dulles Airport (Sterling, Virginia). Dulles Airport is the nearest inland upper

air station to North Anna.

Morning and afternoon mixing height values for 1996 through 1998 were obtained from the National Climatic Data Center. Missing values were replaced where possible as prescribed in the USEPA document "Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models." All non-missing values greater than zero were considered valid.

7.5 SITE Data File: "NSITE.INP"

The population distribution and land use information for the region surrounding the site are specified in the Site Data File. Contained in the Site Data file are the geometry data used for the site (spatial intervals and wind directions), population distribution, fraction of the area that is land, watershed data for the liquid pathways model, information on agricultural land use and growing seasons, and regional economic information. Some of the detailed data in this file supercedes certain data in the EARLY input file.

Much of the site data was initially prepared by the computer program SECPOP90 [Reference 11]. This code contains a database extracted from Bureau of the Census PL 94-171 (block level census) CD-ROMS [Reference 12], the 1992 Census of Agriculture CD ROM Series 1B, the 1994 US Census *County and City Data Book* CD-ROM, the 1993 and 1994 *Statistical Abstract of the United States*, and other minor sources. The reference contains details on how its database was created and checked. The output from SECPOP90 is a file in the MACCS2 site file format based on the data in its reference data base for the specified site.

The plant location for NAPS Unit 1 is described in the North Anna UFSAR Section 2.1.1.1 Site Location. The 50 mile radius area around the plant was divided into sixteen directions that are equivalent to a standard navigational compass rosette. This rosette was further divided into 11 "inner" radial rings, each with sixteen azimuthal sections. A picture of the rosette for North Anna 10 and 50 mile radii are shown in Attachment I.

The SECPOP90-prepared data was then modified and updated using more recent references as discussed below.

7.5.1 Population Distribution

The North Anna UFSAR Section 2.1.3 50 mile population distribution for the year 2030 was used in place of the 1990 Census SECPOP90 data.

7.5.2 LAND FRACTIONS

SECPOP90 calculates the land fraction for each rosette section as explained in the manual for the code [Reference 11]. The code contains a county-level database with the land fractions for each county obtained from the 1990 census data files [Reference 12]. The calculated values are used directly in these analyses.

7.5.3 Region Index

The region indexes were selected to allow unique region numbers for the sectors with large areas, that is, the very small regions of the rosette near the plant were assigned to similar regions. This is required because SECPOP90 has a limit of 99 regions only.

7.5.4 Watershed Index

For North Anna the landmass surrounding the site up to a 50 mile radius is mostly land and stagnant water bodies with small streams with the exception of a part of the Potomac river in the NE direction at 40 miles. It was assumed therefore that the North Anna watershed data represents all landmass for the 16 polar coordinates at 11 spatial intervals. This is represented by specifying a 1 for each coordinate as shown in the NSITE input data file in Attachment III.

7.5.5 Crop Season and Share

The crop season data was assumed to be the same as for the Surry Power Station site and is taken from the NUREG-1150 analysis for Surry [Reference 9]. Agricultural data available in the 1997 Census of Agriculture [Reference 16] was used to produce the land fraction used for each crop.

7.5.6 Watershed Definition

The default data was used here and assumed to be the same for NAPS as for the Surry site which was taken from the analysis for Surry [Reference 9].

7.5.7 Regional Economic Data

The SECPOP90 regional economic values were updated to 1999 using cost of living and other data from the Bureau of the Census and the Department of Agriculture. Agricultural data is taken from data available in the 1999 Census of Agriculture [Reference 16]. This was accomplished by replacing the SECPOP90 data for the counties within the fifty mile radius by the 1999 value. That is, the SECPOP90 county data base was modified so that the results produced by the code were correctly assigned to the various economic regions.

8 Computer Codes And Computer Used

For this ESBWR analysis the MACCS2 code [Reference 1] was run on a DELL platform desktop computer. No other code was used for the ESBWR analysis.

9 Detailed Calculations

Five MACCS2 runs were executed, 1 base case plus 4 sensitivity cases. The base case used the best estimate values with year 2030 population projections and 1998 meteorological data as described in the next section and is termed BASE. The Base Case evacuation modeling was carried out by assuming an evacuation scenario wherein 95% of the population are evacuated normally (within the 10 mile emergency zone). Four sensitivity runs were made using 1996 and 1997 metecrological data respectively plus a sensitivity on reactor power and plume energy.

10 Computer Input And Output

A paper copy of the base case input files for NEARLY, NCHRONC, ABATMOS, and the NSITE are included in Attachment III. The meteorological file is too large and is not included in printed form. An electronic copy of all these files are included in Attachment IV.

The various sensitivity case input files have descriptive names, and are listed below. These are included in the files included in the electronic form of this file.

	Description
CASE1A	BASE CASE: 1998 Met Data, 95% Evac, DLTSHL=7200, Plume E=1.0E-6W
CASE2A	Sensitivity Case: 1997 Met Data, 95% Evac, DLTSHL=7200, Plume E=1.0E-6W

CASE3A Sensitivity Case: 1996 Met Data, 95% Evac, DLTSHL=7200, Plume E=1.0E-6W
CASE4A Sensitivity Case: 1996 Met Data, 95% Evac, DLTSHL=7200, Power = 5500MWt
CASE5B Sensitivity Case: 1996 Met Data, 95% Evac, DLTSHL=7200, Plume E=1.0E6W

The output files are too large to be included in this calculation. Therefore output files are included in the electronic file also.

The titles of the 3 input files corresponding to each sensitivity case used in the executable RUNIT.BAT file are listed below.

CASE1A EBATMOS.INP ABEARLY.INP ABCHRONC.INP NMET98.INP NSITE.INP
CASE2A EBATMOS.INP ABEARLY.INP ABCHRONC.INP NMET97.INP NSITE.INP
CASE3A EBATMOS.INP ABEARLY.INP ABCHRONC.INP NMET96.INP NSITE.INP
CASE4A EBATMOSA.INP ABEARLY.INP ABCHRONC.INP NMET96.INP NSITE.INP
CASE5B EBATMOSB.INP ABEARLY.INP ABCHRONC.INP NMET96.INP NSITE.INP

The titles of the 3 output files corresponding to each sensitivity case is listed below.

CASE1A ESBOUT98X.OUT
CASE2A ESBOUT97X.OUT
CASE3A ESBOUT96X.OUT
CASE4A ESBOUT96A.OUT
CASE5B ESBOUT96B.OUT

The output and input files will also be stored on a CDROM which will accompany this calculation.

11 Summary Of Results

The following results are extracted from the MACCS2 output files produced for 11 source term categories (STC) for the BASE CASE1A and four sensitivity studies CASE2A, CASE3A, CASE4A and CASE5B. Reported here in Tables 11-1 and 11-2 are the total offsite dose in Sieverts and the offsite economic cost in dollars within a 50 mile radius for each of the 11 STC's respectively. Tables 11-3 through 11-10 provide additional output that is considered to be of interest which include the early and late cancer fatalities, the affected land areas which require decontamination, interdiction, condemnation and the Exposure Index. The 11 STCs and Frequencies are defined in Table 6-1 above.

Table 11-1: ESBWR Population Dose, Sieverts						Category Frequency
STC	CASE1A 98MET	CASE2A 97MET	CASE3A 96MET	CASE4A 5500MWt	CASE5B Plume=1.0E6W	Prob/yr
BOC	9.33E+04	8.55E+04	8.77E+04	9.79E+04	8.84E+04	<1E-12
BYP	8.68E+04	7.96E+04	8.22E+04	9.11E+04	8.28E+04	4E-12
CCID	7.17E+04	6.48E+04	6.65E+04	7.16E+04	6.71E+04	2.9E-11
CCIW	1.24E+04	1.09E+04	1.18E+04	1.30E+04	1.20E+04	2.9E-10
DCH	6.29E+04	5.74E+04	5.73E+04	6.41E+04	5.76E+04	<1E-12
EVE	7.72E+04	6.90E+04	7.18E+04	7.70E+04	7.27E+04	2.5E-10
FR	3.15E+02	2.64E+02	2.98E+02	3.60E+02	3.02E+02	2.3E-10
OPVB	3.12E+04	2.83E+04	2.91E+04	3.30E+04	2.93E+04	<1E-12
OPW1	5.52E+04	5.13E+04	5.21E+04	5.73E+04	5.27E+04	<1E-12
OPW2	2.87E+04	2.68E+04	2.76E+04	2.96E+04	2.78E+04	1.4E-11
TSL	2.43E+02	2.02E+02	2.29E+02	2.73E+02	2.32E+02	2.8E-8

Table 11-2: ESBWR Offsite Cost, $						Category Frequency
STC	CASE1A 98MET	CASE2A 97MET	CASE3A 96MET	CASE4A 5500MWt	CASE5B Plume=1.0E6W	Prob/yr
BOC	1.36E+10	1.27E+10	1.41E+10	1.63E+10	1.43E+10	<1E-12
BYP	1.34E+10	1.25E+10	1.38E+10	1.58E+10	1.41E+10	4E-12
CCID	1.51E+10	1.36E+10	1.42E+10	1.62E+10	1.44E+10	2.9E-11
CCIW	8.19E+08	6.24E+08	7.54E+08	1.06E+09	7.80E+08	2.9E-10
DCH	9.46E+09	8.50E+09	9.20E+09	1.01E+10	9.37E+09	<1E-12
EVE	1.59E+10	1.44E+10	1.50E+10	1.70E+10	1.52E+10	2.5E-10
FR	2.48E+06	1.93E+06	2.51E+06	3.25E+06	2.47E+06	2.3E-10
OPVB	4.15E+09	3.45E+09	3.95E+09	4.38E+09	4.04E+09	<1E-12
OPW1	9.13E+09	8.11E+09	8.63E+09	9.63E+09	8.74E+09	<1E-12
OPW2	4.58E+09	3.84E+09	4.25E+09	4.93E+09	4.35E+09	1.4E-11
TSL	1.64E+06	1.47E+06	1.74E+06	2.60E+06	1.68E+06	2.8E-8

The ESBWR consequence in sieverts is converted to risk as Person-Rem/year is shown in Table 11-3 below for all eleven STCs. The risk was calculated as a product of the above listed frequency with the corresponding dose and cost for each STC, respectively. It is to be noted that one sievert is equal to 100 Rem.

Table 11-3: ESBWR Dose Risk Assessment, Person-Rem/year					
STC	CASE1A 98MET	CASE2A 97MET	CASE3A 96MET	CASE4A 5500MWt	CASE5B Plume=1.0E6W
BOC	9.33E-06	8.55E-06	8.77E-06	9.79E-06	8.84E-06
BYP	3.47E-05	3.18E-05	3.29E-05	3.64E-05	3.31E-05
CCID	2.08E-04	1.88E-04	1.93E-04	2.08E-04	1.95E-04
CCIW	3.60E-04	3.16E-04	3.42E-04	3.77E-04	3.48E-04
DCH	6.29E-06	5.74E-06	5.73E-06	6.41E-06	5.76E-06
EVE	1.93E-03	1.73E-03	1.80E-03	1.93E-03	1.82E-03
FR	7.25E-06	6.07E-06	6.85E-06	8.28E-06	6.95E-06
OPVB	3.12E-06	2.83E-06	2.91E-06	3.30E-06	2.93E-06
OPW1	5.52E-06	5.13E-06	5.21E-06	5.73E-06	5.27E-06
OPW2	4.02E-05	3.75E-05	3.86E-05	4.14E-05	3.89E-05
TSL	6.80E-04	5.66E-04	6.41E-04	7.64E-04	6.50E-04
Total	3.28E-03	2.89E-03	3.07E-03	3.39E-03	3.11E-03

The ESBWR percentage dose contribution to total risk is shown on Table 11-4 below. The largest contribution to dose comes from EVE release category and the lowest contribution comes from the OPVB release category.
The release category EVE is defined as an ex-vessel steam explosion that fails containment whereas release category OPVB is defined as a containment failure due to failure of vapor suppression (vacuum breaker) function.

Table 11-4: Percentage Dose Contribution to Total Risk					
STC	CASE1A 98MET	CASE2A 97MET	CASE3A 96MET	CASE4A 5500MWt	CASE5B Plume=1.0E6W
BOC	0.28%	0.30%	0.29%	0.29%	0.28%
BYP	1.06%	1.10%	1.07%	1.08%	1.06%
CCID	6.33%	6.50%	6.28%	6.13%	6.25%
CCIW	10.95%	10.93%	11.14%	11.14%	11.18%
DCH	0.19%	0.20%	0.19%	0.19%	0.19%
EVE	58.76%	59.64%	58.43%	56.86%	58.41%
FR	0.22%	0.21%	0.22%	0.24%	0.22%
OPVB	0.09%	0.10%	0.09%	0.10%	0.09%
OPW1	0.17%	0.18%	0.17%	0.17%	0.17%
OPW2	1.22%	1.30%	1.26%	1.22%	1.25%
TSL	20.72%	19.56%	20.87%	22.58%	20.88%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

The population exceeding the 25 and 200 person rem limits respectively for the Base Case (CASE1A) are shown on Table 11-5. The mean overall dose is reported here which includes the contributions of 95% from Cohort 1 and 5% from Cohort 2. Cohort 1 represents the 95% of population within the 10 mile radius that evacuates and Cohort 2 is the 5% of the population that does not evacuate. The Base Case (CASE1A) assumes that 95% of the population evacuates out to 10 miles and 5% of the population do not evacuate.

Table 11-5: Population Exceeding Overall Dose		
Release Category	25 Person Rem	200 Person Rem
BOC	3.93E+04	2.33E+03
BYP	3.36E+04	1.87E+03
CCID	6.55E+03	1.82E+01
CCIW	4.25E-01	1.77E-04
DCH	8.47E+03	2.18E+01
EVE	1.04E+04	1.32E+02
FR	2.17E-03	0.00E+00
OPVB	1.07E+03	4.87E+00
OPW1	4.54E+03	1.38E+01
OPW2	1.84E+01	7.85E-01
TSL	0.00E+00	0.00E+00

The ESBWR mean value for total economic risk in terms of $/year are shown for all ten STC's in Table 11-6 below. The largest economic risk comes from release category ex-vessel steam explosion (EVE). The ESBWR risk was calculated as a product of the above listed (Table 11-2) frequency with the corresponding cost for each STC respectively.

Table 11-6: ESBWR Dollar Risk Assessment, $/year					
STC	CASE1A 98MET	CASE2A 97MET	CASE3A 96MET	CASE4A 5500MWt	CASE5B Plume=1.0E6W
BOC	1.36E-02	1.27E-02	1.41E-02	1.63E-02	1.43E-02
BYP	5.36E-02	5.00E-02	5.52E-02	6.32E-02	5.64E-02
CCID	4.38E-01	3.94E-01	4.12E-01	4.70E-01	4.18E-01

CCIW	2.38E-01	1.81E-01	2.19E-01	3.07E-01	2.26E-01
DCH	9.46E-03	8.50E-03	9.20E-03	1.01E-02	9.37E-03
EVE	3.98E+00	3.60E+00	3.75E+00	4.25E+00	3.80E+00
FR	5.70E-04	4.44E-04	5.77E-04	7.48E-04	5.68E-04
OPVB	4.15E-03	3.45E-03	3.95E-03	4.38E-03	4.04E-03
OPW1	9.13E-03	8.11E-03	8.63E-03	9.63E-03	8.74E-03
OPW2	6.41E-02	5.38E-02	5.95E-02	6.90E-02	6.09E-02
TSL	4.59E-02	4.12E-02	4.87E-02	7.28E-02	4.70E-02
Total	**4.85E+00**	**4.35E+00**	**4.58E+00**	**5.27E+00**	**4.65E+00**

The ESBWR mean values for affected land areas in hectares are shown in Table 11-7 below. These values were taken from the Base Case MACCS2 output from Cohort 3 CHRONC module. The largest affected land area comes from the farm interdictior for release category DCH. The release category DCH is a direct containment heating (high pressure RPV failure) event that damages the containment boundary.

Table 11-7: CASE1A Mean Values for Affected Land Areas Hectares (0-50mi)

Release Category	Farm Decontamin-ation	Farm Interdiction	Farm Condemnation
BOC	4.89E+04	5.92E+04	5.80E+03
BYP	4.69E+04	5.48E+04	5.78E+03
CCID	8.00E+04	8.91E+04	3.79E+03
CCIW	1.20E+04	2.72E+04	3.71E+01
DCH	6.14E+04	9.15E+04	1.66E+03
EVE	8.13E+04	8.89E+04	4.17E+03
FR	4.19E+01	1.23E+03	0.00E+00
OPVB	3.80E+04	7.82E+04	2.78E+02
OPW1	5.99E+04	8.66E+04	1.51E+03
OPW2	3.91E+04	6.26E+04	3.54E+02
TSL	4.65E+01	5.75E+02	0.00E+00
Total	**2.55E+05**	**3.49E+05**	**8.17E+03**

The early and latent cancer fatalities are presented in Table 11-8. The mean values for early and latent cancer fatalities were taken from the Base Case MACCS2 overall results section which reports the sum total of Cohorts 1, 2 and 3. The early and late cancer fatalities reported are for the 0-50 mile mean values respectively. It is seen that the highest early and late cancer fatalities are associated with release category numbers 8 and 9 respectively. The total early and late cancer fatalities per year were calculated to be 2.36E-10 and 5.64E-07 respectively.

Table 11-8: ESBWR Mean Values for Early and Latent Fatalities (0-50 mi)

Release Category	Early Fatalities	Latent Cancer Fatalities	Frequency Prob/yr	Early Fatalities/yr	Late Cancer Fatalities/yr
BOC	5.17E+01	3.82E+03	<1E-12	5.17E-11	3.82E-09

BYP	4.47E+01	4.24E+03	4E-12	1.79E-10	1.70E-08
CCID	0	1.18E+03	2.9E-11	0.00E+00	3.42E-08
CCIW	0	3.59E+01	2.9E-10	0.00E+00	1.04E-08
DCH	0.00E+00	1.15E+03	<1E-12	0.00E+00	1.15E-09
EVE	2.39E-02	1.82E+03	2.5E-10	5.98E-12	4.55E-07
FR	0	5.45E+00	2.3E-10	0.00E+00	1.25E-09
OPVB	0	4.31E+02	<1E-12	0.00E+00	4.31E-10
OPW1	0	8.70E+02	<1E-12	0.00E+00	8.70E-10
OPW2	0	2.99E+02	1.4E-11	0.00E+00	4.19E-09
TSL	0	1.28E+00	2.8E-8	0.00E+00	3.58E-08
Total				2.36E-10	5.64E-07

The Exposure Index was calculated as the product of the average wind frequency using 1998 meteorological data and the 0-10 mile population data for all 16 compass wind directions (See Table 11-9). The average wind frequency was taken from the MACCS output file and represents the average value for all 36 stability classes. The 0-10 mile population data was taken from the Site input file by summing the population for each wind direction. The product sum total value was calculated as 1299 for the Exposure Index.

Table 11-9: Exposure Index Data For Population (0-10mi)

Wind Direction	Average Wind Frequency	Population Data	Product
1	0.06	1187	71.2
2	0.099	2044	202.4
3	0.089	1672	148.8
4	0.05	1918	95.9
5	0.053	1668	88.4
6	0.057	1452	82.8
7	0.089	827	73.6
8	0.088	1291	113.6
9	0.104	886	92.1
10	0.062	766	47.5
11	0.046	1487	68.4
12	0.037	1699	62.9
13	0.047	634	29.8
14	0.044	926	40.7
15	0.039	1076	42.0
16	0.036	1084	39.0
Total			**1,299.1**

The Exposure Index was also calculated for the 0-50 mile population data for all 16 compass wind directions (See Table 11-10). The average wind frequency using 1998 meteorological data was taken from the MACCS output file and represents the average value for all 36 stability classes. The 0-50 mile population data was taken from the Site input file by summing the population for each wind direction. The product sum total value was calculated as 199,059 for the 0-50 mile Exposure Index.

Table 11-10: Exposure Index Data For Population (0-50mi)			
Wind Direction	**Average Wind Frequency**	**Population Data**	**Product**
1	0.06	88370	5302.2
2	0.099	266190	26352.8
3	0.089	298232	26542.6
4	0.05	50487	2524.4
5	0.053	21278	1127.7
6	0.057	30011	1710.6
7	0.089	194874	17343.8
8	0.088	1045291	91985.6
9	0.104	87390	9088.6
10	0.062	25499	1580.9
11	0.046	19074	877.4
12	0.037	34444	1274.4
13	0.047	162814	7652.3
14	0.044	47124	2073.5
15	0.039	36916	1439.7
16	0.036	60628	2182.6
Total			**199,059**

Additionally responses to preliminary NRC questions (Ref.18) regarding the Environmental Report of the Early Site Permit (ESP) application for the North Anna Site are included in Attachment V. Only the questions from Reference 18 Section 7.2 Severe Accidents, relating to the analysis done in this calculation are addressed here.

12 Conclusions

The ESBWR dose risk assessment has resulted in a total dose of 3.28E-03 person-rem/year to the population within a 50 mile radius for the Base Case (CASE1A). The ESBWR dollar risk assessment has resulted in a total economic dollar value of $4.85/year to the population, land and property within a 50 mile radius of the plant for the Base Case. Four Sensitivity cases were made to determine the impact of met data, reactor power and plume energy. See Tables 11-1 thru-10 above with the results.

Attachment 1
Rosette
North Anna Power Station

Year 2030

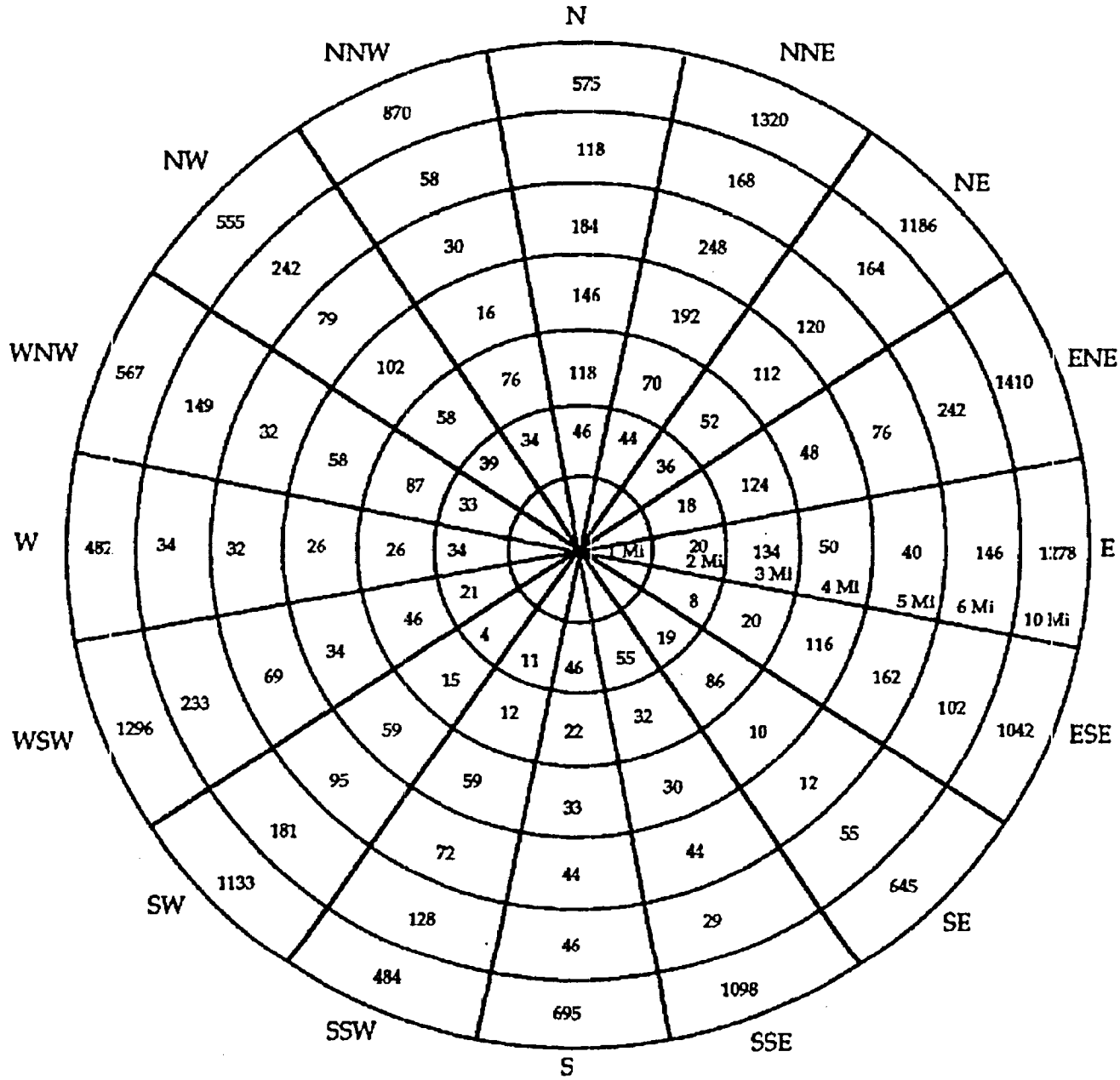
10 Mile Population Distribution

And

50 Mile Population Distribution

ENGINEERING WORK SHEET

Calc Number SM-1526	Rev. 0	Add.	Sheet: _20_ of _61_



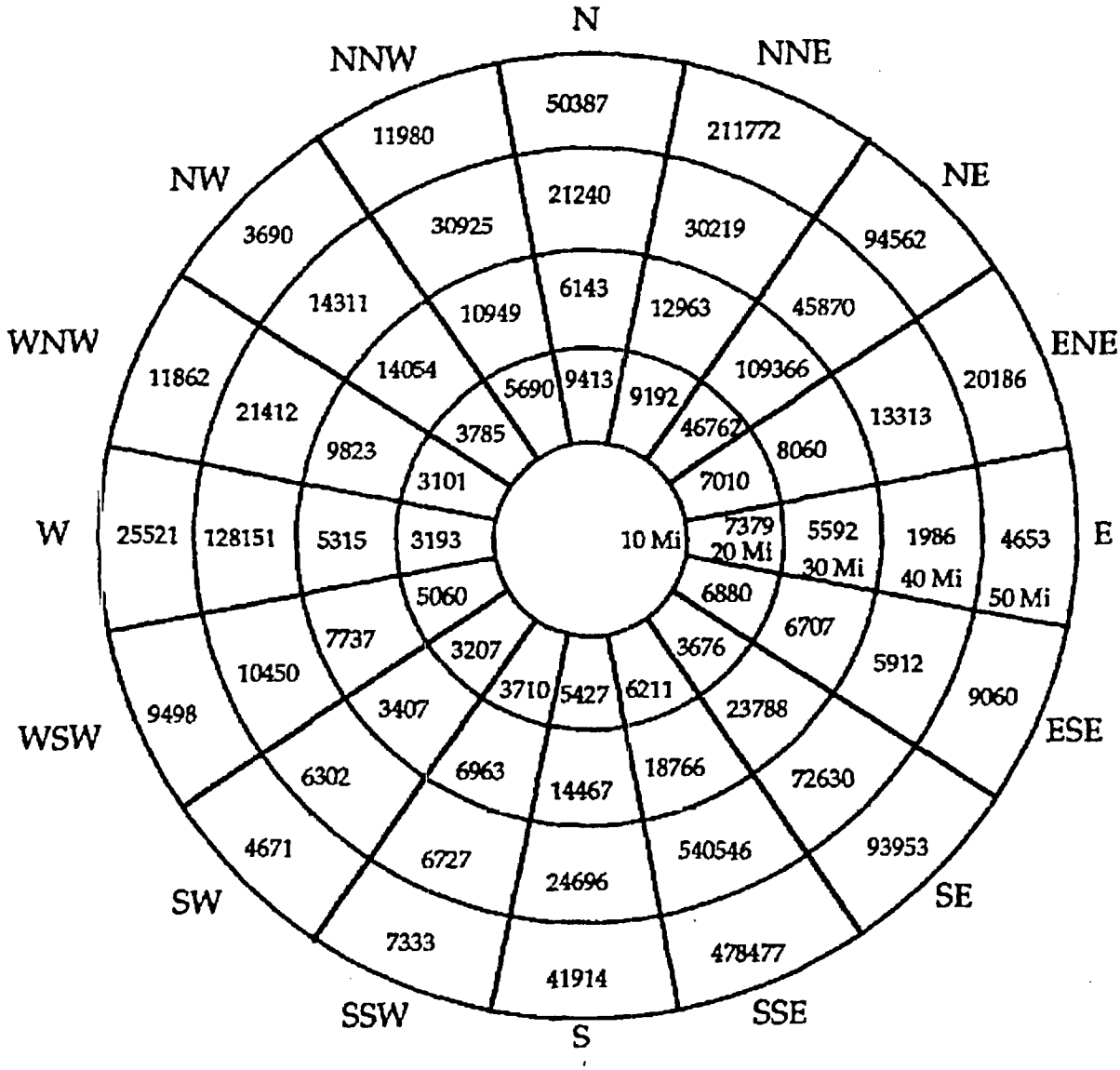
POPULATION INSIDE ONE MILE

N	NNE	NE	ENE	E	ESE	SE	SSE
0	2	2	0	0	2	0	3
0	0	0	0	0	0	1	0
S	SSW	SW	WSW	W	WNW	NW	NNW

N0201008

POPULATION BY ANNULUS

ANNULUS	0 TO 1	1 TO 2	2 TO 3	3 TO 4	4 TO 5	5 TO 6	6 TO 10	TOTAL
POPULATION	10	469	979	1,094	1,340	2,098	14,636	20,625



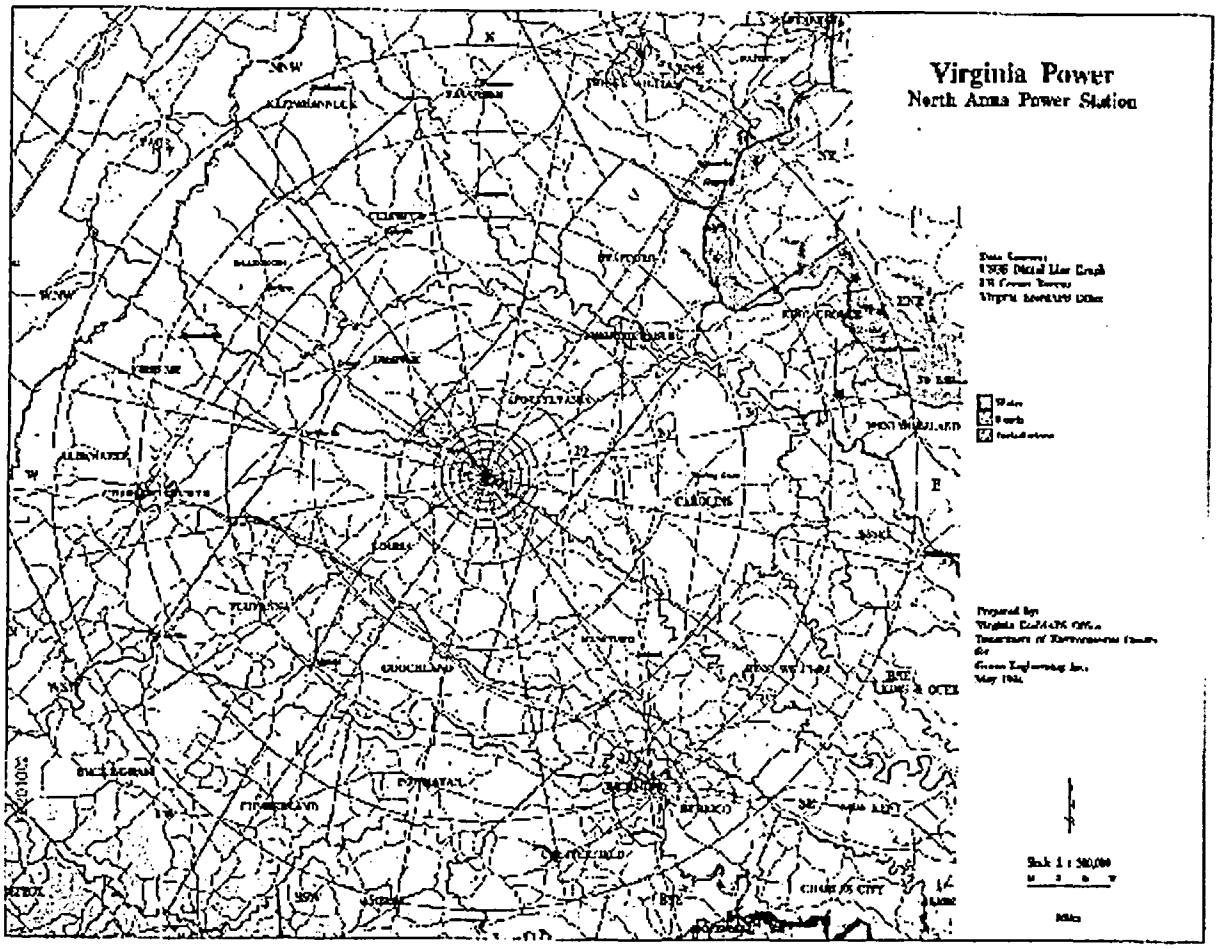
POPULATION BY ANNULUS

ANNULUS	0 TO 10	10 TO 20	20 TO 30	30 TO 40	40 TO 50	TOTAL
POPULATION	20,625	129,698	264,099	974,689	1,079,518	2,468,629

North Anna Power Station 50 Mile Radius

ENGINEERING WORK SHEET

Calc Number SM-1526	Rev. 0	Add.	Sheet: _22_ of _61



Attachment II
Memorandum
"Nuclear Relicensing Meteorological Data Documentation"

To: Mr. Tony Banks EP&C Department

From: Philip C. Knause December 29, 1999

Nuclear Relicensing Meteorological Data Documentation

In support of the nuclear relicensing effort, the Virginia Power Environmental Policy & Compliance Department ("EP&C") provided files containing hourly meteorological data and seasonal mixing height data, with one year of data from each site in each file. Data for 1996 through 1998 were provided.

The hourly data (wind direction, wind speed, stability category, and precipitation) were collected on-site at Surry and North Anna Power Stations. The wind direction and wind speed were recorded at vent height (tower upper elevation); the stability data were determined by a Delta T system measuring the temperature at 10 meters and at vent height; and precipitation was measured at ground level. The instruments were calibrated quarterly. The data were temporarily stored at the sites in dataloggers which were polled nightly to transfer the data to a personal computer at Innsbrook. The data were quality controlled each business day by EP&C personnel. Professional meteorologists resolved any unusual data situations. Each month, the data were transferred to the corporate mainframe computer and were converted to and stored in SAS datasets. SAS programs were written to produce the hourly data files in MACCS2 format. Several conversions were made in the data in order to provide them in the MACCS2 format:

- The wind direction were recorded as direction "from" which the wind was blowing, and these were converted to direction "to".
- Wind speed were recorded as miles per hour, and they were converted to tenths of meters per second.
- Stability data were recorded as absolute Delta T values, and these were converted to stability categories of "1" to "7".
- Precipitation was recorded as inches, and it was converted to hundredths of inches.

In order to provide data for every hour, missing data were replaced using standard methods. The logic for replacing any missing data are contained in the attached table.

Measurement	Primary	Secondary	Tertiary	Quartenary	5th	6th
North Anna						
Wind Direction	Upper elevation	10-meter elevation	Backup 10-meter elevation	Bremo Power Station 10-meter elevation		
Wind Speed	Upper elevation	10-meter elevation (1)	Backup 10-meter elevation (1)	Bremo Power Station 10-meter elevation (1)		
Stability	Delta T	Upper elevation sigma-theta	10-meter elevation sigma-theta	Backup 10-meter elevation sigma-theta		
Precipitation	Ground level	Bremo Power Station Ground Level				
Surry						
Wind Direction	Upper elevation	10-meter elevation	Backup 10-meter elevation	Chesapeake Energy Center 10-meter elevation	Chesterfield Power Station 10-meter elevation	
Wind Speed	Upper elevation	10-meter elevation (1)	Backup 10-meter elevation (1)	Chesapeake Energy Center 10-meter elevation (1)	Chesterfield Power Station 10-meter elevation (1)	
Stability	Delta T	Upper elevation sigma-theta	10-meter elevation sigma-theta	Backup 10-meter elevation sigma-theta	Chesapeake Energy Center 10-meter elevation sigma-theta	Chesterfield Power Station 10-meter elevation sigma-theta
Precipitation	Ground level	Chesapeake Energy Center ground level	Chesterfield Power Station ground level			

80 The 10-meter wind speed data, if used, were powered up to the vent height elevation

The mixing height data were derived from radiosonde measurements taken by the National Weather Service at their station near Dulles Airport (Sterling, Virginia). Dulles is the nearest inland upper air station to North Anna. The Wallops Island upper air

station on the northern portion of the Eastern Shore of Virginia is actually closer to Surry than the Dulles station. Also, the Cape Hatteras, North Carolina upper air station is approximately the same distance to Surry as Dulles; however, the strong coastal influence experienced at Wallops Island and Cape Hatteras makes the data collected at these locations less representative of mixing heights likely to occur in the vicinity of Surry.

Morning and afternoon mixing height values for 1996 through 1998 were obtained from the National Climatic Data Center. Missing values were replaced where possible as prescribed in the USEPA document "Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models." All non-missing values greater than zero were considered valid.

Seasons were defined as follows for the purposes of this mixing height analysis:

- Winter: 12/22 – 3/21 (1/1 – 3/21 and 12/22 – 12/31 for a given calendar year)
- Spring: 3/22 – 6/21
- Summer: 6/22 – 9/21
- Fall: 9/22 – 12/21

Please contact me at Innsbrook, Extension 2946, if you need further information.

Original Signed by

Philip C. Knause

cc: (via e-mail)
Steve Shaw
Tracy Faix
Jim Browder

Attachment III MACCS2 Input File Listings for Base Case

EBATMOS.INP

EBEARLY.INP

EBCHRONC.INP

NSITE.INP

```
* GENERAL DESCRIPTIVE TITLE DESCRIBING THIS ESBWR "ATMOS" INPUT
* This is the ESBWR BASE CASE ATMOS input deck
*    LAST MODIFIED by MGM  4/10/06
RIATNAM1001 'IN1A.INP, ESBWR Model--Using stacked ST data, ATMOS input'
*********************************************************************************
* GEOMETRY DATA BLOCK, LOADED BY INPGEO, STORED IN /GEOM/
*
* NUMBER OF RADIAL SPATIAL ELEMENTS
*
GENUMRAD001  11
*
*  ESBWR/NAPS
*
GESPAEND001    1.61    3.22    4.83    6.44    8.05
GESPAEND002    9.65   16.09   32.18   48.27   64.37
GESPAEND003   80.47
*
*********************************************************************************
* NUCLIDE DATA BLOCK, LOADED BY INPISO, STORED IN /ISOGRP/, /ISONAM/
*
* Number of pseudo-stable nuclides (used to truncate the decay chains)
*
ISNUMSTB001    27
*
* List of pseudo-stable nuclides
*
*          NAMSTB
*
ISNAMSTB001   I-129   (daughter of Te-129 and Te-129m)
ISNAMSTB002   Xe-131m  (daughter of I-131)
ISNAMSTB003   Xe-133m  (daughter of I-133)
ISNAMSTB004   Xe-135m  (daughter of I-135)
ISNAMSTB005   Cs-135   (daughter of Xe-135 and Xe-135m)
ISNAMSTB006   Sm-147   (daughter of Pm-147)
ISNAMSTB007   U-234   (daughter of Pu-238)
ISNAMSTB008   U-235   (daughter of Pu-239)
ISNAMSTB009   U-236   (daughter of Pu-240)
ISNAMSTB010   U-237   (daughter of Pu-241)
ISNAMSTB011   Np-237   (daughter of Am-241)
ISNAMSTB012   Rb-87   (daughter of Kr-87)
ISNAMSTB013   Ba-137m  (daughter of Cs-137)
ISNAMSTB014   Rb-88   (daughter of Kr-88)
ISNAMSTB015   Y-91m   (daughter of Sr-91)
ISNAMSTB016   Zr-93   (daughter of Y-93)
ISNAMSTB017   Nb-93m   (daughter of Zr-93)
ISNAMSTB018   Nb-95m   (daughter of Zr-95)
ISNAMSTB019   Nb-97   (daughter of Zr-97 and Nb-97m)
ISNAMSTB020   Nb-97m   (daughter of Zr-97)
ISNAMSTB021   Tc-99   (daughter of Mo-99)
ISNAMSTB022   Rh-103m  (daughter of Ru-103)
ISNAMSTB023   Rh-106   (daughter of Ru-106)
ISNAMSTB024   Te-131   (daughter of Te-131m)
ISNAMSTB025   Pr-144   (daughter of Ce-144 and Pr-144m)
ISNAMSTB026   Pr-144m  (daughter of Ce-144)
ISNAMSTB027   Pm-147   (daughter of Nd-147)
*
* Number of radioactive nuclides to be considered
*
ISNUMISO001 60
*
* NUMBER OF NUCLIDE GROUPS
*
ISMAXGRP001  9
*
* WET AND DRY DEPOSITION FLAGS FOR EACH NUCLIDE GROUP
*
*          WETDEP    DRYDEP
*
ISDEPFLA001   .FALSE.  .FALSE.
ISDEPFLA002   .TRUE.   .TRUE.
ISDEPFLA003   .TRUE.   .TRUE.
ISDEPFLA004   .TRUE.   .TRUE.
ISDEPFLA005   .TRUE.   .TRUE.
```

```
ISDEPFLA006  .TRUE.  .TRUE.
ISDEPFLA007  .TRUE.  .TRUE.
ISDEPFLA008  .TRUE.  .TRUE.
ISDEPFLA009  .TRUE.  .TRUE.
*
* NUCLIDE GROUP DATA FOR 9 NUCLIDE GROUPS
*
*          NUCNAM  IGROUP
*
ISOTPGRP001  Co-58     6
ISOTPGRP002  Co-60     6
ISOTPGRP003  Kr-85     1
ISOTPGRP004  Kr-85m    1
ISOTPGRP005  Kr-87     1
ISOTPGRP006  Kr-88     1
ISOTPGRP007  Rb-86     3
ISOTPGRP008  Sr-89     5
ISOTPGRP009  Sr-90     5
ISOTPGRP010  Sr-91     5
ISOTPGRP011  Sr-92     5
ISOTPGRP012  Y-90      7
ISOTPGRP013  Y-91      7
ISOTPGRP014  Y-92      7
ISOTPGRP015  Y-93      7
ISOTPGRP016  Zr-95     7
ISOTPGRP017  Zr-97     7
ISOTPGRP018  Nb-95     7
ISOTPGRP019  Mo-99     6
ISOTPGRP020  Tc-99m    6
ISOTPGRP021  Ru-103    6
ISOTPGRP022  Ru-105    6
ISOTPGRP023  Ru-106    6
ISOTPGRP024  Rh-105    6
ISOTPGRP025  Sb-127    4
ISOTPGRP026  Sb-129    4
ISOTPGRP027  Te-127    4
ISOTPGRP028  Te-127m   4
ISOTPGRP029  Te-129    4
ISOTPGRP030  Te-129m   4
ISOTPGRP031  Te-131m   4
ISOTPGRP032  Te-132    4
ISOTPGRP033  I-131     2
ISOTPGRP034  I-132     2
ISOTPGRP035  I-133     2
ISOTPGRP036  I-134     2
ISOTPGRP037  I-135     2
ISOTPGRP038  Xe-133    1
ISOTPGRP039  Xe-135    1
ISOTPGRP040  Cs-134    3
ISOTPGRP041  Cs-136    3
ISOTPGRP042  Cs-137    3
ISOTPGRP043  Ba-139    9
ISOTPGRP044  Ba-140    9
ISOTPGRP045  La-140    7
ISOTPGRP046  La-141    7
ISOTPGRP047  La-142    7
ISOTPGRP048  Ce-141    8
ISOTPGRP049  Ce-143    8
ISOTPGRP050  Ce-144    8
ISOTPGRP051  Pr-143    7
ISOTPGRP052  Nd-147    7
ISOTPGRP053  Np-239    8
ISOTPGRP054  Pu-238    8
ISOTPGRP055  Pu-239    8
ISOTPGRP056  Pu-240    8
ISOTPGRP057  Pu-241    8
ISOTPGRP058  Am-241    7
ISOTPGRP059  Cm-242    7
ISOTPGRP060  Cm-244    7
**********
* WET DEPOSITION DATA BLOCK, LOADED BY INPWET, STORED IN /WETCON/
*
* WASHOUT COEFFICIENT NUMBER ONE, LINEAR FACTOR
```

```
*
WDCWASH1001  9.5E-5   (JON HELTON AFTER JONES, 1986)
*
* WASHOUT COEFFICIENT NUMBER TWO, EXPONENTIAL FACTOR
*
WDCWASH2001  0.8     (JON HELTON AFTER JONES, 1986)
**********************************************************************
* DRY DEPOSITION DATA BLOCK, LOADED BY INPDRY, STORED IN /DRYCON/
*
* NUMBER OF PARTICLE SIZE GROUPS
*
DDNPSGRP001  1
*
* DEPOSITION VELOCITY OF EACH PARTICLE SIZE GROUP (M/S)
*
DDVDEPOS001  0.01  (VALUE SELECTED BY S. ACHARYA, NRC)
**********************************************************************
* DISPERSION PARAMETER DATA BLOCK, LOADED BY INPDIS, STORED IN /DISPY/, /DISPZ/
*
* # of distances in plume-size tables--which can be used as an alternative to the power-law model:
* (to utilize the power-law model, set NUM_DIST to zero or delete the following data card)
*
NUM_DIST001  50
*
```

* A-stability	Distance (m)	Sigma-y (m)	Sigma-z (m)	
A-STB/DIS01	1.000E+00	3.6580E-01	2.5000E-04	Tadmor/Gur (0.5-5 km)
A-STB/DIS02	1.400E+00	4.9569E-01	5.1105E-04	Tadmor/Gur (0.5-5 km)
A-STB/DIS03	2.000E+00	6.8408E-01	1.0905E-03	Tadmor/Gur (0.5-5 km)
A-STB/DIS04	3.000E+00	9.8658E-01	2.5812E-03	Tadmor/Gur (0.5-5 km)
A-STB/DIS05	4.000E+00	1.2793E+00	4.7568E-03	Tadmor/Gur (0.5-5 km)
A-STB/DIS06	5.000E+00	1.5649E+00	7.6428E-03	Tadmor/Gur (0.5-5 km)
A-STB/DIS07	6.000E+00	1.8450E+00	1.1259E-02	Tadmor/Gur (0.5-5 km)
A-STB/DIS08	8.000E+00	2.3923E+00	2.0749E-02	Tadmor/Gur (0.5-5 km)
A-STB/DIS09	1.000E+01	2.9265E+00	3.3338E-02	Tadmor/Gur (0.5-5 km)
A-STB/DIS10	1.000E+02	2.3412E+01	4.4457E+00	Tadmor/Gur (0.5-5 km)
A-STB/DIS11	1.400E+02	3.1726E+01	9.0879E+00	Tadmor/Gur (0.5-5 km)
A-STB/DIS12	2.000E+02	4.3783E+01	1.9392E+01	Tadmor/Gur (0.5-5 km)
A-STB/DIS13	3.000E+02	6.3144E+01	4.5901E+01	Tadmor/Gur (0.5-5 km)
A-STB/DIS14	4.000E+02	8.1877E+01	8.4590E+01	Tadmor/Gur (0.5-5 km)
A-STB/DIS15	5.000E+02	1.0016E+02	1.3591E+02	Tadmor/Gur (0.5-5 km)
A-STB/DIS16	6.000E+02	1.1808E+02	2.0022E+02	Tadmor/Gur (0.5-5 km)
A-STB/DIS17	8.000E+02	1.5312E+02	3.6898E+02	Tadmor/Gur (0.5-5 km)
A-STB/DIS18	1.000E+03	1.8730E+02	5.9284E+02	Tadmor/Gur (0.5-5 km)
A-STB/DIS19	1.400E+03	2.5381E+02	1.2119E+03	Tadmor/Gur (0.5-5 km)
A-STB/DIS20	2.000E+03	3.5027E+02	2.5860E+03	Tadmor/Gur (0.5-5 km)
A-STB/DIS21	3.000E+03	5.0516E+02	6.1210E+03	Tadmor/Gur (0.5-5 km)
A-STB/DIS22	4.000E+03	6.5503E+02	1.1280E+04	Tadmor/Gur (0.5-5 km)
A-STB/DIS23	5.000E+03	8.0128E+02	1.8124E+04	Tadmor/Gur (0.5-5 km)
A-STB/DIS24	6.000E+03	9.4470E+02	2.6700E+04	Tadmor/Gur (0.5-5 km)
A-STB/DIS25	8.000E+03	1.2250E+03	4.9205E+04	Tadmor/Gur (0.5-5 km)
A-STB/DIS26	1.000E+04	1.4985E+03	7.9057E+04	Tadmor/Gur (0.5-5 km)
A-STB/DIS27	1.400E+04	2.0305E+03	1.6161E+05	Tadmor/Gur (0.5-5 km)
A-STB/DIS28	2.000E+04	2.8022E+03	3.4485E+05	Tadmor/Gur (0.5-5 km)
A-STB/DIS29	3.000E+04	4.0414E+03	8.1625E+05	Tadmor/Gur (0.5-5 km)
A-STB/DIS30	4.000E+04	5.2404E+03	1.5042E+06	Tadmor/Gur (0.5-5 km)
A-STB/DIS31	5.000E+04	6.4104E+03	2.4169E+06	Tadmor/Gur (0.5-5 km)
A-STB/DIS32	6.000E+04	7.5577E+03	3.5605E+06	Tadmor/Gur (0.5-5 km)
A-STB/DIS33	8.000E+04	9.8000E+03	6.5615E+06	Tadmor/Gur (0.5-5 km)
A-STB/DIS34	1.000E+05	1.1988E+04	1.0542E+07	Tadmor/Gur (0.5-5 km)
A-STB/DIS35	1.400E+05	1.6245E+04	2.1551E+07	Tadmor/Gur (0.5-5 km)
A-STB/DIS36	2.000E+05	2.2418E+04	4.5986E+07	Tadmor/Gur (0.5-5 km)
A-STB/DIS37	3.000E+05	3.2332E+04	1.0885E+08	Tadmor/Gur (0.5-5 km)
A-STB/DIS38	4.000E+05	4.1924E+04	2.0059E+08	Tadmor/Gur (0.5-5 km)
A-STB/DIS39	5.000E+05	5.1284E+04	3.2229E+08	Tadmor/Gur (0.5-5 km)
A-STB/DIS40	6.000E+05	6.0463E+04	4.7480E+08	Tadmor/Gur (0.5-5 km)
A-STB/DIS41	8.000E+05	7.8401E+04	8.7500E+08	Tadmor/Gur (0.5-5 km)
A-STB/DIS42	1.000E+06	9.5906E+04	1.4059E+09	Tadmor/Gur (0.5-5 km)
A-STB/DIS43	1.400E+06	1.2996E+05	2.8738E+09	Tadmor/Gur (0.5-5 km)
A-STB/DIS44	2.000E+06	1.7935E+05	6.1324E+09	Tadmor/Gur (0.5-5 km)
A-STB/DIS45	3.000E+06	2.5866E+05	1.4515E+10	Tadmor/Gur (0.5-5 km)
A-STB/DIS46	4.000E+06	3.3540E+05	2.6750E+10	Tadmor/Gur (0.5-5 km)
A-STB/DIS47	5.000E+06	4.1028E+05	4.2979E+10	Tadmor/Gur (0.5-5 km)
A-STB/DIS48	6.000E+06	4.8372E+05	6.3316E+10	Tadmor/Gur (0.5-5 km)

A-STB/DIS49	8.000E+06	6.2723E+05	1.1668E+11	Tadmor/Gur (0.5-5 km)
A-STB/DIS50	1.000E+07	7.6726E+05	1.8747E+11	Tadmor/Gur (0.5-5 km)
*				
* B-stability	Distance (m)	Sigma-y (m)	Sigma-z (m)	
B-STB/DIS01	1.000E+00	2.7510E-01	1.9000E-03	Tadmor/Gur (0.5-5 km)
B-STB/DIS02	1.400E+00	3.7279E-01	3.2574E-03	Tadmor/Gur (0.5-5 km)
B-STB/DIS03	2.000E+00	5.1446E-01	5.7681E-03	Tadmor/Gur (0.5-5 km)
B-STB/DIS04	3.000E+00	7.4196E-01	1.1045E-02	Tadmor/Gur (0.5-5 km)
B-STB/DIS05	4.000E+00	9.6208E-01	1.7511E-02	Tadmor/Gur (0.5-5 km)
B-STB/DIS06	5.000E+00	1.1769E+00	2.5036E-02	Tadmor/Gur (0.5-5 km)
B-STB/DIS07	6.000E+00	1.3875E+00	3.3530E-02	Tadmor/Gur (0.5-5 km)
B-STB/DIS08	8.000E+00	1.7992E+00	5.3161E-02	Tadmor/Gur (0.5-5 km)
B-STB/DIS09	1.000E+01	2.2009E+00	7.6007E-02	Tadmor/Gur (0.5-5 km)
B-STB/DIS10	1.000E+02	1.7607E+01	3.0406E+00	Tadmor/Gur (0.5-5 km)
B-STB/DIS11	1.400E+02	2.3859E+01	5.2127E+00	Tadmor/Gur (0.5-5 km)
B-STB/DIS12	2.000E+02	3.2927E+01	9.2307E+00	Tadmor/Gur (0.5-5 km)
B-STB/DIS13	3.000E+02	4.7487E+01	1.7675E+01	Tadmor/Gur (0.5-5 km)
B-STB/DIS14	4.000E+02	6.1576E+01	2.8023E+01	Tadmor/Gur (0.5-5 km)
B-STB/DIS15	5.000E+02	7.5323E+01	4.0066E+01	Tadmor/Gur (0.5-5 km)
B-STB/DIS16	6.000E+02	8.8805E+01	5.3657E+01	Tadmor/Gur (0.5-5 km)
B-STB/DIS17	8.000E+02	1.1515E+02	8.5073E+01	Tadmor/Gur (0.5-5 km)
B-STB/DIS18	1.000E+03	1.4086E+02	1.2163E+02	Tadmor/Gur (0.5-5 km)
B-STB/DIS19	1.400E+03	1.9088E+02	2.0853E+02	Tadmor/Gur (0.5-5 km)
B-STB/DIS20	2.000E+03	2.6342E+02	3.6926E+02	Tadmor/Gur (0.5-5 km)
B-STB/DIS21	3.000E+03	3.7991E+02	7.0705E+02	Tadmor/Gur (0.5-5 km)
B-STB/DIS22	4.000E+03	4.9262E+02	1.1210E+03	Tadmor/Gur (0.5-5 km)
B-STB/DIS23	5.000E+03	6.0260E+02	1.6028E+03	Tadmor/Gur (0.5-5 km)
B-STB/DIS24	6.000E+03	7.1046E+02	2.1465E+03	Tadmor/Gur (0.5-5 km)
B-STB/DIS25	8.000E+03	9.2124E+02	3.4033E+03	Tadmor/Gur (0.5-5 km)
B-STB/DIS26	1.000E+04	1.1269E+03	4.8658E+03	Tadmor/Gur (0.5-5 km)
B-STB/DIS27	1.400E+04	1.5271E+03	8.3419E+03	Tadmor/Gur (0.5-5 km)
B-STB/DIS28	2.000E+04	2.1074E+03	1.4772E+04	Tadmor/Gur (0.5-5 km)
B-STB/DIS29	3.000E+04	3.0393E+03	2.8285E+04	Tadmor/Gur (0.5-5 km)
B-STB/DIS30	4.000E+04	3.9410E+03	4.4845E+04	Tadmor/Gur (0.5-5 km)
B-STB/DIS31	5.000E+04	4.8209E+03	6.4117E+04	Tadmor/Gur (0.5-5 km)
B-STB/DIS32	6.000E+04	5.6838E+03	8.5868E+04	Tadmor/Gur (0.5-5 km)
B-STB/DIS33	8.000E+04	7.3701E+03	1.3614E+05	Tadmor/Gur (0.5-5 km)
B-STB/DIS34	1.000E+05	9.0155E+03	1.9465E+05	Tadmor/Gur (0.5-5 km)
B-STB/DIS35	1.400E+05	1.2217E+04	3.3371E+05	Tadmor/Gur (0.5-5 km)
B-STB/DIS36	2.000E+05	1.6860E+04	5.9093E+05	Tadmor/Gur (0.5-5 km)
B-STB/DIS37	3.000E+05	2.4315E+04	1.1315E+06	Tadmor/Gur (0.5-5 km)
B-STB/DIS38	4.000E+05	3.1529E+04	1.7940E+06	Tadmor/Gur (0.5-5 km)
B-STB/DIS39	5.000E+05	3.8568E+04	2.5649E+06	Tadmor/Gur (0.5-5 km)
B-STB/DIS40	6.000E+05	4.5471E+04	3.4350E+06	Tadmor/Gur (0.5-5 km)
B-STB/DIS41	8.000E+05	5.8962E+04	5.4462E+06	Tadmor/Gur (0.5-5 km)
B-STB/DIS42	1.000E+06	7.2126E+04	7.7867E+06	Tadmor/Gur (0.5-5 km)
B-STB/DIS43	1.400E+06	9.7737E+04	1.3350E+07	Tadmor/Gur (0.5-5 km)
B-STB/DIS44	2.000E+06	1.3488E+05	2.3639E+07	Tadmor/Gur (0.5-5 km)
B-STB/DIS45	3.000E+06	1.9453E+05	4.5264E+07	Tadmor/Gur (0.5-5 km)
B-STB/DIS46	4.000E+06	2.5224E+05	7.1765E+07	Tadmor/Gur (0.5-5 km)
B-STB/DIS47	5.000E+06	3.0855E+05	1.0261E+08	Tadmor/Gur (0.5-5 km)
B-STB/DIS48	6.000E+06	3.6378E+05	1.3741E+08	Tadmor/Gur (0.5-5 km)
B-STB/DIS49	8.000E+06	4.7171E+05	2.1787E+08	Tadmor/Gur (0.5-5 km)
B-STB/DIS50	1.000E+07	5.7702E+05	3.1150E+08	Tadmor/Gur (0.5-5 km)
*				
* C-stability	Distance (m)	Sigma-y (m)	Sigma-z (m)	
C-STB/DIS01	1.000E+00	2.0890E-01	2.0000E-01	Tadmor/Gur (0.5-5 km)
C-STB/DIS02	1.400E+00	2.8308E-01	2.6660E-01	Tadmor/Gur (0.5-5 km)
C-STB/DIS03	2.000E+00	3.9066E-01	3.6158E-01	Tadmor/Gur (0.5-5 km)
C-STB/DIS04	3.000E+00	5.6341E-01	5.1125E-01	Tadmor/Gur (0.5-5 km)
C-STB/DIS05	4.000E+00	7.3056E-01	6.5369E-01	Tadmor/Gur (0.5-5 km)
C-STB/DIS06	5.000E+00	8.9367E-01	7.9097E-01	Tadmor/Gur (0.5-5 km)
C-STB/DIS07	6.000E+00	1.0536E+00	9.2428E-01	Tadmor/Gur (0.5-5 km)
C-STB/DIS08	8.000E+00	1.3662E+00	1.1818E+00	Tadmor/Gur (0.5-5 km)
C-STB/DIS09	1.000E+01	1.6712E+00	1.4300E+00	Tadmor/Gur (0.5-5 km)
C-STB/DIS10	1.000E+02	1.3370E+01	1.0224E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS11	1.400E+02	1.8118E+01	1.3629E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS12	2.000E+02	2.5003E+01	1.8484E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS13	3.000E+02	3.6060E+01	2.6136E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS14	4.000E+02	4.6758E+01	3.3417E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS15	5.000E+02	5.7198E+01	4.0435E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS16	6.000E+02	6.7435E+01	4.7250E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS17	8.000E+02	8.7442E+01	6.0414E+01	Tadmor/Gur (0.5-5 km)

C-STB/DIS18	1.000E+03	1.0696E+02	7.3102E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS19	1.400E+03	1.4495E+02	9.7447E+01	Tadmor/Gur (0.5-5 km)
C-STB/DIS20	2.000E+03	2.0003E+02	1.3216E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS21	3.000E+03	2.8849E+02	1.8687E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS22	4.000E+03	3.7408E+02	2.3893E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS23	5.000E+03	4.5759E+02	2.8911E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS24	6.000E+03	5.3949E+02	3.3784E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS25	8.000E+03	6.9955E+02	4.3196E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS26	1.000E+04	8.5573E+02	5.2267E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS27	1.400E+04	1.1596E+03	6.9673E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS28	2.000E+04	1.6003E+03	9.4493E+02	Tadmor/Gur (0.5-5 km)
C-STB/DIS29	3.000E+04	2.3080E+03	1.3361E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS30	4.000E+04	2.9927E+03	1.7083E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS31	5.000E+04	3.6608E+03	2.0671E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS32	6.000E+04	4.3161E+03	2.4155E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS33	8.000E+04	5.5965E+03	3.0884E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS34	1.000E+05	6.8460E+03	3.7371E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS35	1.400E+05	9.2770E+03	4.9816E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS36	2.000E+05	1.2803E+04	6.7562E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS37	3.000E+05	1.8464E+04	9.5529E+03	Tadmor/Gur (0.5-5 km)
C-STB/DIS38	4.000E+05	2.3942E+04	1.2214E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS39	5.000E+05	2.9287E+04	1.4780E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS40	6.000E+05	3.4529E+04	1.7270E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS41	8.000E+05	4.4773E+04	2.2082E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS42	1.000E+06	5.4769E+04	2.6720E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS43	1.400E+06	7.4218E+04	3.5618E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS44	2.000E+06	1.0242E+05	4.8306E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS45	3.000E+06	1.4772E+05	6.8302E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS46	4.000E+06	1.9154E+05	8.7331E+04	Tadmor/Gur (0.5-5 km)
C-STB/DIS47	5.000E+06	2.3430E+05	1.0567E+05	Tadmor/Gur (0.5-5 km)
C-STB/DIS48	6.000E+06	2.7624E+05	1.2348E+05	Tadmor/Gur (0.5-5 km)
C-STB/DIS49	8.000E+06	3.5819E+05	1.5788E+05	Tadmor/Gur (0.5-5 km)
C-STB/DIS50	1.000E+07	4.3817E+05	1.9104E+05	Tadmor/Gur (0.5-5 km)

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* D-stability	Distance (m)	Sigma-y (m)	Sigma-z (m)	
D-STB/DIS01	1.000E+00	1.4740E-01	3.0000E-01	Tadmor/Gur (0.5-5 km)
D-STB/DIS02	1.400E+00	1.9974E-01	3.7374E-01	Tadmor/Gur (0.5-5 km)
D-STB/DIS03	2.000E+00	2.7565E-01	4.7180E-01	Tadmor/Gur (0.5-5 km)
D-STB/DIS04	3.000E+00	3.9754E-01	6.1486E-01	Tadmor/Gur (0.5-5 km)
D-STB/DIS05	4.000E+00	5.1549E-01	7.4197E-01	Tadmor/Gur (0.5-5 km)
D-STB/DIS06	5.000E+00	6.3058E-01	8.5840E-01	Tadmor/Gur (0.5-5 km)
D-STB/DIS07	6.000E+00	7.4344E-01	9.6696E-01	Tadmor/Gur (0.5-5 km)
D-STB/DIS08	8.000E+00	9.6400E-01	1.1669E+00	Tadmor/Gur (0.5-5 km)
D-STB/DIS09	1.000E+01	1.1792E+00	1.3500E+00	Tadmor/Gur (0.5-5 km)
D-STB/DIS10	1.000E+02	9.4340E+00	6.0746E+00	Tadmor/Gur (0.5-5 km)
D-STB/DIS11	1.400E+02	1.2784E+01	7.5678E+00	Tadmor/Gur (0.5-5 km)
D-STB/DIS12	2.000E+02	1.7642E+01	9.5533E+00	Tadmor/Gur (0.5-5 km)
D-STB/DIS13	3.000E+02	2.5444E+01	1.2450E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS14	4.000E+02	3.2993E+01	1.5024E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS15	5.000E+02	4.0359E+01	1.7382E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS16	6.000E+02	4.7582E+01	1.9580E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS17	8.000E+02	6.1699E+01	2.3628E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS18	1.000E+03	7.5474E+01	2.7335E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS19	1.400E+03	1.0227E+02	3.4054E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS20	2.000E+03	1.4114E+02	4.2989E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS21	3.000E+03	2.0356E+02	5.6024E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS22	4.000E+03	2.6395E+02	6.7606E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS23	5.000E+03	3.2288E+02	7.8215E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS24	6.000E+03	3.8067E+02	8.8107E+01	Tadmor/Gur (0.5-5 km)
D-STB/DIS25	8.000E+03	4.9360E+02	1.0632E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS26	1.000E+04	6.0381E+02	1.2300E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS27	1.400E+04	8.1821E+02	1.5324E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS28	2.000E+04	1.1292E+03	1.9344E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS29	3.000E+04	1.6285E+03	2.5210E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS30	4.000E+04	2.1116E+03	3.0422E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS31	5.000E+04	2.5831E+03	3.5196E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS32	6.000E+04	3.0454E+03	3.9647E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS33	8.000E+04	3.9489E+03	4.7843E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS34	1.000E+05	4.8306E+03	5.5350E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS35	1.400E+05	6.5458E+03	6.8956E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS36	2.000E+05	9.0335E+03	8.7047E+02	Tadmor/Gur (0.5-5 km)
D-STB/DIS37	3.000E+05	1.3028E+04	1.1344E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS38	4.000E+05	1.6893E+04	1.3689E+03	Tadmor/Gur (0.5-5 km)

D-STB/DIS39	5.000E+05	2.0665E+04	1.5838E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS40	6.000E+05	2.4364E+04	1.7841E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS41	8.000E+05	3.1592E+04	2.1529E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS42	1.000E+06	3.8645E+04	2.4907E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS43	1.400E+06	5.2368E+04	3.1029E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS44	2.000E+06	7.2270E+04	3.9170E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS45	3.000E+06	1.0423E+05	5.1048E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS46	4.000E+06	1.3515E+05	6.1601E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS47	5.000E+06	1.6532E+05	7.1267E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS48	6.000E+06	1.9492E+05	8.0280E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS49	8.000E+06	2.5274E+05	9.6877E+03	Tadmor/Gur (0.5-5 km)
D-STB/DIS50	1.000E+07	3.0917E+05	1.1208E+04	Tadmor/Gur (0.5-5 km)

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* E-stability	Distance (m)	Sigma-y (m)	Sigma-z (m)	
E-STB/DIS01	1.000E+00	1.0460E-01	4.0000E-01	Tadmor/Gur (0.5-5 km)
E-STB/DIS02	1.400E+00	1.4174E-01	4.8983E-01	Tadmor/Gur (0.5-5 km)
E-STB/DIS03	2.000E+00	1.9561E-01	6.0717E-01	Tadmor/Gur (0.5-5 km)
E-STB/DIS04	3.000E+00	2.8211E-01	7.7506E-01	Tadmor/Gur (0.5-5 km)
E-STB/DIS05	4.000E+00	3.6581E-01	9.2164E-01	Tadmor/Gur (0.5-5 km)
E-STB/DIS06	5.000E+00	4.4748E-01	1.0542E+00	Tadmor/Gur (0.5-5 km)
E-STB/DIS07	6.000E+00	5.2757E-01	1.1765E+00	Tadmor/Gur (0.5-5 km)
E-STB/DIS08	8.000E+00	6.8409E-01	1.3990E+00	Tadmor/Gur (0.5-5 km)
E-STB/DIS09	1.000E+01	8.3682E-01	1.6001E+00	Tadmor/Gur (0.5-5 km)
E-STB/DIS10	1.000E+02	6.6947E+00	6.4012E+00	Tadmor/Gur (0.5-5 km)
E-STB/DIS11	1.400E+02	9.0719E+00	7.8387E+00	Tadmor/Gur (0.5-5 km)
E-STB/DIS12	2.000E+02	1.2520E+01	9.7165E+00	Tadmor/Gur (0.5-5 km)
E-STB/DIS13	3.000E+02	1.8056E+01	1.2403E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS14	4.000E+02	2.3413E+01	1.4749E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS15	5.000E+02	2.8640E+01	1.6870E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS16	6.000E+02	3.3766E+01	1.8827E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS17	8.000E+02	4.3784E+01	2.2388E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS18	1.000E+03	5.3559E+01	2.5607E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS19	1.400E+03	7.2577E+01	3.1358E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS20	2.000E+03	1.0016E+02	3.8870E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS21	3.000E+03	1.4445E+02	4.9617E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS22	4.000E+03	1.8731E+02	5.9001E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS23	5.000E+03	2.2912E+02	6.7485E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS24	6.000E+03	2.7013E+02	7.5316E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS25	8.000E+03	3.5028E+02	8.9559E+01	Tadmor/Gur (0.5-5 km)
E-STB/DIS26	1.000E+04	4.2848E+02	1.0244E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS27	1.400E+04	5.8063E+02	1.2544E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS28	2.000E+04	8.0129E+02	1.5549E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS29	3.000E+04	1.1556E+03	1.9849E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS30	4.000E+04	1.4985E+03	2.3603E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS31	5.000E+04	1.8330E+03	2.6997E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS32	6.000E+04	2.1611E+03	3.0129E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS33	8.000E+04	2.8023E+03	3.5827E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS34	1.000E+05	3.4279E+03	4.0979E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS35	1.400E+05	4.6452E+03	5.0182E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS36	2.000E+05	6.4105E+03	6.2203E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS37	3.000E+05	9.2453E+03	7.9403E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS38	4.000E+05	1.1988E+04	9.4419E+02	Tadmor/Gur (0.5-5 km)
E-STB/DIS39	5.000E+05	1.4665E+04	1.0800E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS40	6.000E+05	1.7289E+04	1.2053E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS41	8.000E+05	2.2419E+04	1.4332E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS42	1.000E+06	2.7424E+04	1.6393E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS43	1.400E+06	3.7162E+04	2.0074E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS44	2.000E+06	5.1285E+04	2.4883E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS45	3.000E+06	7.3964E+04	3.1764E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS46	4.000E+06	9.5907E+04	3.7771E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS47	5.000E+06	1.1732E+05	4.3203E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS48	6.000E+06	1.3832E+05	4.8215E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS49	8.000E+06	1.7935E+05	5.7334E+03	Tadmor/Gur (0.5-5 km)
E-STB/DIS50	1.000E+07	2.1940E+05	6.5578E+03	Tadmor/Gur (0.5-5 km)

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* F-stability	Distance (m)	Sigma-y (m)	Sigma-z (m)	
F-STB/DIS01	1.000E+00	7.2200E-02	2.0000E-01	Tadmor/Gur (0.5-5 km)
F-STB/DIS02	1.400E+00	9.7838E-02	2.4491E-01	Tadmor/Gur (0.5-5 km)
F-STB/DIS03	2.000E+00	1.3502E-01	3.0356E-01	Tadmor/Gur (0.5-5 km)
F-STB/DIS04	3.000E+00	1.9473E-01	3.8749E-01	Tadmor/Gur (0.5-5 km)
F-STB/DIS05	4.000E+00	2.5250E-01	4.6076E-01	Tadmor/Gur (0.5-5 km)
F-STB/DIS06	5.000E+00	3.0887E-01	5.2700E-01	Tadmor/Gur (0.5-5 km)
F-STB/DIS07	6.000E+00	3.6415E-01	5.8814E-01	Tadmor/Gur (0.5-5 km)

F-STB/DIS08	8.000E+00	4.7219E-01	6.9934E-01	Tadmor/Gur (0.5-5 km)
F-STB/DIS09	1.000E+01	5.7761E-01	7.9989E-01	Tadmor/Gur (0.5-5 km)
F-STB/DIS10	1.000E+02	4.6210E+00	3.1991E+00	Tadmor/Gur (0.5-5 km)
F-STB/DIS11	1.400E+02	6.2619E+00	3.9174E+00	Tadmor/Gur (0.5-5 km)
F-STB/DIS12	2.000E+02	8.6417E+00	4.8557E+00	Tadmor/Gur (0.5-5 km)
F-STB/DIS13	3.000E+02	1.2463E+01	6.1981E+00	Tadmor/Gur (0.5-5 km)
F-STB/DIS14	4.000E+02	1.6161E+01	7.3700E+00	Tadmor/Gur (0.5-5 km)
F-STB/DIS15	5.000E+02	1.9769E+01	8.4297E+00	Tadmor/Gur (0.5-5 km)
F-STB/DIS16	6.000E+02	2.3307E+01	9.4076E+00	Tadmor/Gur (0.5-5 km)
F-STB/DIS17	8.000E+02	3.0222E+01	1.1186E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS18	1.000E+03	3.6969E+01	1.2795E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS19	1.400E+03	5.0096E+01	1.5667E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS20	2.000E+03	6.9135E+01	1.9420E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS21	3.000E+03	9.9707E+01	2.4789E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS22	4.000E+03	1.2929E+02	2.9476E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS23	5.000E+03	1.5815E+02	3.3714E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS24	6.000E+03	1.8646E+02	3.7625E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS25	8.000E+03	2.4178E+02	4.4739E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS26	1.000E+04	2.9576E+02	5.1172E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS27	1.400E+04	4.0078E+02	6.2661E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS28	2.000E+04	5.5309E+02	7.7669E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS29	3.000E+04	7.9767E+02	9.9142E+01	Tadmor/Gur (0.5-5 km)
F-STB/DIS30	4.000E+04	1.0343E+03	1.1789E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS31	5.000E+04	1.2653E+03	1.3484E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS32	6.000E+04	1.4917E+03	1.5048E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS33	8.000E+04	1.9343E+03	1.7893E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS34	1.000E+05	2.3661E+03	2.0466E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS35	1.400E+05	3.2063E+03	2.5061E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS36	2.000E+05	4.4248E+03	3.1063E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS37	3.000E+05	6.3815E+03	3.9651E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS38	4.000E+05	8.2748E+03	4.7149E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS39	5.000E+05	1.0122E+04	5.3927E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS40	6.000E+05	1.1934E+04	6.0183E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS41	8.000E+05	1.5475E+04	7.1563E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS42	1.000E+06	1.8929E+04	8.1852E+02	Tadmor/Gur (0.5-5 km)
F-STB/DIS43	1.400E+06	2.5651E+04	1.0023E+03	Tadmor/Gur (0.5-5 km)
F-STB/DIS44	2.000E+06	3.5400E+04	1.2424E+03	Tadmor/Gur (0.5-5 km)
F-STB/DIS45	3.000E+06	5.1053E+04	1.5858E+03	Tadmor/Gur (0.5-5 km)
F-STB/DIS46	4.000E+06	6.6200E+04	1.8857E+03	Tadmor/Gur (0.5-5 km)
F-STB/DIS47	5.000E+06	8.0980E+04	2.1568E+03	Tadmor/Gur (0.5-5 km)
F-STB/DIS48	6.000E+06	9.5474E+04	2.4070E+03	Tadmor/Gur (0.5-5 km)
F-STB/DIS49	8.000E+06	1.2380E+05	2.8621E+03	Tadmor/Gur (0.5-5 km)
F-STB/DIS50	1.000E+07	1.5144E+05	3.2736E+03	Tadmor/Gur (0.5-5 km)

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* LINEAR SCALING FACTOR FOR SIGMA-Y FUNCTION, NORMALLY 1

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DPYSCALE001 1.

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* LINEAR SCALING FACTOR FOR SIGMA-Z FUNCTION,
* NORMALLY USED FOR SURFACE ROUGHNESS LENGTH CORRECTION.
* (Z1 / Z0) ** 0.2, FROM CRAC2 WE HAVE (10 CM / 3 CM) ** 0.2 = 1.27

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DPZSCALE001 1.27

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* EXPANSION FACTOR DATA BLOCK, LOADED BY INPEXP, STORED IN /EXPAND/

*

* TIME BASE FOR EXPANSION FACTOR (SECONDS)

*

PMTIMBAS001 600. (10 MINUTES)

*

* BREAK POINT FOR FORMULA CHANGE (SECONDS)

*

PMBRKPNT001 3600. (1 HOUR)

*

* EXPONENTIAL EXPANSION FACTOR NUMBER 1

*

PMXPFAC1001 0.2

*

* EXPONENTIAL EXPANSION FACTOR NUMBER 2

*

PMXPFAC2001 0.25

****

* PLUME RISE DATA BLOCK, LOADED BY INPLRS, STORED IN /PLUMRS/

```
*
* SCALING FACTOR FOR THE CRITICAL WIND SPEED FOR ENTRAINMENT OF A BOUYANT PLUME
* (USED BY FUNCTION CAUGHT)
*
PRSCLCRW001  1.
*
* SCALING FACTOR FOR THE A-D STABILITY PLUME RISE FORMULA
* (USED BY FUNCTION PLMRIS)
*
PRSCLADP001  1.
*
* SCALING FACTOR FOR THE E-F STABILITY PLUME RISE FORMULA
* (USED BY FUNCTION PLMRIS)
*
PRSCLEFP001  1.
**********
* RELEASE DATA BLOCK, LOADED BY INPREL, STORED IN /ATNAM2/, /MULREL/
**********
RDATNAM2001 'Case 1BOC  ESBWR Specific Source Term Data Used From GE'
**********
* TIME AFTER ACCIDENT INITIATION WHEN THE ACCIDENT REACHES GENERAL EMERGENCY
* CONDITIONS (AS DEFINED IN NUREG-0654), OR WHEN PLANT PERSONNEL CAN RELIABLY
* PREDICT THAT GENERAL EMERGENCY CONDITIONS WILL BE ATTAINED
**********
RDOALARM001    1200.
*
* NUMBER OF PLUME SEGMENTS THAT ARE RELEASED
*
RDNUMREL001      1
*
* SELECTION OF RISK DOMINANT PLUME
*
RDMAXRIS001      1
*
* REFERENCE TIME FOR DISPERSION AND RADIOACTIVE DECAY
*
RDREFTIM001    0.0
*
* HEAT CONTENT OF THE RELEASE SEGMENTS (W)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
RDPLHEAT001    1.0E-6
*
* HEIGHT OF THE PLUME SEGMENTS AT RELEASE (M)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
RDPLHITE001    49.0
*
* DURATION OF THE PLUME SEGMENTS (S)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
RDPLUDUR001    9000.
*
* TIME OF RELEASE FOR EACH PLUME (S AFTER SCRAM)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
RDPDELAY001    2100.
*
* Initial value of sigma-y for each plume--Note: values required for each plume
*
SIGYINIT001  9.302  9.302 (initial sigma-y, calculated for 40 meter wide bldg.)
*
* Initial value of sigma-z for each plume--Note: values required for each plume
*
SIGZINIT001  23.26  23.26 (initial sigma-z, calculated for 50 meter high bldg.)
*
* Building height (meters)--Note: values required for each plume
*
WEBUILDH001  50.0  50.0  (Surry)
*
* PARTICLE SIZE DISTRIBUTION OF EACH NUCLIDE GROUP
* YOU MUST SPECIFY A COLUMN OF DATA FOR EACH OF THE PARTICLE SIZE GROUPS
*
```

RDPSDIST001 *.
RDPSDIST002 *.
RDPSDIST003 *.
RDPSDIST004 *.
RDPSDIST005 *.
RDPSDIST006 *.
RDPSDIST007 *.
RDPSDIST008 *.
RDPSDIST009 *.
*
* ESBWR CORE INVENTORY, END-OF-CYCLE
* SUPPLIED BY GE for ESBWR, 4/04/06
*
* NUCNAM CORINV (Bq/MWt)
*

RDCORINV001	Co-58	5.10E+12
RDCORINV002	Co-60	4.92E+12
RDCORINV003	Kr-85	1.23E+13
RDCORINV004	Kr-85m	2.73E+14
RDCORINV005	Kr-87	5.27E+14
RDCORINV006	Kr-88	7.42E+14
RDCORINV007	Rb-86	2.35E+12
RDCORINV008	Sr-89	9.93E+14
RDCORINV009	Sr-90	9.76E+13
RDCORINV010	Sr-91	1.25E+15
RDCORINV011	Sr-92	1.34E+15
RDCORINV012	Y-90	1.01E+14
RDCORINV013	Y-91	1.27E+15
RDCORINV014	Y-92	1.34E+15
RDCORINV015	Y-93	1.55E+15
RDCORINV016	Zr-95	1.70E+15
RDCORINV017	Zr-97	1.69E+15
RDCORINV018	Nb-95	1.71E+15
RDCORINV019	Mo-99	1.89E+15
RDCORINV020	Tc-99m	1.68E+15
RDCORINV021	Ru-103	1.50E+15
RDCORINV022	Ru-105	1.00E+15
RDCORINV023	Ru-106	5.21E+14
RDCORINV024	Rh-105	9.10E+14
RDCORINV025	Sb-127	1.03E+14
RDCORINV026	Sb-129	3.15E+14
RDCORINV027	Te-127	1.05E+14
RDCORINV028	Te-127m	1.37E+13
RDCORINV029	Te-129	3.10E+14
RDCORINV030	Te-129m	4.60E+13
RDCORINV031	Te-131m	1.42E+14
RDCORINV032	Te-132	1.41E+15
RDCORINV033	I-131	9.90E+14
RDCORINV034	I-132	1.44E+15
RDCORINV035	I-133	2.04E+15
RDCORINV036	I-134	2.25E+15
RDCORINV037	I-135	1.91E+15
RDCORINV038	Xe-133	2.03E+15
RDCORINV039	Xe-135	6.72E+14
RDCORINV040	Cs-134	1.98E+14
RDCORINV041	Cs-136	6.89E+13
RDCORINV042	Cs-137	1.28E+14
RDCORINV043	Ba-139	1.84E+15
RDCORINV044	Ba-140	1.77E+15
RDCORINV045	La-140	1.82E+15
RDCORINV046	La-141	1.68E+15
RDCORINV047	La-142	1.62E+15
RDCORINV048	Ce-141	1.68E+15
RDCORINV049	Ce-143	1.56E+15
RDCORINV050	Ce-144	1.36E+15
RDCORINV051	Pr-143	1.53E+15
RDCORINV052	Nd-147	6.69E+14
RDCORINV053	Np-239	1.93E+16
RDCORINV054	Pu-238	3.34E+12
RDCORINV055	Pu-239	4.02E+11
RDCORINV056	Pu-240	5.21E+11
RDCORINV057	Pu-241	1.51E+14
RDCORINV058	Am-241	1.70E+11

```
RDCORINV059    Cm-242    4.01E+13
RDCORINV060    Cm-244    1.94E+12
*
*  SCALING FACTOR TO ADJUST THE CORE INVENTORY FOR POWER LEVEL
* scaling factor to adjust inventory from Bq/MWt to Bq
*       enter the total thermal power
*
RDCORSCA001  4500.0  *  ESBWR power level = 4500
*
*
RDAPLFRC001  PARENT     (apply rel fracs the same as prior versions)
*
* SOURCE TERM NUMBER
****** These RELEASE FRACTIONS are for Case 1BOC ********************************
******
******
*
*  ISOTOPE GROUPS:
*
*        XE/KR   I     CS     TE     SR     RU     LA     CE     BA
*
RDRELFRC001 1.00E+00 8.50E-01 3.80E-01 9.06E-01 1.50E-02 7.20E-02 6.10E-04 3.43E-03 1.50E-02
**********************************************************************************
* OUTPUT CONTROL DATA BLOCK, LOADED BY INPOPT, STORED IN /STOPME/, /ATMOPT/
*
* FLAG TO INDICATE THAT THIS IS THE LAST PROGRAM IN THE SERIES TO BE RUN
*
OCENDAT1001  .FALSE. (SET THIS VALUE TO .TRUE. TO SKIP EARLY AND CHRONC)
*
OCIDEBUG001  0
*
* NAME OF THE NUCLIDE TO BE LISTED ON THE DISPERSION LISTINGS
*
OCNUCOUT001  Cs-137
*
*          NUM0
TYPE0NUMBER     2
*
*          INDREL  INDRAD
TYPE0OUT001     1       9
TYPE0OUT002     1      10      XCCDF
**********************************************************************************
* METEOROLOGICAL SAMPLING DATA BLOCK
*
* METEOROLOGICAL SAMPLING OPTION CODE:
*
* METCOD = 1, USER SPECIFIED DAY AND HOUR IN THE YEAR (FROM MET FILE),
*        2, WEATHER CATEGORY BIN SAMPLING,
*        3, 120 HOURS OF WEATHER SPECIFIED ON THE ATMOS USER INPUT FILE,
*        4, CONSTANT MET (BOUNDARY WEATHER USED FROM THE START),
*        5, STRATIFIED RANDOM SAMPLES FOR EACH DAY OF THE YEAR.
*
M1METCOD001  2
*
* LAST SPATIAL INTERVAL FOR MEASURED WEATHER
*
M2LIMSPA001  11
*
* BOUNDARY WEATHER MIXING LAYER HEIGHT
*
M2BNDMXH001  1000.  (METERS)
*
* BOUNDARY WEATHER STABILITY CLASS INDEX
*
M2IBDSTB001  4     (D-STABILITY)
*
* BOUNDARY WEATHER RAIN RATE
*
M2BNDRAN001  5.    (MM/HR)
*
* BOUNDARY WEATHER WIND SPEED
*
M2BNDWND001  5     (M/S)
```

```
*
* NUMBER OF RAIN DISTANCE INTERVALS FOR BINNING
*
M4NRNINT001  5
*
* ENDPOINTS OF THE RAIN DISTANCE INTERVALS (KILOMETERS)
*
* NOTE: THESE MUST BE CHOSEN TO MATCH THE SPATIAL ENDPOINT DISTANCES
*     SPECIFIED FOR THE ARRAY SPAEND (10 % ERROR IS ALLOWED).
*
M4RNDSTS001  3.22  6.44  8.05  16.09  32.19
*
* NUMBER OF RAIN INTENSITIY BREAKPOINTS
*
M4NRINTN001  3
*
* RAIN INTENSITY BREAKPOINTS FOR WEATHER BINNING (MILLIMETERS PER HOUR)
*
M4RNRATE001  2.  4.  6.
*
* NUMBER OF SAMPLES PER BIN
*
M4NSMPLS001  4  (THIS NUMBER SHOULD BE SET TO 4 FOR RISK ASSESSMENT)
*
* INITIAL SEED FOR RANDOM NUMBER GENERATOR
*
M4IRSEED001  79
**********************************************************************

.
****** 10 ESBWR STACKED CASES BEGIN HERE**********************************
**********************************************************************
*
* ESBWR Source Term data
*
*======================================================================
RDATNAM2001   'Case 2BYP'
RDOALARM001    1200.0     (time to reach general emergency condition, sec)
RDPDELAY001    800.0      (time of release after scram, sec)
RDPLUDUR001    7800.0     (release duration, sec)
RDPLHEAT001    1.00E-6    (sensible heat rate, watt)
RDPLHITE001    49.0       (height of the plume segments at release, m)
*
*                 release fractions by group
*        1    2    3    4    5    6    7    8    9
*        XE/KR     I     CS     TE     SR     RU     LA     CE     BA
*
RDRELFRC001   9.80E-01 4.30E-01 3.70E-01 7.42E-01 1.60E-02 1.20E-01 5.30E-04 3.32E-03 2.90E-02
.
*======================================================================
RDATNAM2001   'Case 3CCID'
RDOALARM001    21100.0    (time to reach general emergency condition, sec)
RDPDELAY001    53100.0    (time of release after scram, sec)
RDPLUDUR001    36000.0    (release duration, sec)
RDPLHEAT001    1.00E-6    (sensible heat rate, watt)
RDPLHITE001    49.0       (height of the plume segments at release, m)
*
*                 release fractions by group
*        1    2    3    4    5    6    7    8    9
*        XE/KR     I     CS     TE     SR     RU     LA     CE     BA
*
RDRELFRC001   9.20E-01 5.30E-01 3.20E-01 5.95E-01 2.30E-06 5.10E-06 1.40E-07 1.40E-06 2.20E-05
.
*======================================================================
RDATNAM2001   'Case 4CCIW'
RDOALARM001    24000.0    (time to reach general emergency condition, sec)
RDPDELAY001    90400.0    (time of release after scram, sec)
RDPLUDUR001    36000.0    (release duration, sec)
RDPLHEAT001    1.00E-6    (sensible heat rate, watt)
RDPLHITE001    49.0       (height of the plume segments at release, m)
*
*                 release fractions by group
*        1    2    3    4    5    6    7    8    9
*        XE/KR     I     CS     TE     SR     RU     LA     CE     BA
```

```
*
RDRELFRC001  1.00E+00 7.30E-05 7.90E-03 1.54E-02 8.20E-08 5.90E-08 1.10E-08 7.49E-08 6.00E-08
*
*=============================================================================
RDATNAM2001  'Case 5DCH'
RDOALARM001   16300.0    (time to reach general emergency condition, sec)
RDPDELAY001   63000.0    (time of release after scram, sec)
RDPLUDUR001   36000.0    (release duration, sec)
RDPLHEAT001   1.00E-6    (sensible heat rate, watt)
RDPLHITE001   49.0       (height of the plume segments at release, m)
*
*                 release fractions by group
*       1    2    3    4    5    6    7    8    9
*       XE/KR     I     CS     TE     SR     RU     LA     CE     BA
*
RDRELFRC001  9.00E-01 8.00E-01 1.50E-01 4.90E-01 3.20E-04 2.70E-04 3.20E-04 3.20E-04 3.20E-04
*
*=============================================================================
RDATNAM2001  'Case 6EVE'
RDOALARM001   22400.0    (time to reach general emergency condition, sec)
RDPDELAY001   22500.0    (time of release after scram, sec)
RDPLUDUR001   36000.0    (release duration, sec)
RDPLHEAT001   1.00E-6    (sensible heat rate, watt)
RDPLHITE001   49.0       (height of the plume segments at release, m)
*
*                 release fractions by group
*       1    2    3    4    5    6    7    8    9
*       XE/KR     I     CS     TE     SR     RU     LA     CE     BA
*
RDRELFRC001  8.40E-01 2.50E-01 3.40E-01 6.90E-01 1.30E-02 1.10E-04 8.20E-04 6.25E-03 5.70E-03
*
*=============================================================================
RDATNAM2001  'Case 7FR'
RDOALARM001   9800.0     (time to reach general emergency condition, sec)
RDPDELAY001   102600.0    (time of release after scram, sec)
RDPLUDUR001   36000.0    (release duration, sec)
RDPLHEAT001   1.00E-6    (sensible heat rate, watt)
RDPLHITE001   49.0       (height of the plume segments at release, m)*
*                 release fractions by group
*       1    2    3    4    5    6    7    8    9
*       XE/KR     I     CS     TE     SR     RU     LA     CE     BA
*
RDRELFRC001  1.00E+00 9.80E-06 4.60E-05 2.53E-03 1.10E-08 1.90E-07 4.10E-10 1.51E-09 3.20E-08
*
*=============================================================================
RDATNAM2001  'Case 8-OPVB'
RDOALARM001   16500.0    (time to reach general emergency condition, sec)
RDPDELAY001   65300.0    (time of release after scram, sec)
RDPLUDUR001   36000.0    (release duration, sec)
RDPLHEAT001   1.00E-6    (sensible heat rate, watt)
RDPLHITE001   49.0       (height of the plume segments at release, m)*
*                 release fractions by group
*       1    2    3    4    5    6    7    8    9
*       XE/KR     I     CS     TE     SR     RU     LA     CE     BA
*
RDRELFRC001  9.90E-01 2.80E-01 3.40E-02 1.10E-01 1.70E-03 1.20E-04 1.50E-04 3.11E-04 8.70E-04
*
*=============================================================================
RDATNAM2001  'Case 9-OPW1'
RDOALARM001   16600.0    (time to reach general emergency condition, sec)
RDPDELAY001   91500.0    (time of release after scram, sec)
RDPLUDUR001   36000.0    (release duration, sec)
RDPLHEAT001   1.00E-6    (sensible heat rate, watt)
RDPLHITE001   49.0       (height of the plume segments at release, m)*
*                 release fractions by group
*       1    2    3    4    5    6    7    8    9
*       XE/KR     I     CS     TE     SR     RU     LA     CE     BA
*
RDRELFRC001  9.90E-01 6.00E-01 1.40E-01 3.70E-01 1.60E-03 4.30E-07 5.80E-06 1.81E-04 7.50E-04
*
*=============================================================================
RDATNAM2001  'Case 10-OPW2'
RDOALARM001   17600.0    (time to reach general emergency condition, sec)
```

```
RDPDELAY001    146900.0   (time of release after scram, sec)
RDPLUDUR001    36000.0    (release duration, sec)
RDPLHEAT001    1.00E-6    (sensible heat rate, watt)
RDPLHITE001    49.0       (height of the plume segments at release, m)*
*                         release fractions by group
*          1    2    3    4    5    6    7    8    9
*          XE/KR     I         CS        TE        SR        RU        LA        CE        BA
*
RDRELFRC001    9 90E-01 3.80E-02 4.30E-02 1.57E-01 1.20E-03 2.00E-07 3.90E-06 1.40E-04 5.70E-04
.
*=============================================================================
RDATNAM2001    'Case 11TSL'
RDOALARM001    21000.0    (time to reach general emergency condition, sec)
RDPDELAY001    1100.0     (time of release after scram, sec)
RDPLUDUR001    36000.0    (release duration, sec)
RDPLHEAT001    1.00E-6    (sensible heat rate, watt)
RDPLHITE001    49.0       (height of the plume segments at release, m)*
*                         release fractions by group
*          1    2    3    4    5    6    7    8    9
*          XE/KR     I         CS        TE        SR        RU        LA        CE        BA
*
RDRELFRC001    2.00E-03 1.50E-04 5.50E-05 2.15E-04 2.10E-06 3.90E-05 7.30E-08 2.00E-07 7.70E-06
.
```

```
**************North Anna EARLY Input File***************


80 GENERAL DESCRIPTIVE TITLE DESCRIBING THIS NAPS "EARLY" INPUT FILE
80 BASE CASE using EZDLTSHL = 7200 seconds and 95% Evacuation
80 Last Modified by MGM 04/06/04
MIEANAM1001 'NAPS ABWR NEARLY.INP, Sample Problem 1  EARLY input'
DCF_FILE001 'DOSDATA.INP'  (DCF file of MACCS 1.5.11.1)
*
*              ORGNAM          ORGFLG
*
MIORGDEF001   'A-SKIN'          .TRUE.
MIORGDEF002   'A-RED MARR'      .TRUE.
MIORGDEF003   'A-LUNGS'         .TRUE.
MIORGDEF004   'A-THYROIDH'      .TRUE.
MIORGDEF005   'A-STOMACH'       .TRUE.
MIORGDEF006   'A-LOWER LI'      .FALSE.   (does not contribute to early fatalities)
MIORGDEF007   'L-EDEWBODY'      .TRUE.
MIORGDEF008   'L-RED MARR'      .TRUE.
MIORGDEF009   'L-BONE SUR'      .TRUE.
MIORGDEF010   'L-BREAST'        .TRUE.
MIORGDEF011   'L-LUNGS'         .TRUE.
MIORGDEF012   'L-THYROID'       .TRUE.
MIORGDEF013   'L-LOWER LI'      .TRUE.
MIORGDEF014   'L-BLAD WAL'      .TRUE.
MIORGDEF015   'L-LIVER'         .FALSE.
MIORGDEF016   'L-THYROIDH'      .TRUE.
*
80 FLAG TO INDICATE THAT THIS IS THE LAST PROGRAM IN THE SERIES TO BE RUN
*
MIENDAT2001   .FALSE.     (SET THIS VALUE TO .TRUE. TO SKIP CHRONC)
*
80 DISPERSION MODEL OPTION CODE:  1  *  STRAIGHT LINE
80 2  *  WIND-SHIFT WITH ROTATION
80 3  *  WIND-SHIFT WITHOUT ROTATION
*
MIIPLUME001   2
*
80 NUMBER OF FINE GRID SUBDIVISIONS USED BY THE MODEL
*
MINUMFIN001   7     (3, 5 OR 7 ALLOWED)
*
80 LEVEL OF DEBUG OUTPUT REQUIRED, NORMAL RUNS SHOULD SPECIFY ZERO
*
MIIPRINT001   0
*
80 LOGICAL FLAG SIGNIFYING THAT THE BREAKDOWN OF RISK BY WEATHER CATEGORY
80 BIN ARE TO BE PRESENTED TO SHOW THEIR RELATIVE CONTRIBUTION TO THE MEAN
*
80 RISBIN
*
MIRISCAT001    .FALSE.
*
80 FLAG INDICATING IF WIND-ROSES FROM ATMOS ARE TO BE OVERRIDDEN
*
MIOVRRID001   .FALSE.   (USE THE WIND ROSE CALCULATED FOR EACH WEATHER BIN)
80 POPULATION DISTRIBUTION DATA BLOCK, LOADED BY INPOPU, STORED IN /POPDAT/
*
```

```
PDPOPFLG001  FILE
*
*PDPOPFLG001  UNIFORM
*PDIBEGIN001  1    (SPATIAL INTERVAL AT WHICH POPULATION BEGINS)
*PDPOPDEN001  50.  (POPULATION DENSITY (PEOPLE PER SQUARE KILOMETER))
```

```
80 SHIELDING AND EXPOSURE FACTORS, LOADED BY INDFAC, STORED IN /EADFAC/
*
80 THREE VALUES OF EACH PROTECTION FACTOR ARE SUPPLIED,
80 ONE FOR EACH TYPE OF ACTIVTY:
*
80 ACTIVITY TYPE:
80 1 - EVACUEES WHILE MOVING
80 2 - NORMAL ACTIVITY IN SHELTERING AND EVACUATION ZONE
80 3 - SHELTERED ACTIVITY
*
80 CLOUD SHIELDING FACTOR
*
*    SITE         GG    PB    SEQ  SUR  ZION
80 SHELTERING  0.7  0.5  0.65 0.6  0.5
*
80 EVACUEES  NORMAL  SHELTER
*
SECSFACT001       1.      0.75      0.6    *  SURRY SHELTERING VALUE
*
80 PROTECTION FACTOR FOR INHALATION
*
SEPROTIN001       1.      0.41       0.33  * VALUES FOR NORMAL ACTIVITY AND
80 SHELTERING SELECTED BY NRC STAFF
*
80 BREATHING RATE (CUBIC METERS PER SECOND)
*
SEBRRATE001  2.66E-4  2.66E-4  2.66E-4
*
80 SKIN PROTECTION FACTOR
*
SESKPFAC001  1.0       0.41      0.33     * VALUES FOR NORMAL ACTIVITY AND
80 SHELTERING SELECTED BY NRC STAFF
*
80 GROUND SHIELDING FACTOR
*
*    SITE         GG    PB    SEQ  SUR  ZION
80 SHELTERING  0.25 0.1  0.2  0.2  0.1
*
SEGSHFAC001       0.5     0.33     0.2    * VALUE FOR NORMAL ACTIVITY SELECTED BY
80 NRC STAFF
*
80 RESUSPENSION INHALATION MODEL CONCENTRATION COEFFICIENT (/METER)
*
80 RESCON = 1.E-4 IS APPROPRIATE FOR MECHANICAL RESUSPENSION BY VEHICLES.
80 RESHAF = 2.11 DAYS CAUSES 1.E-4 TO DECAY IN ONE WEEK TO 1.E-5, THE VALUE
80 OF RESCON USED IN THE FIRST TERM OF THE LONG-TERM RESUSPENSION EQUATION
80 USED IN CHRONC.
*
SERESCON001    1.E-4      (RESUSPENSION IS TURNED ON)
*
80 RESUSPENSION CONCENTRATION COEFFICIENT HALF-LIFE (SEC)
*
SERESHAF001    1.82E5     (2.11 DAYS)
```

```
80 EVACUATION ZONE DATA BLOCK, LOADED BY EVNETW, STORED IN /NETWOR/, /EOPTIO/
*
80 SPECIFIC DESCRIPTION OF THE EMERGENCY RESPONSE SCENARIO BEING USED
*
EZEANAM2001  'EVACUATION WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE'
*
80 THE TYPE OF WEIGHTING TO BE APPLIED TO THE EMERGENCY RESPONSE SCENARIOS
80 YOU MUST SUPPLY A VALUE OF 'TIME' OR 'PEOPLE'
*
EZWTNAME001  'PEOPLE'
*
80 WEIGHTING FRACTION APPLICABLE TO THIS SCENARIO FOR EVACUATION
*
EZWTFRAC001  0.95   (95% of the people within 10 miles evacuate)
*
80 LAST RING IN THE MOVEMENT ZONE
*
EZLASMOV001     8    (EVACUEES DISAPPEAR AFTER TRAVELING TO 20 MILES)
*
80 Flag defining the time at which evacuees "enter" the destination element
*
*TRAVELPOINT'   'CENTERPOINT' (new option implemented at MACCS2 v. 1.11f)
TRAVELPOINT    'BOUNDARY'    (functionality derived from MACCS circa 1984)
*
80 RADIAL EVACUATION SPEED (M/S) or (4 mph) Contains Three Phases
*  3 Phases: (Initial)  (Middle)    (Late)
EZESPEED001    1.8        1.8        1.8          (NAPS)
EZEVATYP001     'RADIAL'
EZDURBEG001    86400.0
EZDURMID001    0.0
EZREFPNT001     'ALARM'
EZNUMEVA001     7
EZDLTSHL001   7200.  7200.  7200.  7200.  7200.  7200.
EZDLTSHL002   7200.  7200.  7200.  7200.  7200.  7200.
EZDLTEVA001      0.     0.     0.     0.     0.     0.
EZDLTEVA002      0.     0.     0.     0.     0.     0.
```

```
80 SHELTER AND RELOCATION ZONE DATA BLOCK, LOADED BY INPEMR,
80 STORED IN /INPSRZ/, /RELOCA/
*
80 DURATION OF THE EMERGENCY PHASE (SECONDS FROM PLUME ARRIVAL)
*
SRENDEMP001  604800.   (ONE WEEK)
*
80 CRITICAL ORGAN FOR RELOCATION DECISIONS
*
SRCRIORG001 'L-EDEWBODY'
*
80 HOT SPOT RELOCATION TIME (SECONDS FROM PLUME ARRIVAL)
*
SRTIMHOT001  43200.    (ONE-HALF DAY)
*
80 NORMAL RELOCATION TIME (SECONDS FROM PLUME ARRIVAL)
*
SRTIMNRM001  86400.    (ONE DAY)
*
80 HOT SPOT RELOCATION DOSE CRITERION THRESHOLD (SIEVERTS)
*
SRDOSHOT001  0.5    (50 REM DOSE TO WHOLE BODY IN 1 WEEK TRIGGERS RELOCATION)
```

```
*
80 NORMAL RELOCATION DOSE CRITERION THRESHOLD (SIEVERTS)
*
SRDOSNRM001  0.25   (25 REM DOSE TO WHOLE BODY IN 1 WEEK TRIGGERS RELOCATION)
80 EARLY FATALITY MODEL PARAMETERS, LOADED BY INEFAT, STORED IN /EFATAL/
*
80 NUMBER OF EARLY FATALITY EFFECTS
*
EFNUMEFA001   2
*
*            ORGNAM        EFFACA    EFFACB    EFFTHR
*
EFATAGRP001 'A-RED MARR'      3.8       5.0     1.5
EFATAGRP002 'A-LUNGS'        10.0       7.0     5.0
80 EARLY INJURY MODEL PARAMETERS, LOADED BY INEINJ, STORED IN /EINJUR/
*
80 NUMBER OF EARLY INJURY EFFECTS
*
EINUMEIN001  7
*
*            EINAME            ORGNAM    EISUSC EITHRE EIFACA EIFACB
*
EINJUGRP001 'PRODROMAL VOMIT' 'A-STOMACH'  1.      .5     2.     3.
EINJUGRP002 'DIARRHEA'        'A-STOMACH'  1.      1.     3.     2.5
EINJUGRP003 'PNEUMONITIS'     'A-LUNGS'    1.      5.    10.     7.
EINJUGRP004 'SKIN ERYTHEMA'   'A-SKIN'     1.      3.     6.     5.
EINJUGRP005 'TRANSEPIDERMAL'  'A-SKIN'     1.     10.    20.     5.
EINJUGRP006 'THYROIDITIS'     'A-THYROIDH' 1.     40.   240.     2.
EINJUGRP007 'HYPOTHYROIDISM'  'A-THYROIDH' 1.      2.    60.     1.3
80 ACUTE EXPOSURE CANCER PARAMETERS, LOADED BY INACAN STORED IN /ACANCR/.
*
80 NUMBER OF ACUTE EXPOSURE CANCER EFFECTS
*
LCNUMACA001   7
*
80 THRESHOLD DOSE FOR APPLYING THE DOSE DEPENDENT REDUCTION FACTOR
*
LCDDTHRE001   0.2  (LOWEST DOSE FOR WHICH DDREFA WILL BE APPLIED)
*
80 DOSE THRESHOLD FOR LINEAR DOSE RESPONSE (Sv)
*
LCACTHRE001   0.0  (LINEAR-QUADRATIC MODEL IS NOT BEING USED)
*
*            ACNAME     ORGNAM  ACSUSC DOSEFA DOSEFB CFRISK   CIRISK  DDREFA
*
LCANCERS001 'LEUKEMIA' 'L-RED MARR' 1.0   1.0   0.0   9.70E-3  0.0     2.0
LCANCERS002 'BONE'     'L-BONE SUR' 1.0   1.0   0.0   9.00E-4  0.0     2.0
LCANCERS003 'BREAST'   'L-BREAST'   1.0   1.0   0.0   5.40E-3  1.7E-2  1.0
LCANCERS004 'LUNG'     'L-LUNGS'    1.0   1.0   0.0   1.55E-2  0.0     2.0
LCANCERS005 'THYROID'  'L-THYROIDH' 1.0   1.0   0.0   7.20E-4  7.2E-3  1.0
LCANCERS006 'GI'       'L-LOWER LI' 1.0   1.0   0.0   3.36E-2  0.0     2.0
LCANCERS007 'OTHER'    'L-EDEWBODY' 1.0   1.0   0.0   2.76E-2  0.0     2.0
80 RESULT 1 OPTIONS BLOCK, LOADED BY INOUT1, STORED IN /INOUT1/
80 TOTAL NUMBER OF A GIVEN EFFECT (LATENT CANCER, EARLY DEATH, EARLY INJURY)
*
80 NUMBER OF DESIRED RESULTS OF THIS TYPE
*
```

```
TYPE1NUMBER    27
*
TYPE1OUT001    'ERL FAT/TOTAL'                1  7   NOCCDF (0 TO 10 MILES)
TYPE1OUT002    'ERL INJ/PRODROMAL VOMIT'      1  7   NOCCDF
TYPE1OUT003    'ERL INJ/DIARRHEA'             1  7
TYPE1OUT004    'ERL INJ/PNEUMONITIS'          1  7
TYPE1OUT005    'ERL INJ/THYROIDITIS'          1  7
TYPE1OUT006    'ERL INJ/HYPOTHYROIDISM'       1  7
TYPE1OUT007    'ERL INJ/SKIN ERYTHEMA'        1  7
TYPE1OUT008    'ERL INJ/TRANSEPIDERMAL'       1  7
TYPE1OUT009    'CAN FAT/TOTAL'                1  7   NOCCDF
TYPE1OUT010    'CAN FAT/LUNG'                 1  11  (0 TO 50 MILES)
TYPE1OUT011    'CAN FAT/THYROID'              1  11
TYPE1OUT012    'CAN FAT/BREAST'               1  11
TYPE1OUT013    'CAN FAT/GI'                   1  11
TYPE1OUT014    'CAN FAT/LEUKEMIA'             1  11
TYPE1OUT015    'CAN FAT/BONE'                 1  11
TYPE1OUT016    'CAN FAT/OTHER'                1  11
TYPE1OUT017    'CAN INJ/THYROID'              1  11
TYPE1OUT018    'CAN INJ/BREAST'               1  11
TYPE1OUT019    'CAN FAT/TOTAL'                1  11  (0 TO 50 MILES)
TYPE1OUT020    'ERL FAT/TOTAL'                1  11
TYPE1OUT021    'ERL INJ/PRODROMAL VOMIT'      1  11
TYPE1OUT022    'ERL INJ/DIARRHEA'             1  11
TYPE1OUT023    'ERL INJ/PNEUMONITIS'          1  11
TYPE1OUT024    'ERL INJ/THYROIDITIS'          1  11
TYPE1OUT025    'ERL INJ/HYPOTHYROIDISM'       1  11
TYPE1OUT026    'ERL INJ/SKIN ERYTHEMA'        1  11
TYPE1OUT027    'ERL INJ/TRANSEPIDERMAL'       1  11
```

```
80 RESULT 2 OPTIONS BLOCK, LOADED BY INOUT2, STORED IN /INOUT2/
80 FURTHEST DISTANCE AT WHICH A GIVEN RISK OF EARLY DEATH IS EXCEEDED.
*
80 NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE2NUMBER  1
*
80 FATALITY RISK THRESHOLD
*
TYPE2OUT001  0.
```

```
80 RESULT 3 OPTIONS BLOCK, LOADED BY INOUT3, STORED IN /INOUT3/
80 NUMBER OF PEOPLE WHOSE DOSE TO A GIVEN ORGAN EXCEEDS A GIVEN THRESHOLD.
*
80 NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE3NUMBER  4
*
*              ORGAN NAME    DOSE THRESHOLD (Sv)
*
TYPE3OUT001    'A-RED MARR'        1.5
TYPE3OUT002    'A-LUNGS'           5.0
TYPE3OUT003    'L-EDEWBODY'        2.0
TYPE3OUT004    'L-EDEWBODY'        0.25
```

```
80 RESULT 4 OPTIONS BLOCK, LOADED BY INOUT4, STORED IN /INOUT4/
80 360 DEGREE AVERAGE RISK OF A GIVEN EFFECT AT A GIVEN DISTANCE.
*
80 POSSIBLE TYPES OF EFFECTS ARE:
*
80 'ERL FAT/TOTAL'
```

```
80 'ERL INJ/INJURY NAME'
80 'CAN FAT/CANCER NAME'
80 'CAN FAT/TOTAL'
*
80 NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE4NUMBER  5
*
*            RADIAL INDEX   TYPE OF EFFECT
*
TYPE4OUT001       1         'ERL FAT/TOTAL'
TYPE4OUT002       2         'ERL FAT/TOTAL'
TYPE4OUT003       3         'ERL FAT/TOTAL'
TYPE4OUT004       4         'ERL FAT/TOTAL'
TYPE4OUT005       5         'ERL FAT/TOTAL'
```

```
80 RESULT 5 OPTIONS BLOCK, LOADED BY INOUT5, STORED IN /INOUT5/
*
80 TOTAL POPULATION DOSE TO A GIVEN ORGAN BETWEEN TWO DISTANCES.
*
80 NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE5NUMBER     2
*
*             ORGAN       I1DIS5     I2DIS5
*
TYPE5OUT001 'L-EDEWBODY'      1          7          (0-10 MILES)
TYPE5OUT002 'L-EDEWBODY'      1          11    NOCCDF  (0-50 MILES)
```

```
80 RESULT 6 OPTIONS BLOCK, LOADED BY INOUT6, STORED IN /INOUT6/
*
80 CENTERLINE DOSE TO AN ORGAN VS DIST BY PATHWAY, PATHWAY NAMES ARE AS FOLLOWS:
*
80 PATHWAY NAME:
*    'CLD'      - CLOUDSHINE
*    'GRD'      - GROUNDSHINE
80 'INH ACU' - "ACUTE DOSE EQUIVALENT" FROM DIRECT INHALATION OF THE CLOUD
80 'INH LIF' - "LIFETIME DOSE COMMITMENT" FROM DIRECT INHALATION OF THE CLOUD
80 'RES ACU' - "ACUTE DOSE EQUIVALENT" FROM RESUSPENSION INHALATION
80 'RES LIF' - "LIFETIME DOSE COMMITMENT" FROM RESUSPENSION INHALATION
80 'TOT ACU' - "ACUTE DOSE EQUIVALENT" FROM ALL PATHWAYS
80 'TOT LIF' - "LIFETIME DOSE COMMITMENT" FROM ALL PATHWAYS
*
80 NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE6NUMBER     0
*
*             ORGNAM         PATHNM      I1DIS6   I2DIS6
*
*TYPE6OUT001  'A-RED MARR'    'TOT ACU'      1        11     (0-50 MILES)
*TYPE6OUT002  'A-LUNGS'       'TOT ACU'      1        11     (0-50 MILES)
*TYPE6OUT003  'L-EDEWBODY'    'TOT LIF'      1        11     (0-50 MILES)
```

```
80 RESULT 7 OPTIONS BLOCK, LOADED BY INOUT7, STORED IN /INOUT7/
*
80 CENTERLINE RISK OF A GIVEN EFFECT VS DISTANCE
*
80 NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE7NUMBER   0
*
```

```
*                    NAME           I1DIS7       I2DIS7
*
*TYPE7OUT001     'ERL FAT/TOTAL'        1           11       (0-50 MILES)
80 RESULT 8 OPTIONS BLOCK, LOADED BY INOUT8, STORED IN /INOUT8/
*
80 POPULATION WEIGHTED FATALITY RISK BETWEEN 2 DISTANCES
*
80 NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE8NUMBER   2
*
*                NAME       I1DIS8  I2DIS8
*
TYPE8OUT001 'ERL FAT/TOTAL'   1       2     NOCCDF  (0-EXCL ZONE + 1 MI)
TYPE8OUT002 'CAN FAT/TOTAL'   1       7     NOCCDF  (0-10 MILES)
80 RESULT A OPTIONS BLOCK, LOADED BY INOUTA, STORED IN /INOUTA/
*
80 peak dose to a given organ
*
80 NUMA
TYPEANUMBER   1
*
*              ORGNAM    I1DISA  I2DISA
TYPEAOUT001 'L-EDEWBODY'  1       11
.
*********** BEGINNING OF CHANGE CASE 1 USER INPUT ******************************
80 EMERGENCY RESPONSE SCENARIO NUMBER 2
*
80 SPECIFIC DESCRIPTION OF THE EMERGENCY RESPONSE SCENARIO BEING USED
*
EZEANAM2001  'NO EVACUATION, RELOCATION MODELS APPLY EVERYWHERE'
*
80 THE TYPE OF WEIGHTING TO BE APPLIED TO THE EMERGENCY RESPONSE SCENARIOS
*
80 WEIGHTING FRACTION APPLICABLE TO THIS SCENARIO FOR EVACUATION
*
EZWTFRAC001  0.05   (5% of the people DO NOT evacuate)
*
80 LAST RING IN THE MOVEMENT ZONE
*
EZLASMOV001     0    (A ZERO TURNS OFF THE EVACUATION MODEL)
*
.



**********North Anna CHRONC Input File**********

80 GENERAL DESCRIPTIVE TITLE DESCRIBING THIS NAPS "CHRONC" INPUT FILE
80 BASE CASE Using revise Economic data CHEVACST =40, CHRELCST = 40
80 CHDBCST = 42000, CHPOPCST = 7300, CHVALWF = 6979, CHVALWNF = 141206
80 LAST MODIFIED by MGM  04/02/04
CHCHNAME001 'NAPS ABWR CHRONC.INP,  "New" COMIDA2-Based Food Model'
80 EMERGENCY RESPONSE COST DATA BLOCK
*
80 DAILY COST FOR A PERSON WHO IS EVACUATED (DOLLARS/PERSON-DAY)
```

```
*
CHEVACST001  40.00   (INCLUDES FOOD AND HOUSING COSTS BUT NOT LOST INCOME)
*
80 DAILY COST FOR A PERSON WHO IS RELOCATED (DOLLARS/PERSON-DAY)
*
CHRELCST001  40.00   (INCLUDES FOOD AND HOUSING COSTS BUT NOT LOST INCOME)
*****************************************************************************
80 LONG TERM PROTECTIVE ACTION DATA BLOCK
*
80 Duration of the intermediate phase period--at version 1.11c TMIPND is no
80 longer processed.  The new input variable DUR_INTPHAS is the period's
80 duration, not the time after plume arrival at which the period ends.
*
DUR_INTPHAS   0.0    (in seconds)   (no intermediate phase)
*
80 LONG-TERM PHASE DOSE PROJECTION PERIOD, THE DURATION OF THE EXPOSURE
80 PERIOD OVER WHICH THE LONG-TERM DOSE CRITERION IS EVALUATED (SECONDS)
*
CHTMPACT001   1.58E8              (5 YEARS)
*
80 DOSE CRITERION FOR INTERMEDIATE PHASE RELOCATION (Sv)
*
CHDSCRTI001   1.0E5               (NO INTERMEDIATE PHASE RELOCATION)
*
80 DOSE CRITERION FOR LONG-TERM PHASE RELOCATION (Sv)
*
CHDSCRLT001    0.04
*
80 CRITICAL ORGAN NAME FOR LONG-TERM ACTIONS
*
CHCRTOCR001 'L-EDEWBODY'
*
* Long Term Exposure Period    Previously permanently set to:
80 one million years = 3.15 E13 seconds
80 MACCS2 allowable range is 3.15E7 to 1.E10
*
CHEXPTIM001    1.E10
*****************************************************************************
80 DECONTAMINATION PLAN DATA BLOCK
*
80 NUMBER OF LEVELS OF DECONTAMINATION
*
CHLVLDEC001  2
*
80 DECONTAMINATION TIMES CORRESPONDING TO THE LVLDEC LEVELS OF DECONTAMINATION
80 (SECONDS)
*
CHTIMDEC001   5.184E6  1.0368E7    (60, 120 DAYS)
*
80 DOSE REDUCTION FACTORS CORRESPONDING TO THE LVLDEC LEVELS OF DECONTAMINATION
*
CHDSRFCT001   3.       15.
*
80 COST OF FARM DECONTAMINATION PER FARMLAND UNIT AREA (DOLLARS/HECTARE)
80 FOR THE VARIOUS LEVELS OF DECONTAMINATION
*
CHCDFRM0001   658.1   1463.
*
80 COST OF NONFARM DECONTAMINATION PER RESIDENT PERSON (DOLLARS/PERSON)
80 FOR THE VARIOUS LEVELS OF DECONTAMINATION
```

```
*
CHCDNFRM001   3510.    9360.
*
80 FRACTION OF FARMLAND DECONTAMINATION COST DUE TO LABOR
80 FOR THE VARIOUS DECONTAMINATION LEVELS
*
CHFRFDL0001  .3        .35
*
80 FRACTION OF NON-FARM DECONTAMINATION COST DUE TO LABOR
80 FOR THE VARIOUS DECONTAMINATION LEVELS
*
CHFRNFDL001  .7        .5
*
80 FRACTION OF TIME WORKERS IN FARM AREAS SPEND IN CONTAMINATED AREAS
80 FOR THE VARIOUS DECONTAMINATION LEVELS
*
CHTFWKF0001  .10       .33
*
80 FRACTION OF TIME WORKERS IN NON-FARM AREAS SPEND IN CONTAMINATED AREAS
80 FOR THE VARIOUS DECONTAMINATION LEVELS
*
CHTFWKNF001  .33       .33
*
80 AVERAGE COST OF DECONTAMINATION LABOR (DOLLARS/MAN-YEAR)
*
CHDLBCST001   42000.
*************************************************************************
80 INTERDICTION COST DATA BLOCK
*
80 DEPRECIATION (DETERIORATION) RATE DURING INTERDICTION PERIOD (PER YEAR)
*
CHDPRATE001     .20    (VALUE OBTAINED FROM WASH-1400, APPENDIX 6)
*
80 INVESTMENT INCOME RETURN (DISCOUNT RATE) DURING INTERDICTION PERIOD (PER YEAR)
80 THIS VALUE SHOULD BE DERIVED AS A REAL RETURN RATE ADJUSTED FOR INFLATION
*
CHDSRATE001     .12    (VALUE OBTAINED FROM WASH-1400, APPENDIX 6)
*
80 POPULATION RELOCATION COST (DOLLARS/PERSON):
80 ALTERNATIVE HOUSING, MOVING COSTS, AND LOST INCOME FOR PEOPLE IN
80 AREAS WHICH REQUIRE DECONTAMINATION, INTERDICTION, OR CONDEMNATION
*
CHPOPCST001   7300.
*************************************************************************
80 GROUNDSHINE WEATHERING DEFINITION DATA BLOCK
*
80 NUMBER OF TERMS IN THE GROUNDSHINE WEATHERING RELATIONSHIP (EITHER 1 OR 2)
*
CHNGWTRM001   2
*
80 GROUNDSHINE WEATHERING COEFFICIENTS
*
CHGWCOEF001   0.5     0.5              (JON HELTON)
*
80 HALF LIVES CORRESPONDING TO THE GROUNDSHINE WEATHERING COEFFICIENTS (S)
*
CHTGWHLF001   1.6E7   2.8E9           (JON HELTON)
*************************************************************************
80 RESUSPENSION WEATHERING DEFINITION DATA BLOCK
*
80 NUMBER OF TERMS IN THE RESUSPENSION WEATHERING RELATIONSHIP
```

```
*
CHNRWTRM001    3
*
* RESUSPENSION CONCENTRATION COEFFICIENTS    (/ METER)
80 RELATIONSHIP BETWEEN GROUND CONCENTRATION AND INSTANTANEOUS AIR CONC.
*
CHRWCOEF001  1.0E-5   1.0E-7   1.0E-9  (VALUES HERE SELECTED BY JON HELTON)
*
80 HALF-LIVES CORRESPONDING TO THE RESUSPENSION CONCENTRATION COEFFICIENTS (S)
*
CHTRWHLF001  1.6E7    1.6E8    1.6E9   (6 MONTHS, 5 YEARS, 50 YEARS)
80 SITE REGION DESCRIPTION DATA BLOCK
*
80 FRACTION OF AREA THAT IS LAND IN THE REGION
*
CHFRACLD001   0.95   (ROUGH GUESS VALUE, SITE FILE OVERRIDES THIS VALUE)
*
80 FRACTION OF LAND DEVOTED TO FARMING IN THE REGION
*
CHFRCFRM001   0.382  (VIRGINIA STATE VALUE, SITE FILE OVERRIDES THIS VALUE)
*
80 AVERAGE VALUE OF ANNUAL FARM PRODUCTION IN THE REGION (DOLLARS/HECTARE)
80 (CASH RECEIPTS FROM FARMING PLUS VALUE OF HOME CONSUMPTION)/(LAND IN FARMS)
*
CHFRMPRD001   371.0  (VIRGINIA STATE VALUE, SITE FILE OVERRIDES THIS VALUE)
*
80 FRACTION OF FARM PRODUCTION RESULTING FROM DAIRY PRODUCTION IN THE REGION
80 (VALUE OF MILK PRODUCED)/(CASH RECEIPTS FROM FARMING PLUS HOME CONSUMPTION)
*
CHDPFRCT001   0.198  (VIRGINIA STATE VALUE, SITE FILE OVERRIDES THIS VALUE)
*
80 VALUE OF FARM WEALTH (DOLLARS/HECTARE)
80 (AVERAGE VALUE PER HECTARE OF FARM LAND AND BUILDINGS TO 100 MILES)
*
CHVALWF0001   6979.  *  NAPS
*
80 FRACTION OF FARM WEALTH IN IMPROVEMENTS FOR THE REGION
*
CHFRFIM0001   0.25  *  SURRY/NAPS
*
80 NON-FARM WEALTH, PROPERTY AND IMPROVEMENTS FOR THE REGION (DOLLARS/PERSON)
80 THE VALUE OF ALL RESIDENTIAL, BUSINESS, AND PUBLIC ASSETS WHICH WOULD BE
80 LOST IN THE EVENT OF PERMANENT INTERDICTION (CONDEMNATION) OF THE AREA
*
CHVALWNF001  141206.  *  NAPS
*
80 FRACTION OF NON-FARM WEALTH IN IMPROVEMENTS FOR THE REGION
*
CHFRNFIM001   0.8
CHFDPATH001 'NEW'
*
80 name of the COMIDA2 binary output file
*
BIN_FILE001 'SAMP_A.BIN'   (revised data file of 8/12/95)
*
80 Dose limits triggering first year crop disposal of the separate
80 milk and non-milk components of the diet, corresponding in purpose,
80 more or less, to the MACCS 1.5 input variables PSCMLK and PSCOTH
```

```
*
80 For NUREG-1150 calculations, the maximum allowable ground concentrations for
80 production of milk and non-milk crops contaminated by an accident occurring
80 in the growing season were derived based on an assumed maximum allowable
80 dose of 5 rem effective or 15 rem thyroid, per the 1982 FDA guidance that's
80 reprinted in the 1992 EPA PAG Manual.  For purposes of comparison against
80 the prior results, it is being assumed, for simplicity, that milk and
80 non-milk crops contribute equally to the first year dose.  Thus, the 5 rem
80 effective dose limit used in NUREG-1150 is equally split between milk and
80 non-milk crops, with 2.5 rem allowed for each.  Similarly, the 15 rem
80 thyroid limit is split into 7.5 and 7.5 rem for the milk and non-milk
80 portions of the diet.
*
*              effective     thyroid  (doses in sieverts)
DOSEMILK001     0.025          0.075
DOSEOTHR001     0.025          0.075
*
80 Annual dose limits for the subsequent year's (i.e., after the first year)
80 interdiction of BOTH the milk and non-milk (combined) components of the diet
*
80 Note: the long-term food critera, GCMAXR, used for NUREG-1150 wre based on
80 an ingestion dose integrated from zero to infinity.  It is not possible to
80 translate those parameter values into corresponding annual dose limits, as is
80 required by the COMIDA2-based food model.  The "total" dose limits used in
80 NUREG-1150 for "root uptake", 0.5 rem effective and 1.5 rem thyroid, are used
80 here as annual dose limits for interdiction of food production in years the
80 years subsequent to the accident.
*
*              effective     thyroid  (doses in sieverts)
DOSELONG001     0.005          0.015
*
80 NUMBER OF NUCLIDES IN THE WATER INGESTION PATHWAY MODEL
*
CHNUMWPI001     4
*
80 TABLE OF NUCLIDE DEFINITIONS IN THE WATER INGESTION PATHWAY MODEL
*
80 IF A SITE DATA FILE IS DEFINED, THE DATA DEFINING THE WATERSHED INGESTION
80 FACTOR IS SUPERSEDED BY THE CORRESPONDING DATA IN THE SITE DATA FILE
*
*                          INITIAL      ANNUAL     INGESTION FACTOR
*              WATER       WASHOFF      WASHOFF     ((Bq INGESTED)/
*             NUCLIDE      FRACTION      RATE        (Bq IN WATER))
*
*              NAMWPI       WSHFRI       WSHRTA          WINGF
CHWTRISO001    Sr-89         0.01         0.004          5.0E-6
CHWTRISO002    Sr-90         0.01         0.004          5.0E-6
CHWTRISO003    Cs-134        0.005        0.001          5.0E-6
CHWTRISO004    Cs-137        0.005        0.001          5.0E-6
80 SPECIAL OPTIONS DATA BLOCK
*
80 DETAILED PRINT OPTION CONTROL SWITCHES, LOOK AT THE CODE BEFORE TURNING ON!!
80 KSWDSC
*
CHKSWTCH001    0
80 DEFINE THE TYPE 9 RESULTS
*
80 LONG-TERM POPULATION DOSE IN A GIVEN REGION BROKEN DOWN BY THE 12 PATHWAYS
```

```
*
80 NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
80 FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 12
*
TYPE9NUMBER   1       (UP TO 10 ALLOWED)
*
*              ORGNAM         INNER      OUTER
*
TYPE9OUT001   'L-EDEWBODY'       1          11     (0-50 MILES)
80 ECONOMIC COST RESULTS IN A REGION BROKEN DOWN BY 12 TYPES OF COSTS
*
80 NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
80 FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 12
*
TYP10NUMBER   1       (UP TO 10 ALLOWED)
*
*              INNER      OUTER
*
TYP10OUT001      1          11     (0-50 MILES)
80 DEFINE A FLAG THAT CONTROLS THE PRODUCTION OF THE ACTION DISTANCE RESULTS
*
80 SPECIFYING A VALUE OF .TRUE. TURNS ON ALL 8 OF THE ACTION DISTANCE RESULTS,
80 A VALUE OF .FALSE. WILL ELIMINATE THE ACTION DISTANCE RESULTS FROM THE OUTPUT.
*
TYP11FLAG11   .FALSE.
80 IMPACTED AREA/POPULATION RESULTS IN A REGION BROKEN DOWN BY 6 TYPES OF IMPACTS
*
80 NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
80 FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 8
*
TYP12NUMBER   1       (UP TO 10 ALLOWED)
*
*              INNER      OUTER
*
TYP12OUT001      1          11     (0-50 MILES)
80 Maximal annual food ingestion dose to an individual, requested by IXOT13
*
80 This result is calculated after accounting for temporary or
80 permanent interdiction.  It is only available for the "new" food model.
*
80 NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
*
TYP13NUMBER   0    (UP TO 10 ALLOWED)
*
80 IRAD13 is the radial spatial interval at which results are requested
*
80 ORGN13 is the name of the organ for which results are requested
80 (allowable values for ORGN13 are 'EFFECTIVE' or 'THYROID')
*
.
```

**********North Anna SITE Data File**********

SECPOP90 V2.3 MACCS Site Data File for North Anna
Lat: 38d 3'48'' Long: 77d 47'13'' LAST MODIFIED 12-17-1999
80 SPATIAL INTERVALS
16 WIND DIRECTIONS
7 CROP CATEGORIES
4 WATER PATHWAY ISOTOPES
1 WATERSHEDS
80 ECONOMIC REGIONS
SPATIAL DISTANCES KILOMETERS

1.61	3.22	4.83	6.44	8.05	9.65	16.09	32.18
48.27	64.37	80.47					

POPULATION

0.	46.	118.	146.	184.	118.	575.	9413.
6143.	21240.	50387.					
2.	44.	70.	192.	248.	168.	1320.	9192.
12963.	30219.	211772.					
2.	36.	52.	112.	120.	164.	1186.	46762.
109366.	45870.	94562.					
0.	18.	124.	48.	76.	242.	1410.	7010.
8060.	13313.	20186.					
0.	20.	134.	50.	40.	146.	1278.	7379.
5592.	1986.	4563.					
2.	8.	20.	116.	162.	102.	1042.	6880.
6707.	5912.	9060.					
0.	19.	86.	10.	12.	55.	645.	3676.
23788.	72630.	93953.					
3.	55.	32.	30.	44.	29.	1098.	6211.
18766.	540546.	478477.					
0.	46.	22.	33.	44.	46.	695.	5427.
14467.	24696.	41914.					
0.	11.	12.	59.	72.	128.	484.	3710.
6963.	6727.	7333.					
0.	4.	15.	59.	95.	181.	1133.	3207.
3407.	6302.	4671.					
0.	21.	46.	34.	69.	233.	1296.	5060.
7737.	10450.	9498.					
0.	34.	26.	26.	32.	34.	482.	3193.
5315.	128151.	25521.					
0.	33.	87.	58.	32.	149.	567.	3101.
9823.	21412.	11862.					
1.	39.	58.	102.	79.	242.	555.	3785.
14054.	14311.	3690.					
0.	34.	76.	16.	30.	58.	870.	5690.
10949.	30925.	11980.					

LAND FRACTION

80.0.□.□.□.□.□.□*□* 0.97 0.97 0.97 0.97 0.97 0.97 0.99 1.00 1.00 1.00
0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.98 0.98 0.97
0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.91 0.78
80.0.□.□.□.□.□.□*□* 0.97 0.97 0.97 0.00 0.97 0.97 0.98 0.98 0.96 0.90
0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.99 0.99 0.95 0.90
80.0.□.□.□.□.□.□.□*□* 0.97 0.97 0.97 0.97 0.97 0.97 0.99 0.99 0.97 0.95
0.97 0.00 0.97 0.97 0.97 0.97 0.99 1.00 1.00 0.99 0.98
0.97 0.97 0.97 0.97 0.97 0.97 0.97 1.00 0.99 0.97 0.97
80.0.□.□.□.□.□.□.□*□* 0.97 0.00 0.97 0.97 0.97 0.97 0.98 0.98 0.99 0.98
0.97 0.97 0.97 0.00 0.97 0.97 0.97 0.97 0.98 0.99 1.00
0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.98 0.99 0.99 1.00

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0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.99 0.99 0.99
0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.98 1.00 1.00
0.97 0.97 0.97 0.97 0.97 0.97 0.97 0.99 1.00 1.00 1.00
0.97 0.97 0.97 0.97 0.97 0.97 0.98 1.00 1.00 1.00 1.00
80.0.□.□.□.□.□.□•□• 0.97 0.97 0.97 0.00 0.97 0.97 0.99 1.00 1.00 1.00
REGION INDEX
1 2 2 2 2 2 2 3 4 5 6
1 2 2 2 2 2 2 7 8 910
1 2 2 2 2 2 211121314
1 2 2 2 2 2 215161718
1 2 2 2 2 2 219202122
1 2 2 2 2 2 223242526
1272829303:3233343536
1272727272'2737383940
1272727272'2741424344
1272727272'2745464748
1272727272'2749505152
1272727272'2753545556
1272727272'2757585960
1272727276:6263646566
1676869707:7273747576
1 2 2 2 2 2 277787980
WATERSHED INDEX
1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
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1 1 1 1 1 1 1 1 1 1 1
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1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
CROP SEASON AND SHARE
  1 PASTURE                 90. 270.   0.41
  2 STORED FORAGE          150. 240.   0.13
  3 GRAINS                 150. 240.   0.21
  4 GRN LEAFY VEGETABLES   150. 240.   0.002
  5 OTHER FOOD CROPS       150. 240.   0.004
  6 LEGUMES AND SEEDS      150. 240.   0.15
  7 ROOTS AND TUBERS       150. 240.   0.003
WATERSHED DEFINITION              1111111111222222222233333333334444444444
  1 Sr-89                            5.0E-6    0.0
  2 Sr-90                            5.0E-6    0.0
  3 Cs-134                           5.0E-6    0.0
  4 Cs-137                           5.0E-6    0.0
REGIONAL ECONOMIC DATA
  1 EXCLUSION       0.237 .196      301.      5682.    121231.
  2 REGION_02       0.187 .362      315.      9617.    131822.
  3 REGION_03       0.359 .213      510.      7306.    136163.
  4 REGION_04       0.495 .244      499.      7434.    151560.
  5 REGION_05       0.547 .239      484.      9041.    178741.
  6 REGION_06       0.543 .228      500.      9873.    187870.
```

7	REGION_07	0.187	.365	313.	9662.	131866.
8	REGION_08	0.257	.142	336.	10497.	162264.
9	REGION_09	0.303	.106	376.	11381.	179934.
10	REGION_10	0.174	.242	644.	13466.	163079.
11	REGION_11	0.187	.365	313.	9662.	131866.
12	REGION_12	0.117	.074	238.	10404.	157487.
13	REGION_13	0.144	.004	311.	11315.	165761.
14	REGION_14	0.184	.067	529.	10960.	155691.
15	REGION_15	0.182	.294	353.	8663.	130899.
16	REGION_16	0.184	.081	406.	6872.	136128.
17	REGION_17	0.280	.000	361.	5453.	137948.
18	REGION_18	0.309	.000	481.	6253.	140558.
19	REGION_19	0.167	.059	484.	5363.	127707.
20	REGION_20	0.163	.000	517.	4526.	126897.
21	REGION_21	0.260	.000	469.	4221.	129440.
22	REGION_22	0.381	.000	565.	4386.	132106.
23	REGION_23	0.163	.000	517.	4526.	126897.
24	REGION_24	0.164	.000	518.	4548.	127178.
25	REGION_25	0.260	.078	486.	4205.	129697.
26	REGION_26	0.302	.044	465.	3836.	126644.
27	REGION_27	0.248	.158	298.	4765.	118786.
28	REGION_28	0.248	.158	298.	4765.	118782.
29	REGION_29	0.248	.158	298.	4765.	118782.
30	REGION_30	0.232	.211	302.	6029.	122159.
31	REGION_31	0.216	.267	306.	7356.	125704.
32	REGION_32	0.297	.101	574.	6813.	151359.
33	REGION_33	0.312	.059	706.	7498.	165179.
34	REGION_34	0.292	.051	681.	7106.	160138.
35	REGION_35	0.317	.087	663.	6931.	161577.
36	REGION_36	0.259	.063	667.	6932.	166318.
37	REGION_37	0.322	.068	705.	7632.	166437.
38	REGION_38	0.291	.047	725.	7761.	174110.
39	REGION_39	0.133	.001	713.	6710.	178269.
40	REGION_40	0.088	.000	812.	6938.	166779.
41	REGION_41	0.262	.140	377.	5319.	127984.
42	REGION_42	0.270	.065	431.	6431.	174439.
43	REGION_43	0.238	.380	461.	6866.	149780.
44	REGION_44	0.157	.080	1147.	7335.	147445.
45	REGION_45	0.249	.136	307.	4962.	128258.
46	REGION_46	0.257	.041	362.	6189.	182163.
47	REGION_47	0.272	.334	526.	5967.	140373.
48	REGION_48	0.318	.174	1251.	4528.	120349.
49	REGION_49	0.251	.116	314.	5126.	136469.
50	REGION_50	0.285	.002	334.	5071.	156279.
51	REGION_51	0.299	.030	649.	3521.	109866.
52	REGION_52	0.234	.017	695.	3155.	104004.
53	REGION_53	0.248	.157	298.	4764.	118781.
54	REGION_54	0.309	.024	268.	3850.	118092.
55	REGION_55	0.335	.023	276.	5205.	130383.
56	REGION_56	0.326	.053	375.	6965.	142491.
57	REGION_57	0.248	.158	298.	4765.	118782.
58	REGION_58	0.302	.120	301.	6453.	136149.
59	REGION_59	0.346	.073	286.	8218.	158406.
60	REGION_60	0.371	.079	308.	8830.	160018.
61	REGION_61	0.248	.158	298.	4765.	118782.
62	REGION_62	0.228	.231	306.	6526.	123614.
63	REGION_63	0.389	.133	515.	5491.	131831.
64	REGION_64	0.459	.140	581.	6067.	137365.
65	REGION_65	0.398	.219	377.	6412.	122434.

66	REGION_66	0.367 .161	1395.	7574.	127782.
67	REGION_67	0.220 .252	305.	7004.	124763.
68	REGION_68	0.187 .365	313.	9662.	131866.
69	REGION_69	0.248 .158	298.	4765.	118782.
70	REGION_70	0.187 .365	313.	9662.	131866.
71	REGION_71	0.187 .365	313.	9662.	131866.
72	REGION_72	0.238 .320	371.	8964.	133138.
73	REGION_73	0.464 .121	630.	5877.	138768.
74	REGION_74	0.477 .262	479.	6073.	125842.
75	REGION_75	0.484 .312	418.	5941.	117144.
76	REGION_76	0.431 .183	1413.	6654.	120587.
77	REGION_77	0.458 .126	623.	5956.	138624.
78	REGION_78	0.469 .252	501.	6668.	138080.
79	REGION_79	0.469 .279	454.	6978.	138495.
80	REGION_80	0.438 .040	234.	8887.	155434.

END

Attachment IV Embedded Files

North Anna - ABWR ESP
MACCS2 Input Files
MACCS2 Output Files

MACCS2 Input Output Files.zip

Attachment V

Draft Response to NRC Request For Additional Information Regarding The Early Site Permit.

The official NRC RAIs are documented in Reference 18 of this calculation. Only Draft responses to RAIs that were generated in this calculation will be included in this attachment. Relevant inputs to RAI ER Section 7.2 parts a,b,c are included here as shown below.

04/12/06

14. ER Section 7.2 Severe Accidents

a. Include the results of a site-specific assessment of the consequences of severe accidents for air and surface water pathways based on the results of the MACCS2 computer code.

Dominion Response

A site-specific assessment of severe accident consequences has been calculated using the MACCS2 computer code. GE provided accident source term release fractions and their corresponding frequencies for the ESBWR. Population dose and economic cost out to a 50-mile radius from the site is provided for all severe accident categories. Analysis results for the ESBWR are included as a part of this RAI response. Analyses results for the ABWR and AP1000 were provided to NRC in Dominion letters 04-170 and 04-170A, dated May 17, 2004 and July 12, 2004, respectively.

Dominion's ESBWR MACCS2 Results

The ESBWR consequences in terms of dose in sieverts and US dollars are provided below for all eleven source term categories that were evaluated.

Table 11-1: ESBWR Population Dose, Sieverts						Category Frequency
STC	CASE1A 98MET	CASE2A 97MET	CASE3A 96MET	CASE4A 5500MWt	CASE5B Plume=1.0E6W	Prob/yr
BOC	9.33E+04	8.55E+04	8.77E+04	9.79E+04	8.84E+04	<1E-12
BYP	8.68E+04	7.96E+04	8.22E+04	9.11E+04	8.28E+04	4E-12

CCID	7.17E+04	6.48E+04	6.65E+04	7.16E+04	6.71E+04	2.9E-11
CCIW	1.24E+04	1.09E+04	1.18E+04	1.30E+04	1.20E+04	2.9E-10
DCH	6.29E+04	5.74E+04	5.73E+04	6.41E+04	5.76E+04	<1E-12
EVE	7.72E+04	6.90E+04	7.18E+04	7.70E+04	7.27E+04	2.5E-10
FR	3.15E+02	2.64E+02	2.98E+02	3.60E+02	3.02E+02	2.3E-10
OPVB	3.12E+04	2.83E+04	2.91E+04	3.30E+04	2.93E+04	<1E-12
OPW1	5.52E+04	5.13E+04	5.21E+04	5.73E+04	5.27E+04	<1E-12
OPW2	2.87E+04	2.68E+04	2.76E+04	2.96E+04	2.78E+04	1.4E-11
TSL	2.43E+02	2.02E+02	2.29E+02	2.73E+02	2.32E+02	2.8E-8

Table 11-2: ESBWR Offsite Cost, $						**Category Frequency**
STC	CASE1A 98MET	CASE2A 97MET	CASE3A 96MET	**CASE4A 5500MWt**	**CASE5B** Plume=1.0E6W	Prob/yr
BOC	1.36E+10	1.27E+10	1.41E+10	1.63E+10	1.43E+10	<1E-12
BYP	1.34E+10	1.25E+10	1.38E+10	1.58E+10	1.41E+10	4E-12
CCID	1.51E+10	1.36E+10	1.42E+10	1.62E+10	1.44E+10	2.9E-11
CCIW	8.19E+08	6.24E+08	7.54E+08	1.06E+09	7.80E+08	2.9E-10
DCH	9.46E+09	8.50E+09	9.20E+09	1.01E+10	9.37E+09	<1E-12
EVE	1.59E+10	1.44E+10	1.50E+10	1.70E+10	1.52E+10	2.5E-10
FR	2.48E+06	1.93E+06	2.51E+06	3.25E+06	2.47E+06	2.3E-10
OPVB	4.15E+09	3.45E+09	3.95E+09	4.38E+09	4.04E+09	<1E-12
OPW1	9.13E+09	8.11E+09	8.63E+09	9.63E+09	8.74E+09	<1E-12
OPW2	4.58E+09	3.84E+09	4.25E+09	4.93E+09	4.35E+09	1.4E-11
TSL	1.64E+06	1.47E+06	1.74E+06	2.60E+06	1.68E+06	2.8E-8

b. Provide electronic copies of input and output files for the MACCS2 code for an ESBWR at 4500 Mwt.

Dominion Response

The site specific MACCS2 input and output files using the source term inventory for a ESBWR design thermal power level of 4500 MWt, and the analysis results are provided on the enclosed CD.

c. For an ESBWR, provide and justify the accident release categories and the core damage frequency for each release category.

Dominion Response

A description of the ESBWR accident release categories and their corresponding release frequencies as provided to Dominion by GE is included as part of this response.

Accident Release Categories / Release Frequencies

Shown below are descriptions of the accident release categories and their corresponding frequencies.

Table 6-1: ESBWR Source Term Category Frequencies

Release Category	*Summary Description*	Release Frequency (reactor year^{-1})
BYP	Containment is bypassed because of CIS failure with large (>12" diameter hole) opening in containment. Lower drywell debris bed covered.	<1E-12
BOC	Break outside of containment.	4E-12
CCID	Containment fails due to core concrete interaction; lower drywell debris bed uncovered.	2.9E-11
CCIW	Containment fails due to core concrete interaction; lower drywell debris bed covered.	2.9E-10
DCH	Direct containment heating (high pressure RPV failure) event damages containment	<1E-12
EVE	Ex-vessel steam explosion fails containment	2.5E-10
FR	Release through controlled (filtered) venting from suppression chamber	2.3E-10
OPVB	Containment fails due to failure of vapor suppression (vacuum breaker) function.	<1E-12
OPW1	Containment fails due to early (<24 hours) loss of containment heat removal.	<1E-12
OPW2	Containment fails due to late (>24 hours) loss of containment heat removal.	1.4E-11
TSL	Containment leakage at Technical Specification limit.	2.8E-8

Attachment VI
Reviewer Comments

None. All comments were editorial.

Response to Reviewer Comments

None.

Dominion℠

NDCM 3.7 Attachment 4

CALCULATION REVIEW CHECKLIST ATTACHMENT _VII__

Calculation No. SM-1526	Rev. 0	Addendum N/A	Page 1 of 1__

NOTE: If "Yes" is not answered, an explanation shall be provided below.
Reference may be made to explanations contained in the calculation or addendum.

Questions:	Yes	N/A
1. Have the sources of design inputs been correctly selected and referenced in the calculation?	☒	☐
2. Are the sources of design inputs up-to-date and retrievable/attached to the calculation?	☒	☐
3. Where appropriate, have the other disciplines reviewed or provided the design inputs for which they are responsible?	☒	☐
4. Have design inputs been confirmed by analysis, test, measurement, field walkdown, or other pertinent means as appropriate for the configuration analyzed?	☒	☐
5. Are assumptions adequately described and bounded by the Station Design Basis?	☒	☐
6. Have the bases for engineering judgments been adequately and clearly presented?	☒	☐
7. Were appropriate calculation/analytic methods used and are outputs reasonable when compared to inputs?	☒	☐
8. Are computations technically accurate?	☒	☐
9. Has the calculation made appropriate allowances for instrument errors and calibration equipment errors? (Reference STD-EEN-0304)	☐	☒
10. Have those computer codes used in the analysis been referenced in the calculation?	☒	☐
11. Have all exceptions to station design basis criteria and regulatory requirements been identified and justified in accordance with NQA-1-1994.	☒	☐
12. The design authority/original preparer for this calculation has been informed of its revision or addendum, if required.	☒	☐

Comments: (Attach additional pages if needed)
For item 9, PRA calculations are not required to make allowances for instrument errors.
Reviewer comments have been discussed and incorporated into Attachment VI of this calculation.

Prepared By (Print Name) Myron G. Matras	Signature	Date
Reviewed By (Print Name) Tom G. Hook	Signature	Date