19E Deterministic Evaluations

The information in this appendix of the reference ABWR DCD, including all subsections, tables, and figures, is incorporated by reference with the following departures and supplements.

STD DEP T1 2.14-1 (Table 19E.2-1, Table 19E.2-29)

STD DEP 2.2-5 (Tables 19E.3-2 through 19E.3-4, 19E.3-6, and 19E.3-8 through 19E.3-13)

STD DEP 9.5-2 (Figure 19E.2-24)

STD DEP Admin (Table 19E.3-6, Case 5)

19E.1 Introduction

The following site-specific supplement addresses performance of MACCS2 Code runs.

A site-specific accident consequence analysis has been performed for the STP 3 & 4 site using the MACCS2 code, and is included in 19E.3.

19E.2.1.2.3.3 Equipment Required For Accident Mitigation

STD DEP T1 2.14-1

(11) ~~*Recombiners*~~Not Used

~~*The recombiner system is needed in a long term accident (order of days) to ensure that the oxygen concentration does not reach flammability limits. The recombiners are located outside of the primary containment. Piping is used to remove and return fluid to the primary containment. Therefore, the process fluid provides the only significant impact on this system. Since the supply and return lines are isolated during the early part of an event, the recombiners are not subjected to the primary containment thermodynamic loads until days later, after accident recovery when the environment is not as severe. At this time, recovery from a postulated accident might occur in a much less severe environment. Additionally, the integrated radiation doses will be well below the design basis values. Therefore, the recombiners will survive these accident scenarios.*~~

Table 19E.2-1 Potential Suppression Pool Bypass (Continued)

Description	Number of Lines	Pathway From	Pathway To	Pathway Size (mm) (1 in. = 25.4mm)	Isolation Valves	Basis For Exclusion (See Notes)
~~Flammability Control~~	~~2~~	~~DW~~	~~RB~~	~~100~~	~~(AO,MO)~~	~~3~~

Table 19E.2-29 Equipment and Instrumentation Required to Survive Severe Accident Scenarios

Equipment and Instrumentation	10CFR50.34(f)	In-Vessel Severe Accident	Ex-Vessel Severe Accident
~~Recombiners~~	~~+~~	~~+~~	~~+~~

19E.2.8.2.1 Introduction

STD DEP 9.5-2

The flooder system is comprised of ten piping lines. Each line originates in one of the ten vertical pipes which are part of the drywell to wetwell connecting vent system. The vents are arranged symmetrically around the perimeter of the lower drywell. The flow through each flooder line will be initiated by melting ~~a fusible plug at the line exit (lower drywell side). Since 10.2 cm (4 inch) diameter fusible disks may be commercially available, the flooder line diameter was chosen as 10.2 cm (4 inches).~~ a temperature-sensitive fusible plug (or fusible link) that in turn triggers the fusible plug valve to fully open and remain open.

~~The teflon disk resides between the stainless steel disk and the fusible plug in the flooder valve (Figure 19E.2-24). Its purpose is to insulate the fusible plug from the relatively cold suppression pool water. If insulation was not provided, melting of the plug might not be uniform and operation of the flooder valve might be impaired. The disk will not melt or stick in the valve because teflon has a softening temperature of approximately 673 K (400°C) and a maximum continuous operating temperature of 561 K (288°C) both of which are above the plug melting temperature of 533 K (260°C). Furthermore, teflon has high chemical resistance and will not adhere to the stainless steel plug nor the fusible plug.~~

19E.2.8.2.6 Valve Opening Time

STD DEP 9.5-2

~~The basic configuration of the fusible plug valve is shown in Figure 19E.2-24. The plastic cap has a melting point much lower than that of the fusible plug. Flow initiation occurs when the small annular groove, 2.0 mm in depth, melts. Hydrostatic pressure then expels the remainder of the plug, the stainless steel disk and the teflon disk.~~

~~The valve opening time is the time required to melt the fusible metal in the annular groove.~~ To estimate the opening time, a calculation has been made for a pure bismuth plug. Bismuth was used because it has the closest melting point to 533 K.

Figure 19E.2-24 ~~*Flooder Valve Assembly*~~ Not Used

19E.3 Consequence Analysis

STD DEP 2.2-5

The CRAC-2 computer code (Reference 19E.3-1) was used in the ABWR SSAR *to determine the consequences of potential reactor accidents. The CRAC code evaluates offsite dose and consequences for each accident category over a range of possible weather conditions and evacuation assumptions. The CRAC code models are described in Reference 19E.3-2.*

The MACCS2 computer code (Reference 19E.3-10) was used to evaluate the impacts of severe accidents at STP 3 & 4 on the surrounding public by analyzing the atmospheric transport and deposition under time-variant meteorology, short- and long-term mitigative actions and exposure pathways, deterministic and stochastic health effects, and economic costs. *The rationale for site related input selection is presented in Subsection 19E.3.1. This data and data from the plant performance analysis is presented in Subsection 19E.3.2. The calculated results are compared to the goals in Subsection 19E.3.3.*

19E.3.1.1 Meteorology

STD DEP 2.2-5

For the MACCS2 STP 3 & 4 consequence evaluation, the STP site-specific meteorological data files suitable for use with the MACCS2 code were obtained from the STP 3 & 4 site analysis team and the National Weather Service (NWS) Palacios Municipal Airport station. Sequential hourly onsite verified data (including wind speed, wind direction, and stability class) for the years 1997, 1999, and 2000 were supplied by the STP 3 & 4 site analysis team. Precipitation data (including air temperature and dew point) for the years 1997 – 2001 were obtained from the NWS Palacios Municipal Airport Station. The use of this site-specific data is discussed in Reference 19E.3-10.

19E.3.1.2 Population

STD DEP 2.2-5

For the MACCS2 STP 3 & 4 consequence evaluation, the NRC's SECPOP2000 code was used to develop regional populations corresponding to each regional meteorology. These population figures were then projected to the year 2060 using Texas Office of State Demographer county growth rates, for use as input to the MACCS2 program. The population values used are given in Table 19E.3-2.

19E.3.1.3 Evacuation

STD DEP 2.2-5

For the MACCS2 STP 3 & 4 consequence evaluation, the evacuation parameters used in this study are given in Table 19E.3-3. Five percent of the people are assumed not to evacuate. Ninety-five percent are assumed to wait 2 hours after notification to begin to evacuate and then move radially outward at 2.73 meters per second (6.1 mph).

Values used for shielding were the standard MACCS2 assumptions. Definitions for the parameters given in Table 19E.3-3 are provided in Table 19E.3-4.

These evacuation assumptions were used for individual and societal risk calculations. For the purposes of evaluating dose levels for comparison to the dose goal (Subsection 19E.3.3.1 item 3), the standard MACCS2 assumptions for the population's actions during a general emergency were applied to the dose goal calculation. It is assumed that 95% of the EPZ population evacuate with 5% that do not evacuate. The non-evacuating population is assumed to have normal shielding protection (e.g., cloud shielding factor = 0.75, skin protection factor = 0.41) and the evacuees have no protection.

19E.3.1.4 Agriculture and Economy

STD DEP 2.2-5

Site-specific information on the distribution of agriculture and associated economics was gathered from the 2002 National Census of Agriculture county data for those counties within 50 miles of STP. The distribution of the MACCS2 required agriculture and economic data was derived by considering the fraction of each county within the 50-mile model domain and within each of its 160 sub-areas (16 directions * 10 distances). The data includes spatial distributions of land fraction and 50-mile farmland devoted to specified crop types (e.g., grains, leafy vegetables). Associated economic data, distributed about the site analogously to the population, includes total farm sales, farm sales from dairy production, fraction of land devoted to farming, etc.

Additional area-wide economic data, formulated in 1986; such as cost for a relocated person and farmland decontamination costs were escalated to April 2007 using the consumer price index ratio.

The parameter for area-wide value of farm wealth (dollars/hectare), was calculated from 2002 National Agriculture Census county farm land, building and machinery value statistics. County data was apportioned by the fraction of each county within 50 miles of STP. The parameter for area-wide non-farm wealth (dollars/person), was similarly calculated and was based on 2005 Texas property valuations.

Tables 19E.3-9 through 19E.3-13 show the site-specific agricultural and economic parameters used in this study.

19E.3.2 CRAC and MACCS2 Input Data

STD DEP 2.2-5 (for change to subsection title 19E.3.2)

19E.3.2.1 Input Which Differs From Standard CRAC/MACCS2 Assumptions

STD DEP 2.2-5

The following table describes these inputs.

Table	Inputs
19E.3-2	*Population Density*
19E.3-3	*Evacuation Parameters*
19E.3-5	*Site and Reactor Data for Meteorological Modeling*
19E.3-6	*Event Release Parameters*
19E.3-8	Meteorological Data Collected
19E.3-9	Land Fraction
19E.3-10	Regional Index
19E.3-11	Crop Season and Share
19E.3-12	Regional Economic Data
19E.3-13	Area Wide Wealth

19E.3.2.2 Input to CRAC/MACCS2 from Performance Analysis

STD DEP 2.2-5

STD DEP Admin (description of TLL(j))

The plant performance analysis results which are input parameters to the CRAC and or MACCS2 *code are described here and are shown in Table 19E.3-6. These inputs describe the data used which are plant specific and are not related to radiological modeling which is discussed in Subsection 19E.3.1. The plant input parameters are described below with the subsection of the SSAR in which the parameters are developed indicated at the end of each section in parenthesis.*

For each accident case, which represents the accident sequence listed below it, the following data are used (Table 19E.3-6):

Release Category Name, LNAME(j) - Abbreviated name given to release which results from the event. (Subsection 19E.2)

Release Probability, P(j) - the probability per year associated with release LNAME(j). (Subsection 10D.4)

TL(j) - time(hr) from reactor shutdown (defined as the end of neutron generation) to release to the atmosphere. The value is used to determine isotopic decay prior to release from the plant. For an ATWS event, containment failure is postulated to occur before core damage. Since neutron production may continue up to the time of core melt, TL may be zero for an ATWS event. The values for this parameter were converted from hours (h) to seconds (s) for use in MACCS2 as parameter PDELAY. *(Subsection 19E.2)*

DR(j) - duration of initial release (h) of radionuclides from the plant. This value is used to determine the expansion of the cloud. The maximum value of this parameter is 10 hours (CRAC limitation for plume modeling). For the MACCS2 STP 3 & 4 consequence evaluation, the maximum value of this parameter is 24 hours. The values for this parameter were converted from hours (h) to seconds (s) for use in MACCS2 as parameter PLUDUR. *(Subsection 19E.2)*

TLL(j) - warning time (h) between official notification of public and release of radioactivity from the plant. The basis for the warning time is the onset of severe core damage. The emergency action levels specified in Reference 19E.3-6, Appendix I require that a site area emergency be delayed when "~~delayed~~ degraded *core with possible loss of coolable geometry" occurs.* This parameter is renamed for use in MACCS2 as parameter PDELAY-OALARM.

OALARM (j) - time (s) at which notification is given to off-site emergency response officials to initiate protective measures for the surrounding population. This MACCS2 specific parameter value is calculated by subtracting PDELAY-OALARM from PDELAY.

FPR(j) - Sensible heat release rate in calories/s in the release cloud. This value is used to determine the initial buoyancy of the released cloud plume. The values for this parameter were converted from calories/second (cal/s) to megawatts (MW) for use in MACCS2 as parameter DPLHEAT.

RH(j) - Plume release height in meters from the ground. If this value is less than the building height, a ground release with building wake effect is assumed. Otherwise, the plume will be buoyed to a height equal to the release height plus a buoyancy height. This parameter is renamed for use in MACCS2 as parameter DPLHIT. *(Subsection 19D.5)*

FLEAK(j,k) - fraction of core inventory at the beginning of the accident for each isotope group which is eventually released into the atmosphere. This parameter is renamed for use in MACCS2 as parameter RELFRAC. *The standard isotopes groups are:*

(1) Noble gases (Kr, Xe)

(2) Not used, originally used for organic iodide

(3) Iodine, including organic iodide

(4) Cesium, including Rb

(5) Tellurium, including Sb

(6) Barium, including Sr

(7) Cobalt, including Mo, Tc, Ru, Rh

(8) Lanthanum, including Y, Zr, Nb, Ce, Pr, Nd, Np, Pu, Am, Cm

19E.3.3.3 Results

STD DEP 2.2-5

The results from the internal events analysis and the seismic event analysis (the average of the individual results over all five meteorological regions evaluated) are shown in Table 19E.3-7. A plot of whole body dose at a distance of 805 m (one-half mile) against cumulative probability is shown in Figure 19E.3-1. Based upon these results, the ABWR meets the established consequence related goals. These results bound the MACCS2 consequence analysis using site-specific data for STP 3 & 4.

19E.3.4 References

The following supplement is associated with STD DEP 2.2-5

19E.3-10 "Code Manual for MACCS2: Volume 1, User's Guide", NUREG/CR-6613, Sandia National Laboratories, Accident Analysis/Consequence Assessment Department, P.O. Box 5800, Albuquerque, NM 87185-0748.

Table 19E.3-2 Population Density

Radial Interval (mi)	CRAC Mean Population by Geography Sector (people per sq. mi.) NE	NW	S	W	SW
0-5	100	60	30	20	10
5-10	130	60	80	30	20
10-20	170	90	70	60	30
20-30	180	120	100	50	40
30-50	400t	100	80	40	130

MACCS2 Population Density

Radial Interval (mi.)

Geographical Region	1	2	3	4	5	10	20	30	40	50
N	0	0	22	0	0	46	1792	744	20573	12145
NNE	0	0	0	0	722	244	31089	1829	6155	36110
NE	0	0	0	0	45	144	1350	14181	27129	59839
ENE	0	0	0	0	0	609	393	4651	39425	149296
E	23	0	0	0	4	315	120	1852	200	109
ESE	0	0	0	103	168	102	3	0	0	0
SE	0	0	0	4	145	1757	19	0	0	0
SSE	0	0	0	0	0	157	170	0	0	0
S	0	0	0	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	1	0	0	0
SW	0	0	1	0	0	110	500	0	1622	917
WSW	0	0	0	6	9	168	8105	1535	21538	4813
W	0	0	0	7	0	165	369	1136	1830	5993
WNW	0	0	0	0	6	3313	1681	674	13247	1747
NW	0	0	0	28	44	318	685	1085	2005	283
NNW	0	0	0	0	0	49	694	6167	16461	2907

Note:
CRAC data taken from Reference 19E.3-4, Table 3-2

The MACCS2 population density data for each geographical region shown above is based on year 2000 national census values and have been projected to the year 2060.

Table 19E.3-3 Evacuation Parameters

CRAC Parameter	Strategy 1	Strategy 2
Fraction of Population Evacuating	0.95	0.05
Time Delay Before Evacuation – h	1.5	0
Evacuation Speed – m/s (mph)	4.47 (10)	0
Maximum Distance of Evacuation – m (mi)	4827 (3)	0
Distance Moved by Evacuees – m (mi)	1260 (7)	0
Sheltering Radius – m (mi)	24140 (15)	0

MACCS2 Parameter	Value
Fraction of Population Evacuating	**0.95**
The Furthest Ring in Which Evacuees Will Incur Exposures – Ring Number (mi)	**6 (10)**
Travel Point	**Boundary**
Evacuation Speed – m/s (mph)	**2.73 (6.1)**
Evacuation Type	**Radial**
Duration of the Early Phase of Evacuation – s	**86400**
Duration of the Middle Phase of Evacuation – s	**0**
Reference time point for actions in the evacuation and sheltering zone.	**Alarm**
The Number of Radial Spatial Elements (i.e., contiguous rings) Comprising the Sheltering and Evacuation Region	**6**
Delay To Take Shelter – s (h)	**7200 (2.0)**
Delay That Elapses from the Beginning of the Shelter Period to When Individuals Begin their Evacuation – s	**0**

Table 19E.3-4 Evacuation Parameter Definition

Parameter	Definition
Fraction of Population Evacuating	Fraction of population following the evacuation strategy.
Time Delay Before Evacuating	Time between notice to evacuate and start of evacuation.
Evacuation Speed	Once evacuation begins, it is assumed that the public moves directly outward and away from the plant site at this speed.
Maximum Distance of Evacuation	Once evacuation begins, individuals within this distance are assumed to evacuate as above with their exposure determined by detailed tracking of their position relative to the radioactive cloud plume. People living beyond this distance are assumed to not be evacuated initially. They are assumed to be exposed to ground contamination for 24 hours and then evacuated.
Distance moved by Evacuees before Sheltering	Distance at which evacuees are assumed to take shelter. This parameter is nominally designed to represent the use of prearranged evacuation shelters.
Sheltering Radius	People living within this distance are assumed to take shelter if they do not evacuate. Sheltering is assumed for 24 hours at which time these people are assumed to be relocated out of the contaminated area, without further exposure.
MACCS2 Specific Parameter	**Definition**
Delay To Take Shelter	**For each distance ring in the shelter/evacuate region, this variable defines the delay to take shelter (seconds) for resident individuals.**
The Furthest Ring in Which Evacuees Will Incur Exposures – Ring Number	**Defines the furthest ring in which evacuees will incur exposures. When evacuees exit this ring and proceed to the next outermost ring, no further exposures are incurred.**
Travel Point	**Assures evacuees clear 10 mile EPZ**
Evacuation Type	**Defines whether a radial or network evacuation is to be modeled. If the radial option is chosen, the code automatically generates a network path where all individuals travel radially outward. For a network evacuation, addition data must be entered by the user.**

Table 19E.3-4 Evacuation Parameter Definition (Continued)

MACCS2 Specific Parameter	Definition
Duration of the Early Phase of Evacuation	The duration (seconds) of the early phase of evacuation that begins when the sheltering period has elapsed. During this period, evacuees travel at the rate specified by the evacuation speed (ESPEED)
Duration of the Middle Phase of Evacuation	Defines the duration (seconds) of the middle phase of evacuation. This period begins when the early-phase evacuation period has elapsed. During this period, evacuees travel at the rate specified by ESPEED(2). When this period has elapsed, evacuees travel at the rate specified by ESPEED(3)
Reference time point for actions in the evacuation and sheltering zone.	If ALARM is chosen, the reference time point for these actions is the off-site alarm time (OALARM) as defined in the ATMOS source term definition. If ARRIVAL is chosen, the reference time for evacuation and sheltering actions is the arrival of the first plume at the spatial element.
The Number of Radial Spatial Elements (i.e., contiguous rings) Comprising the Sheltering and Evacuation Region	The region where individuals are subject to sheltering and/or evacuation
Delay That Elapses from the Beginning of the Shelter Period to When Individuals Begin their Evacuation	For each distance ring in the shelter/evacuate region, this variable defines the duration of the sheltering period (seconds) that is to occur before evacuation begins for residents. When DLTEVA is specified as 0, evacuation will occur with no additional delay (that is, there is no shelter period at that distance).

Table 19E.3-6 Event Release Parameters

Accident	P(i)*	TL (hr)	DR (hr)	TLL) (hr)	FPR (cal/s)	RH (m)	Release Fractions† NG	Iodine	Cesium
NCL		2.7	10	1.7	3.3E+5	37	0.044	2.3E-05	2.3E-05
Case1		20	1	19.2	3.3E+5	37	1	1.5E-07	1.3E-05
LCHPFSRN									
LCHPPSRN									
LBLCFSRN									
SBRCPFRN									
LCLPPFRN									
LCPFSRN									
CASE 2		19	1	18.2	3.3E+5	37	1	5.0E-06	5.0E-06
LCLPPFCR									
LCLPFSCR									
CASE 3		50	10	49.2	3.3E+5	37	1	2.8E-04	2.2E-03
LCHPFSD90									
CASE 4		20	1	19.2	3.3E+5	37	1	1.6E-03	1.6E-03
DF100FSR									
DF100PFR									
CASE 5		19	1	**18.2**	3.3E+5	37	1	6.0E-03	5.3E-04
LBLCPFRN									
CASE 6		19	10	18.2	3.3E+5	37	1	3.1E-02	7.7E-02
LCHPPSD90									
LBLCPFD90									
LBLCFSD90									
CASE 7		20	10	19.2	3.3E+5	37	1	8.9E-02	9.9E-02
LCLPFSD90									
LCHPPFPM									
LCLPPFD90									
CASE 8		2	10	1.2	1.0E+6	37	1	1.9E-01	2.5E-01
LCHPPFEH									
LCHPPFBR									
LCHPPFBD									
CASE 9		23.6	10	12.2	3.3E+5	37	1	3.7E-01	3.6E-01
SBRCPFD90									

MACCS2 Parameters	PDELAY ‡ (sec)	PLUDUR ‡ (sec)	OALARM ‡ (sec)	DPLHEAT‡ (MW)	DPLHIT (m)	RELFRAC Noble	RELFRAC Iodine	RELFRAC Cesium
NCL	**9720**	**36000**	**3600**	**1.38**	**37**	**0.044**	**2.30E-05**	**2.30E-05**
CASE 1	**72000**	**3600**	**2880**	**1.38**	**37**	**1**	**1.50E-07**	**1.30E-05**
CASE 2	**68400**	**3600**	**2880**	**1.38**	**37**	**1**	**5.00E-06**	**5.00E-06**

Table 19E.3-6 Event Release Parameters (Continued)

MACCS2 Parameters	PDELAY‡ (sec)	PLUDUR‡ (sec)	OALARM‡ (sec)	DPLHEAT‡ ((MW)	DPLHIT (m)	RELFRAC Noble	RELFRAC Iodine	RELFRAC Cesium
CASE 3	180000	36000	2880	1.38	37	1	2.80E-04	2.20E-03
CASE 4	72000	3600	2880	1.38	37	1	1.60E-03	1.60E-03
CASE 5	68400	3600	2880	1.38	37	1	6.00E-03	5.30E-04
CASE 6	68400	36000	2880	1.38	37	1	3.10E-02	7.70E-02
CASE 7	72000	36000	2880	1.38	37	1	8.90E-02	9.90E-02
CASE 8	7200	36000	2880	4.19	37	1	1.90E-01	2.50E-01
CASE 9	84960	36000	41040	1.38	37	1	3.70E-01	3.60E-01

* *Probabilities not part of DCD (Refer to SSAR)*

† *Group 5-8 negligible release*

‡ Event Release Parameters Converted To MACCS2 Format

Note:

See Subsection 19E.3.2.2 for definitions of parameters in this table.

Table Updated based on ABWR SSAR Table 19E.3-6 (Amendment 31), Case 5, TLL (PDELAY-OALARM) Value

Table 19E.3-8 Meteorological Data Collected

Years Data Gathered	Data Collected	Source
1997, 1999, 2000	Wind Speed Wind Direction Stability Class	STP 3 & 4 Site Analysis Team Supplied Data
1997, 1998, 1999, 2000, 2001	Precipitation Air Temperature Dew Point	National Weather Service – Palacios Municipal Airport Station

Table 19E.3-9 Land Fraction

Geographical Region	Radial Interval (mi)									
	1	2	3	4	5	10	20	30	40	50
N	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ENE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93
E	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.65	0.22	0.03
ESE	1.00	1.00	1.00	1.00	1.00	1.00	0.32	0.01	0.00	0.00
SE	1.00	1.00	0.80	1.00	1.00	0.98	0.14	0.00	0.00	0.00
SSE	1.00	1.00	0.60	1.00	1.00	0.95	0.20	0.00	0.00	0.00
S	1.00	1.00	0.60	1.00	1.00	0.95	0.12	0.00	0.00	0.00
SSW	1.00	1.00	0.60	1.00	1.00	1.00	0.31	0.03	0.01	0.00
SW	1.00	1.00	1.00	1.00	1.00	0.98	0.27	0.00	0.53	0.56
WSW	1.00	1.00	1.00	1.00	1.00	0.84	0.93	0.75	0.56	1.00
W	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00
WNW	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NW	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NNW	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 19E.3-10 Region Index

Geographical Region	Radial Interval (mi)									
	1	2	3	4	5	10	20	30	40	50
N	2	3	3	3	3	3	4	5	6	7
NNE	2	3	3	3	3	3	3	8	9	10
NE	2	3	3	3	3	3	3	11	12	13
ENE	2	3	3	3	3	3	3	14	12	12
E	2	3	3	3	3	3	3	15	16	12
ESE	2	3	3	3	3	3	17	3	1	1
SE	2	3	3	3	3	3	18	1	1	1
SSE	2	3	3	3	3	3	3	1	1	1
S	2	3	3	3	3	3	3	1	1	1
SSW	2	3	3	3	3	3	19	3	20	1
SW	2	3	3	3	3	3	21	1	20	20
WSW	2	3	3	3	3	3	22	23	24	25
W	2	3	3	3	3	3	26	27	28	29
WNW	2	3	3	3	3	3	30	27	27	31
NW	2	3	3	3	3	3	32	33	34	35
NNW	2	3	3	3	3	3	36	37	37	38

Table 19E.3-11 Crop Season and Share

Index	Crop	Day of Year Growing Season Begins	Day of Year Growing Season Ends	(Fraction of the Site-Averaged Farmland Devoted to this Crop
1	PASTURE	90.0	270.0	0.801716
2	STORED FORAGE	150.0	240.0	0.031869
3	GRAINS	150.0	240.0	0.159238
4	GRN LEAFY VEGETABLES	150.0	240.0	0.000035
5	OTHER FOOD CROPS	150.0	240.0	0.003029
6	LEGUMES AND SEEDS	150.0	240.0	0.018213
7	ROOTS AND TUBERS	150.0	240.0	0.000046

Table 19E.3-12 Regional Economic Data

Region Index	Region Name	Fraction of Land Devoted to Farming in Region	Fraction of Farm Sales Resulting from Dairy Production in Region	Total Annual Farm Sales for the Region	Farmland Property Value for the Region	Nonfarm Property Value for the Region
1	WATER	0.000	0.000	0.0	0.0	0.0
2	WITHIN1MI	0.000	0.003	461.9	2505.6	72253.9
3	REGION-3	0.868	0.003	461.9	2505.6	72253.9
4	REGION-4	0.869	0.003	463.7	2511.9	71755.4
5	REGION-5	0.909	0.002	553.5	2828.9	46678.8
6	REGION-6	0.907	0.002	555.9	2953.4	43907.9
7	REGION-7	0.839	0.001	449.1	3697.2	53348.9
8	REGION-8	0.836	0.002	414.6	2790.9	69730.6
9	REGION-9	0.747	0.000	288.3	3827.1	65459.2
10	REGION-10	0.740	0.000	292.5	4719.7	67010.7
11	REGION-11	0.740	0.001	264.3	3410.3	71721.1
12	REGION-12	0.692	0.000	190.9	3746.1	71523.3
13	REGION-13	0.695	0.000	196.1	3795.7	71293.4
14	REGION-14	0.787	0.002	336.5	3079.4	71916.0
15	REGION-15	0.861	0.003	450.3	2558.6	72222.7
16	REGION-16	0.706	0.000	212.3	3648.0	71581.1
17	REGION-17	0.868	0.003	461.9	2505.6	72253.9
18	REGION-18	0.868	0.003	461.9	2505.6	72253.9
19	REGION-19	0.868	0.003	461.9	2505.6	72253.9
20	REGION-20	0.756	0.000	188.4	2144.9	184015.7
21	REGION-21	0.868	0.003	459.9	2502.9	73075.7
22	REGION-22	0.868	0.002	384.9	2538.3	72728.9
23	REGION-23	0.801	0.000	199.1	2331.1	139913.5
24	REGION-24	0.762	0.000	188.9	2164.1	178193.8
25	REGION-25	0.773	0.001	183.0	2153.1	168738.6
26	REGION-26	0.877	0.002	349.0	2592.1	64046.1
27	REGION-27	0.887	0.000	219.9	2691.0	54660.8
28	REGION-28	0.889	0.001	210.9	2637.7	53867.0
29	REGION-29	0.908	0.005	147.7	2265.7	47203.2
30	REGION-30	0.874	0.002	382.1	2566.7	66454.0
31	REGION-31	0.888	0.000	215.4	2664.6	54197.3
32	REGION-32	0.878	0.003	482.0	2582.7	66136.7
33	REGION-33	0.911	0.002	519.7	2851.1	44524.5
34	REGION-34	0.909	0.002	491.6	2836.1	45474.8
35	REGION-35	0.903	0.006	351.9	3077.7	48125.9
36	REGION-36	0.879	0.003	486.2	2591.2	65479.8
37	REGION-37	0.915	0.002	566.9	2876.3	42929.0
38	REGION-38	0.905	0.002	472.5	3092.8	44147.4

Table 19E.3-13 Area Wide Wealth Parameter

Parameter	Value ($ per hectare)
Area-Wide Value of Farm Wealth (dollars/hectare)	3222.0701
Area-Wide Non-Farm Wealth (dollars/person)	70371.98