Entergy

Entergy Nuclear South
Entergy Operations, Inc.
17265 River Road
Killona, LA 70066
Tel 504 739 6440
Fax 504 739 6698
kpeters@entergy.com

Ken Peters
Director, Nuclear Safety Assurance
Waterford 3

W3F1-2004-0017

March 4, 2004

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Supplement to Amendment Request NPF-38-249
Extended Power Uprate
Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License No. NPF-38

REFERENCES:
1. Entergy Letter dated November 13, 2003, "License Amendment Request NPF-38-249 Extended Power Uprate"
2. NRC Letter dated January 28, 2004, "Waterford Steam Electric Station, Unit 3 – Request for Additional Information Related to Revision to Facility Operating License and Technical Specification – Extended Power Uprate Request (TAC No. MC1355)"
3. Entergy Letter dated March 28, 2003, "Submittal of Second Reactor Vessel Surveillance Capsule Report"

Dear Sir or Madam:

By letter (Reference 1), Entergy Operations, Inc. (Entergy) proposed a change to the Waterford Steam Electric Station, Unit 3 (Waterford 3) Operating License and Technical Specifications to increase the units rated thermal power level from 3441 megawatts thermal (MWt) to 3716 MWt.

By letter (Reference 2), the Nuclear Regulatory Commission (NRC) staff requested additional information (RAI) related to two review areas. The first set of questions (three) addresses meteorological data and atmospheric dispersion calculations and Entergy's response to these questions is contained in Attachment 1. Electronic files associated with the answers in Attachment 1 can be found on the enclosed compact disc submitted with this letter. The second set of questions (seven) addresses steam generator integrity and chemical engineering and Entergy's response to these questions is contained in Attachment 2. Attachment 3 requests NRC approval to implement the revised reactor vessel surveillance capsule removal schedule submitted to the NRC in Reference 3.

This letter contains one new commitment as identified in Attachment 4. The original no significant hazards consideration included in Reference 1 is not affected by any information contained in this supplemental letter.

A001

If you have any questions or require additional information, please contact D. Bryan Miller at 504-739-6692.

I declare under penalty of perjury that the foregoing is true and correct. Executed on March 4, 2004.

Sincerely,

KJP/DBM/cbh

Attachments:

1. Response to Request For Additional Information - Meteorological Data and Atmospheric Dispersion Calculations
2. Response to Request For Additional Information - Steam Generator Integrity and Chemical Engineering
3. Reactor Vessel Material Surveillance Program – Surveillance Capsule Removal Schedule
4. List of Regulatory Commitments

Enclosure:

Compact Disc: Contains data files identified in the Attachment 1 responses.

cc: (w/o Enclosure)

Dr. Bruce S. Mallett
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011

NRC Senior Resident Inspector
Waterford 3
P.O. Box 822
Killona, LA 70066-0751

U.S. Nuclear Regulatory Commission
Attn: Mr. Nageswaran Kalyanam MS O-07D1
Washington, DC 20555-0001

Wise, Carter, Child & Caraway
Attn: J. Smith
P.O. Box 651
Jackson, MS 39205

Winston & Strawn
Attn: N.S. Reynolds
1400 L Street, NW
Washington, DC 20005-3502

Louisiana Department of Environmental Quality
Office of Environmental Compliance
Surveillance Division
P. O. Box 4312
Baton Rouge, LA 70821-4312

American Nuclear Insurers
Attn: Library
Town Center Suite 300S
29th S. Main Street
West Hartford, CT 06107-2445

Attachment 1

To

W3F1-2004-0017

Response to Request for Additional Information
Meteorological Data and Atmospheric Dispersion Calculations

Response to Request for Additional Information
Meteorological Data and Atmospheric Dispersion Calculations

Question 1:

Please provide an electronic copy of the hourly meteorological data used to calculate the control room atmospheric dispersion factors as well as the joint frequency distributions used in the PAVAN calculations. The hourly data should be provided either in the format specified in Appendix A to Section 2.7, "Meteorology and Air Quality," of NUREG-1555, 'Environmental Standard Review Plan,' or in the ARCON96 format described in NUREG/CR-6331, "Atmospheric Relative Concentrations in Building Wakes." Data may be provided in compressed form, but a method to decompress the data should be provided. What are the heights at which the data were measured? Was stability class determined as a function of delta-temperature? If so, which delta-temperature measurement heights were used and how were these measurements converted to stability class (e.g., converted to °C/100 meters for comparison to Regulatory Guide (RG) 1.23, "Onsite Meteorological Programs" criteria)? What are the units of wind speed (e.g., miles per hour, meters per second)? In generating the hourly meteorological files used as input to ARCON96, did the valid wind direction values range from 1 to 360° and were invalid data designated by completely filling the field for that parameter with 9's? Page 2.13-12 states that data were obtained from "each of the meteorological towers." Which towers were used to provide what data and how were the data combined in the hourly data files and in the joint frequency distributions used to make the relative concentration (X/Q) calculations?

Response 1:

Data files of the hourly meteorological data for the years 1997 through 2001 used to calculate the control room atmospheric dispersion factors are provided on the enclosed compact disc in ARCON96 format with the following file names:

File Name	Description
W97.MET	Meteorological Data for 1997
W98.MET	Meteorological Data for 1998
W99.MET	Meteorological Data for 1999
W00.MET	Meteorological Data for 2000
W01.MET	Meteorological Data for 2001

The following joint frequency distributions (JFD) were obtained from the Waterford 3 "Annual Meteorological Monitoring Program Report" for the years 1997 through 2001.

Joint Frequency Distribution of Wind Speed and Wind Direction for 1997 by Pasquill Stability Class

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1997 00:00:00 TO 12/31/1997 23:59:59

CLASS A

Wind Speed (M/S) at 10-m Level Wind

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	0	1	19	8	2	0	0	0	30
NNE	0	0	0	0	0	0	4	0	0	0	0	0	4
NE	0	0	0	0	0	2	33	5	2	0	0	0	42
ENE	0	0	0	0	0	1	12	2	0	0	0	0	15
E	0	0	0	0	0	2	0	0	0	0	0	0	2
ESE	0	0	0	0	0	0	0	1	0	0	0	0	1
SE	0	0	0	0	0	0	0	3	0	0	0	0	3
SSE	0	0	0	0	0	1	1	0	0	0	0	0	2
S	0	0	0	0	0	1	4	0	0	0	0	0	5
SSW	0	0	0	0	0	0	3	2	0	0	0	0	5
SW	0	0	0	0	0	3	9	5	2	0	0	0	19
WSW	0	0	0	0	0	3	8	3	0	0	0	0	14
W	0	0	0	0	0	1	6	0	0	0	0	0	7
WNW	0	0	0	0	0	1	7	0	0	0	0	0	8
NW	0	0	0	0	0	0	4	0	0	0	0	0	4
NNW	0	0	0	0	0	1	1	0	0	0	0	0	2
Total	0	0	0	0	0	17	111	29	6	0	0	0	163

Number of calms for A Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1997 00:00:00 TO 12/31/1997 23:59:59
CLASS B

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	0	10	26	19	3	0	0	0	58
NNE	0	0	0	0	2	9	5	0	0	0	0	0	16
NE	0	0	0	0	0	15	58	10	2	0	0	0	85
ENE	0	0	0	0	1	15	32	7	0	0	0	0	55
E	0	0	0	0	0	0	3	3	0	0	0	0	6
ESE	0	0	0	0	0	0	6	4	0	0	0	0	10
SE	0	0	0	0	0	1	8	9	1	0	0	0	19
SSE	0	0	0	0	0	1	6	5	2	0	0	0	14
S	0	0	0	0	0	1	12	1	2	0	0	0	16
SSW	0	0	0	0	0	3	7	4	0	0	0	0	14
SW	0	0	0	0	0	3	10	12	1	0	0	0	26
WSW	0	0	0	0	0	6	5	2	0	0	0	0	13
W	0	0	0	0	1	5	4	2	0	0	0	0	12
WNW	0	0	0	0	0	5	14	2	0	0	0	0	21
NW	0	0	0	0	0	0	6	0	0	0	0	0	6
NNW	0	0	0	0	1	3	3	1	0	0	0	0	8
Total	0	0	0	0	5	77	205	81	11	0	0	0	379

Number of calms for B Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1997 00:00:00 TO 12/31/1997 23:59:59
CLASS C

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	2	19	29	16	2	0	0	0	68
NNE	0	0	0	0	4	15	6	5	1	0	0	0	31
NE	0	0	0	1	8	32	60	9	1	0	0	0	111
ENE	0	0	0	0	4	20	46	7	0	0	0	0	77
E	0	0	0	0	1	3	3	0	0	0	0	0	7
ESE	0	0	0	0	1	0	6	1	0	0	0	0	8
SE	0	0	0	0	0	2	6	10	0	0	0	0	18
SSE	0	0	0	0	0	3	15	6	1	0	0	0	25
S	0	0	0	0	0	6	19	7	1	0	0	0	33
SSW	0	0	0	0	1	7	13	7	5	0	0	0	33
SW	0	0	0	0	4	11	26	10	0	0	0	0	51
WSW	0	0	0	2	2	5	19	11	0	0	0	0	39
W	0	0	0	1	6	9	11	1	0	0	0	0	28
WNW	0	0	0	0	0	11	13	3	0	0	0	0	27
NW	0	0	0	0	0	6	13	1	0	0	0	0	20
NNW	0	0	0	0	0	6	14	4	0	0	0	0	24
Total	0	0	0	4	33	155	299	98	11	0	0	0	600

Number of calms for C Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1997 00:00:00 TO 12/31/1997 23:59:59
CLASS D

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	1	0	5	15	82	146	93	19	1	0	0	362
NNE	0	1	0	8	27	54	113	111	15	1	0	0	330
NE	0	1	2	8	24	92	185	116	8	1	0	0	437
ENE	0	0	4	4	21	76	170	99	17	2	0	0	393
E	0	2	1	6	9	20	59	30	8	0	0	0	135
ESE	0	0	0	2	6	10	78	48	5	1	0	0	150
SE	0	0	0	1	2	13	62	46	5	0	0	0	129
SSE	0	0	1	3	10	37	97	64	23	0	0	0	235
S	0	0	1	7	13	66	93	49	17	1	0	0	247
SSW	0	0	3	7	12	53	66	44	27	0	0	0	212
SW	0	0	1	9	14	50	73	25	6	0	0	0	178
WSW	0	0	4	10	19	36	62	20	0	0	0	0	151
W	0	0	1	17	23	41	32	4	0	0	0	0	118
WNW	0	1	1	13	25	42	31	4	0	0	0	0	117
NW	0	0	0	7	7	44	30	1	1	0	0	0	90
NNW	0	0	2	6	8	41	104	33	6	0	0	0	200
Total	0	6	21	113	235	757	1401	787	157	7	0	0	3484

Number of calms for D Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1997 00:00:00 TO 12/31/1997 23:59:59
CLASS E

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	6	15	10	53	48	7	1	0	0	0	140
NNE	1	2	2	16	19	40	81	12	1	0	0	0	174
NE	0	0	1	15	37	62	86	3	0	0	0	0	204
ENE	0	1	3	7	18	81	104	14	0	0	0	0	228
E	0	1	1	5	7	45	51	1	0	0	0	0	111
ESE	0	0	1	5	7	34	90	2	0	0	0	0	139
SE	0	2	2	3	17	34	45	4	0	0	0	0	107
SSE	2	3	4	12	29	68	67	6	0	0	0	0	191
S	1	4	7	21	39	86	39	5	0	0	0	0	202
SSW	1	4	7	28	35	77	50	14	0	0	0	0	216
SW	1	6	11	35	33	56	36	2	0	0	0	0	180
WSW	0	3	10	36	46	40	13	1	0	0	0	0	149
W	0	7	14	51	45	30	14	0	0	0	0	0	161
WNW	0	2	9	22	20	15	7	1	0	0	0	0	76
NW	1	1	6	21	26	29	7	0	0	0	0	0	91
NNW	0	1	3	9	23	40	15	0	0	0	0	0	91
Total	7	37	87	301	411	790	753	72	2	0	0	0	2460

Number of calms for E Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1997 00:00:00 TO 12/31/1997 23:59:59
CLASS F

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	2	0	4	12	9	4	3	0	0	0	0	0	34
NNE	0	1	7	12	4	9	0	0	0	0	0	0	33
NE	0	3	6	10	12	13	1	0	0	0	0	0	45
ENE	0	3	3	4	4	36	9	0	0	0	0	0	59
E	0	1	1	3	6	5	2	0	0	0	0	0	18
ESE	0	0	5	4	1	1	0	0	0	0	0	0	11
SE	1	1	3	2	4	3	0	0	0	0	0	0	14
SSE	1	3	4	15	12	23	3	0	0	0	0	0	61
S	1	6	7	35	62	21	1	0	0	0	0	0	133
SSW	2	10	25	65	33	10	0	0	0	0	0	0	145
SW	1	12	16	63	30	6	0	0	0	0	0	0	128
WSW	1	11	34	39	26	7	0	0	0	0	0	0	118
W	0	7	26	59	9	1	0	0	0	0	0	0	102
WNW	0	4	17	29	16	1	0	0	0	0	0	0	67
NW	1	6	5	17	11	3	2	0	0	0	0	0	45
NNW	2	4	4	10	6	6	0	0	0	0	0	0	32
Total	12	72	167	379	245	149	21	0	0	0	0	0	1045

Number of calms for F Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1997 00:00:00 TO 12/31/1997 23:59:59
CLASS G

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	2	6	4	3	1	1	0	0	0	0	0	0	17
NNE	1	1	4	3	0	0	0	0	0	0	0	0	9
NE	0	1	2	4	1	1	0	0	0	0	0	0	9
ENE	1	0	3	5	1	4	0	0	0	0	0	0	14
E	0	2	2	3	0	0	0	0	0	0	0	0	7
ESE	1	1	2	2	0	1	0	0	0	0	0	0	7
SE	0	1	1	0	0	0	0	0	0	0	0	0	2
SSE	2	1	2	3	3	3	0	0	0	0	0	0	14
S	0	5	1	23	12	5	0	0	0	0	0	0	46
SSW	1	5	18	37	15	1	0	0	0	0	0	0	77
SW	5	17	16	40	6	0	0	0	0	0	0	0	84
WSW	3	22	34	32	2	0	0	0	0	0	0	0	93
W	3	40	36	28	2	0	0	0	0	0	0	0	109
WNW	6	20	13	19	6	0	0	0	0	0	0	0	64
NW	4	13	8	5	1	1	0	0	0	0	0	0	32
NNW	3	8	10	4	0	0	0	0	0	0	0	0	25
Total	32	143	156	211	50	17	0	0	0	0	0	0	609

Number of calms for G Stability: 0
Total valid hours for all stabilities = 8740
Total invalid hours for all stabilities = 20

Joint Frequency Distribution of Wind Speed and Wind Direction for 1998 by Pasquill Stability Class

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1998 00:00:00 TO 12/31/1998 23:59:59

CLASS A

Wind Speed (M/S) at 10-m Level

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	0	2	7	1	0	0	0	0	10
NNE	0	0	0	0	1	2	4	0	0	0	0	0	7
NE	0	0	0	0	0	2	25	0	0	0	0	0	27
ENE	0	0	0	0	0	2	23	11	0	0	0	0	36
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	1	0	0	0	0	1
SE	0	0	0	0	0	0	3	7	0	0	0	0	10
SSE	0	0	0	0	0	1	5	21	6	0	0	0	33
S	0	0	0	0	0	0	8	15	3	0	0	0	26
SSW	0	0	0	0	0	0	0	3	1	0	0	0	4
SW	0	0	0	0	0	2	4	6	0	0	0	0	12
WSW	0	0	0	0	0	0	3	0	0	0	0	0	3
W	0	0	0	0	0	1	2	0	0	0	0	0	3
WNW	0	0	0	0	1	0	7	1	0	0	0	0	9
NW	0	0	0	1	0	0	8	7	0	0	0	0	16
NNW	0	0	0	0	0	0	14	13	0	0	0	0	27
Total	0	0	0	1	2	12	113	86	10	0	0	0	224

Number of calms for A Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1998 00:00:00 TO 12/31/1998 23:59:59
CLASS B

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	1	3	4	4	0	0	0	0	12
NNE	0	0	0	0	0	2	1	1	0	0	0	0	4
NE	0	0	0	0	0	11	53	5	0	0	0	0	69
ENE	0	0	0	0	0	7	15	2	0	0	0	0	24
E	0	0	0	0	0	0	0	2	0	0	0	0	2
ESE	0	0	0	0	0	1	1	2	0	0	0	0	4
SE	0	0	0	0	0	2	8	14	2	0	0	0	26
SSE	0	0	0	0	0	1	10	15	3	0	0	0	29
S	0	0	0	0	0	1	13	12	1	0	0	0	27
SSW	0	0	0	0	0	3	6	12	1	0	0	0	22
SW	0	0	0	0	0	9	33	4	0	0	0	0	46
WSW	0	0	0	0	0	2	11	5	0	0	0	0	18
W	0	0	0	0	0	0	6	2	0	0	0	0	8
WNW	0	0	0	0	0	1	3	3	0	0	0	0	7
NW	0	0	0	0	0	0	4	4	0	0	0	0	8
NNW	0	0	0	0	0	3	16	9	0	0	0	0	28
Total	0	0	0	0	1	46	184	96	7	0	0	0	334

Number of calms for B Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1998 00:00:00 TO 12/31/1998 23:59:59
CLASS C

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	2	8	7	2	0	0	0	0	19
NNE	0	0	0	0	2	6	3	2	1	0	0	0	14
NE	0	0	0	0	5	11	38	7	1	0	0	0	62
ENE	0	0	0	0	2	14	19	6	0	0	0	0	41
E	0	0	0	0	0	2	6	0	0	0	0	0	8
ESE	0	0	0	0	0	1	5	5	2	0	0	0	13
SE	0	0	0	0	0	1	10	14	3	0	0	0	28
SSE	0	0	0	0	0	3	22	18	2	0	0	0	45
S	0	0	0	0	1	6	28	9	4	0	0	0	48
SSW	0	0	1	0	1	5	26	4	2	0	0	0	39
SW	0	0	0	1	1	24	52	5	0	0	0	0	83
WSW	0	0	0	0	2	19	16	7	0	0	0	0	44
W	0	0	0	0	0	10	7	1	0	0	0	0	18
WNW	0	0	0	0	1	2	3	1	0	0	0	0	7
NW	0	0	0	0	0	3	12	1	0	0	0	0	16
NNW	0	0	0	0	3	12	17	13	1	0	0	0	46
Total	0	0	1	1	20	127	271	95	16	0	0	0	531

Number of calms for C Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1998 00:00:00 TO 12/31/1998 23:59:59
CLASS D

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	2	11	24	51	84	52	8	3	0	0	235
NNE	0	0	0	10	18	35	49	38	15	0	0	0	165
NE	0	0	3	6	29	104	119	46	1	0	0	0	308
ENE	0	0	1	5	12	50	97	39	7	1	0	0	212
E	0	0	0	2	4	13	59	30	7	0	0	0	115
ESE	0	0	0	4	3	14	62	79	4	0	0	0	166
SE	0	0	0	2	3	17	113	77	7	0	0	0	219
SSE	0	0	0	3	8	43	157	59	8	0	0	0	278
S	0	0	2	5	5	40	119	30	11	0	0	0	212
SSW	0	0	1	8	12	39	53	8	0	0	0	0	121
SW	0	0	0	12	14	37	72	20	1	0	0	0	156
WSW	0	0	2	12	26	59	74	16	3	0	0	0	192
W	0	0	1	11	25	57	29	1	0	0	0	0	124
WNW	0	0	0	7	9	31	38	12	1	1	0	0	99
NW	0	0	0	6	9	19	50	23	11	3	0	0	121
NNW	0	0	0	7	12	62	110	52	10	1	0	0	254
Total	0	0	12	111	213	671	1285	582	94	9	0	0	2977

Number of calms for D Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1998 00:00:00 TO 12/31/1998 23:59:59
CLASS E

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	1	3	6	7	18	41	82	9	3	0	0	0	170
NNE	0	1	3	19	13	32	42	9	2	0	0	0	121
NE	0	1	4	14	33	75	73	13	4	2	0	0	219
ENE	0	3	4	8	26	62	92	15	4	1	0	0	215
E	0	2	1	5	8	75	147	29	1	0	0	0	268
ESE	0	0	1	7	18	56	98	23	1	0	0	0	204
SE	0	0	3	9	21	75	126	29	3	0	0	0	266
SSE	0	5	4	15	45	146	84	4	0	0	0	0	303
S	1	2	7	27	35	88	57	3	2	1	0	0	223
SSW	1	1	2	19	26	46	23	2	2	0	0	0	122
SW	0	5	6	29	48	88	32	2	0	0	0	0	210
WSW	0	3	7	45	37	40	31	0	0	0	0	0	163
W	0	2	11	36	17	12	8	2	0	0	0	0	88
WNW	0	2	4	18	21	15	20	0	0	0	0	0	80
NW	0	2	5	12	15	36	16	3	1	1	0	0	91
NNW	0	2	3	16	17	32	52	8	10	0	0	0	140
Total	3	34	71	286	398	919	983	151	33	5	0	0	2883

Number of calms for E Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1998 00:00:00 TO 12/31/1998 23:59:59
CLASS F

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	1	3	9	7	4	6	1	0	0	0	0	0	31
NNE	2	1	7	10	12	3	0	0	0	0	0	0	35
NE	0	3	6	18	9	22	5	0	0	0	0	0	63
ENE	0	1	2	11	9	18	4	0	0	0	0	0	45
E	0	0	2	7	5	6	1	1	0	0	0	0	22
ESE	0	2	3	2	2	3	0	0	0	0	0	0	12
SE	0	1	6	11	5	17	1	0	0	0	0	0	41
SSE	0	7	8	25	40	39	0	0	0	0	0	0	119
S	1	9	19	63	57	19	0	0	0	0	0	0	168
SSW	2	15	16	72	32	13	1	1	0	0	0	0	152
SW	0	13	19	43	30	3	2	0	0	0	0	0	110
WSW	0	12	30	33	15	3	1	0	0	0	0	0	94
W	1	6	13	34	7	1	0	0	0	0	0	0	62
WNW	1	5	12	17	10	12	0	0	0	0	0	0	57
NW	0	5	5	12	4	5	0	0	0	0	0	0	31
NNW	1	4	7	11	10	12	0	0	0	0	0	0	45
Total	9	87	164	376	251	182	16	2	0	0	0	0	1087

Number of calms for F Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1998 00:00:00 TO 12/31/1998 23:59:59
CLASS G

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	3	6	3	6	2	2	0	0	0	0	0	0	22
NNE	1	3	6	5	3	0	0	0	0	0	0	0	18
NE	0	2	0	0	1	0	0	0	0	0	0	0	3
ENE	0	4	0	1	3	0	0	0	0	0	0	0	8
E	0	1	2	0	0	0	0	0	0	0	0	0	3
ESE	0	3	3	1	0	0	0	0	0	0	0	0	7
SE	0	1	2	1	4	1	0	0	0	0	0	0	9
SSE	1	4	3	11	9	4	0	0	0	0	0	0	32
S	1	7	13	26	18	1	0	0	0	0	0	0	66
SSW	1	9	29	59	17	1	0	0	0	0	0	0	116
SW	3	20	32	48	6	3	0	0	0	0	0	0	112
WSW	7	40	35	24	6	0	0	0	0	0	0	0	112
W	12	24	31	20	2	1	0	0	0	0	0	0	90
WNW	6	10	16	8	2	1	0	0	0	0	0	0	43
NW	3	10	11	11	0	0	0	0	0	0	0	0	35
NNW	5	9	16	6	2	1	0	0	0	0	0	0	39
Total	43	153	202	227	75	15	0	0	0	0	0	0	715

Number of calms for G Stability: 0
Total valid hours for all stabilities = 8751
Total invalid hours for all stabilities = 9

Joint Frequency Distribution of Wind Speed and Wind Direction for 1999 by Pasquill Stability Class

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59

CLASS A

Wind Speed (M/S) at 10-m Level

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	1	5	34	9	4	0	0	0	53
NNE	0	0	0	0	1	3	19	4	0	0	0	0	27
NE	0	0	0	0	0	34	149	14	0	0	0	0	197
ENE	0	0	0	0	0	13	14	2	0	0	0	0	29
E	0	0	0	0	0	3	2	0	0	0	0	0	5
ESE	0	0	0	0	0	1	7	1	0	0	0	0	9
SE	0	0	0	0	0	3	11	6	0	0	0	0	20
SSE	0	0	0	0	2	5	12	11	1	0	0	0	31
S	0	0	0	0	1	3	20	28	10	0	0	0	62
SSW	0	0	0	0	0	2	11	6	0	0	0	0	19
SW	0	0	0	0	0	5	29	8	0	0	0	0	42
WSW	0	0	0	0	0	1	6	1	0	0	0	0	8
W	0	0	0	0	0	0	6	0	0	0	0	0	6
WNW	0	0	0	0	0	6	12	7	0	0	0	0	25
NW	0	0	0	0	0	0	7	6	0	0	0	0	13
NNW	0	0	0	0	1	5	23	13	8	0	0	0	50
Total	0	0	0	0	6	89	362	116	23	0	0	0	596

Number of calms for A Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59
CLASS B

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	1	1	9	10	6	3	0	0	0	30
NNE	0	0	0	0	2	7	11	1	0	0	0	0	21
NE	0	0	0	0	1	29	68	7	0	0	0	0	105
ENE	0	0	0	0	1	11	18	2	0	0	0	0	32
E	0	0	0	0	0	0	2	0	0	0	0	0	2
ESE	0	0	0	0	0	0	7	3	0	0	0	0	10
SE	0	0	0	0	2	5	18	5	0	0	0	0	30
SSE	0	0	0	0	0	11	29	6	0	0	0	0	46
S	0	0	0	0	2	16	22	13	5	2	0	0	60
SSW	0	0	0	0	2	8	7	2	0	0	0	0	19
SW	0	0	0	1	1	13	13	5	0	0	0	0	33
WSW	0	0	0	1	4	16	7	2	0	0	0	0	30
W	0	0	0	1	2	9	7	0	0	0	0	0	19
WNW	0	0	0	0	4	8	9	1	0	0	0	0	22
NW	0	0	0	0	0	4	9	0	0	0	0	0	13
NNW	0	0	0	0	1	7	13	6	2	0	0	0	29
Total	0	0	0	4	23	153	250	59	10	2	0	0	501

Number of calms for B Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59
CLASS C

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	8	24	5	1	2	0	0	0	40
NNE	0	0	0	1	6	7	9	0	0	0	0	0	23
NE	0	0	0	3	3	26	51	7	0	0	0	0	90
ENE	0	0	0	0	1	7	8	1	0	0	0	0	17
E	0	0	0	0	1	5	1	1	0	0	0	0	8
ESE	0	0	0	0	1	6	5	3	0	0	0	0	15
SE	0	0	0	0	1	6	18	7	1	0	0	0	33
SSE	0	0	0	0	3	6	25	13	3	0	0	0	50
S	0	0	0	0	2	8	15	13	7	1	0	0	46
SSW	0	0	1	1	3	8	11	4	0	0	0	0	28
SW	0	0	0	0	5	9	11	5	0	0	0	0	30
WSW	0	0	0	5	6	16	8	1	0	0	0	0	36
W	0	0	0	0	1	9	12	3	0	0	0	0	25
WNW	0	0	0	0	4	20	7	0	0	0	0	0	31
NW	0	0	0	0	3	4	7	1	0	0	0	0	15
NNW	0	0	0	1	6	13	11	6	0	0	0	0	37
Total	0	0	1	11	54	174	204	66	13	1	0	0	524

Number of calms for C Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59
CLASS D

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	2	15	29	43	89	53	16	0	0	0	247
NNE	0	1	2	17	20	40	44	20	3	0	0	0	147
NE	0	1	4	12	27	82	94	21	3	0	0	0	244
ENE	0	0	0	6	13	41	55	18	2	0	0	0	135
E	0	0	1	2	7	8	31	15	0	0	0	0	64
ESE	0	0	0	0	3	13	47	25	1	0	0	0	89
SE	0	1	1	3	7	24	81	31	4	0	0	0	152
SSE	0	0	0	2	11	46	93	32	5	0	0	0	189
S	0	0	2	2	13	33	54	60	9	10	0	0	183
SSW	0	0	1	5	12	34	59	21	2	0	0	0	134
SW	0	1	1	6	18	30	51	7	0	0	0	0	114
WSW	0	0	1	14	21	55	39	1	0	0	0	0	131
W	0	0	3	14	14	26	22	2	0	0	0	0	81
WNW	0	0	0	9	22	23	31	4	0	0	0	0	89
NW	0	0	2	4	11	20	20	13	0	0	0	0	70
NNW	0	0	2	6	16	40	79	41	12	0	0	0	196
Total	0	4	22	117	244	558	889	364	57	10	0	0	2265

Number of calms for D Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59
CLASS E

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	1	3	0	13	17	75	88	11	0	0	0	0	208
NNE	0	3	5	11	21	68	59	14	0	0	0	0	181
NE	1	1	2	12	35	89	63	19	1	0	0	0	223
ENE	0	0	1	7	11	63	47	4	0	0	0	0	133
E	0	2	1	5	6	29	37	3	0	0	0	0	83
ESE	0	0	3	5	5	40	72	7	0	0	0	0	132
SE	0	1	0	10	17	83	95	15	0	0	0	0	221
SSE	0	1	3	14	48	142	65	7	0	0	0	0	280
S	0	2	4	17	52	100	89	10	2	0	0	0	276
SSW	1	1	9	35	36	54	48	4	2	0	0	0	190
SW	1	6	9	28	42	48	25	0	0	0	0	0	159
WSW	1	3	10	63	49	30	12	0	0	0	0	0	168
W	0	2	15	57	34	16	9	0	0	0	0	0	133
WNW	0	1	7	21	25	19	4	0	0	0	0	0	77
NW	1	1	3	10	14	33	11	2	0	0	0	0	75
NNW	0	4	4	13	4	33	32	7	0	0	0	0	97
Total	6	31	76	321	416	922	756	103	5	0	0	0	2636

Number of calms for E Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59
CLASS F

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	3	5	17	7	18	9	0	0	0	0	0	59
NNE	0	4	4	14	16	26	2	0	0	0	0	0	66
NE	0	3	4	6	18	46	10	0	0	0	0	0	87
ENE	0	4	5	8	6	13	1	0	0	0	0	0	37
E	1	0	0	5	2	1	0	0	0	0	0	0	9
ESE	1	4	0	4	2	1	0	0	0	0	0	0	12
SE	0	3	2	6	13	21	5	0	0	0	0	0	50
SSE	0	0	7	26	39	32	2	0	0	0	0	0	106
S	0	8	22	71	50	19	0	0	0	0	0	0	170
SSW	0	14	22	94	23	17	0	0	0	0	0	0	170
SW	1	16	31	44	10	3	2	0	0	0	0	0	107
WSW	0	14	35	59	25	3	0	0	0	0	0	0	136
W	1	16	20	50	15	1	1	0	0	0	0	0	104
WNW	0	7	15	23	11	3	0	0	0	0	0	0	59
NW	0	7	6	13	15	4	0	0	0	0	0	0	45
NNW	0	3	9	16	10	12	2	0	0	0	0	0	52
Total	4	106	187	456	262	220	34	0	0	0	0	0	1269

Number of calms for F Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/1999 00:00:00 TO 12/31/1999 23:59:59
CLASS G

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	1	6	8	15	3	0	0	0	0	0	0	0	33
NNE	1	2	5	11	4	0	0	0	0	0	0	0	23
NE	4	1	5	7	9	1	0	0	0	0	0	0	27
ENE	1	2	2	3	0	0	0	0	0	0	0	0	8
E	1	3	1	1	1	0	0	0	0	0	0	0	7
ESE	0	3	2	1	0	0	0	0	0	0	0	0	6
SE	0	3	0	1	2	5	1	0	0	0	0	0	12
SSE	2	5	4	19	12	6	0	0	0	0	0	0	48
S	1	9	21	46	12	0	0	0	0	0	0	0	89
SSW	4	12	30	63	13	2	0	0	0	0	0	0	124
SW	6	18	41	32	3	0	0	0	0	0	0	0	100
WSW	9	39	48	21	1	1	0	0	0	0	0	0	119
W	13	60	41	32	7	0	0	0	0	0	0	0	153
WNW	9	39	38	26	4	1	0	0	0	0	0	0	117
NW	6	18	9	15	4	1	0	0	0	0	0	0	53
NNW	4	7	18	13	6	2	0	0	0	0	0	0	50
Total	62	227	273	306	81	19	1	0	0	0	0	0	969

Number of calms for G Stability: 0
Total valid hours for all stabilities = 8760
Total invalid hours for all stabilities = 0

Joint Frequency Distribution of Wind Speed and Wind Direction for 2000 by Pasquill Stability Class

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2000 00:00:00 TO 12/31/2000 23:59:59

CLASS A

Wind Speed (M/S) at 10-m Level

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	2	2	24	8	3	2	0	0	41
NNE	0	0	0	0	0	4	17	5	0	0	0	0	26
NE	0	0	0	0	0	7	113	19	0	0	0	0	139
ENE	0	0	0	0	0	4	7	2	0	0	0	0	13
E	0	0	0	0	0	3	3	2	0	0	0	0	8
ESE	0	0	0	0	0	2	5	3	0	0	0	0	10
SE	0	0	0	0	0	0	16	12	0	0	0	0	28
SSE	0	0	0	0	0	2	28	14	2	0	0	0	46
S	0	0	0	0	0	3	26	56	2	0	0	0	87
SSW	0	0	0	0	1	3	17	8	1	0	0	0	30
SW	0	0	0	0	1	9	36	14	1	0	0	0	61
WSW	0	0	0	0	0	5	3	5	0	0	0	0	13
W	0	0	0	0	0	0	9	1	0	0	0	0	10
WNW	0	0	0	0	0	0	12	2	0	0	0	0	14
NW	0	0	0	0	0	0	8	2	0	0	0	0	10
NNW	0	0	0	0	0	1	21	14	2	0	0	0	38
Total	0	0	0	0	4	45	345	167	11	2	0	0	574

Number of calms for A Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2000 00:00:00 TO 12/31/2000 23:59:59
CLASS B

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	1	1	12	13	0	0	0	0	0	27
NNE	0	0	0	0	2	7	9	3	0	0	0	0	21
NE	0	0	0	0	0	26	43	13	0	0	0	0	82
ENE	0	0	0	1	1	6	9	2	0	0	0	0	19
E	0	0	0	0	0	2	2	1	0	0	0	0	5
ESE	0	0	0	0	1	1	6	3	0	0	0	0	11
SE	0	0	0	0	0	1	15	11	1	0	0	0	28
SSE	0	0	0	1	0	0	20	13	3	0	0	0	37
S	0	0	0	0	1	6	25	12	3	0	0	0	47
SSW	0	0	0	0	3	10	18	3	0	0	0	0	34
SW	0	0	0	1	1	13	25	2	0	0	0	0	42
WSW	0	0	0	0	2	18	12	1	0	0	0	0	33
W	0	0	0	0	2	8	8	0	0	0	0	0	18
WNW	0	0	0	0	1	8	13	1	1	0	0	0	24
NW	0	0	0	0	0	1	5	5	0	0	0	0	11
NNW	0	0	0	0	3	5	19	15	2	1	0	0	45
Total	0	0	0	4	18	124	242	85	10	1	0	0	484

Number of calms for B Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2000 00:00:00 TO 12/31/2000 23:59:59
CLASS C

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	5	13	8	6	1	0	0	0	33
NNE	0	0	0	1	6	14	12	2	1	0	0	0	36
NE	0	0	0	0	2	28	65	6	1	0	0	0	102
ENE	0	0	0	1	0	2	12	3	0	0	0	0	18
E	0	0	0	0	1	3	4	0	0	0	0	0	8
ESE	0	0	0	0	1	3	6	2	0	0	0	0	12
SE	0	0	0	0	1	4	18	12	2	0	0	0	37
SSE	0	0	0	1	1	8	23	15	0	0	0	0	48
S	0	0	0	1	1	10	29	19	6	0	0	0	66
SSW	0	0	0	2	1	10	26	7	2	0	0	0	48
SW	0	0	0	0	4	20	28	5	0	0	0	0	57
WSW	0	0	0	3	3	19	12	0	0	0	0	0	37
W	0	0	0	0	8	12	14	0	0	0	0	0	34
WNW	0	0	0	0	6	16	10	0	0	0	0	0	32
NW	0	0	0	2	2	4	8	7	0	0	0	0	23
NNW	0	0	0	0	6	10	24	13	2	0	0	0	55
Total	0	0	0	11	48	176	299	97	15	0	0	0	646

Number of calms for C Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2000 00:00:00 TO 12/31/2000 23:59:59
CLASS D

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	4	21	42	98	92	7	0	0	0	264
NNE	0	0	0	10	24	35	74	32	3	0	0	0	178
NE	0	0	2	6	13	75	143	73	4	0	0	0	316
ENE	0	0	0	6	8	28	55	35	7	0	0	0	139
E	0	0	2	1	3	6	16	7	0	0	0	0	35
ESE	0	0	0	2	2	12	48	25	0	0	0	0	89
SE	0	0	0	4	4	17	83	29	1	0	0	0	138
SSE	0	1	2	3	7	31	138	32	0	0	0	0	214
S	0	0	0	3	9	36	95	42	17	0	0	0	202
SSW	0	1	3	6	12	34	42	25	12	0	0	0	135
SW	0	0	2	7	11	34	55	15	2	0	0	0	126
WSW	0	0	2	11	23	56	26	8	1	0	0	0	127
W	0	1	2	5	19	37	38	2	0	0	0	0	104
WNW	0	0	0	6	10	30	25	5	0	0	0	0	76
NW	0	0	1	4	11	22	41	9	0	0	0	0	88
NNW	0	0	0	7	8	44	112	59	8	1	0	0	239
Total	0	3	16	85	185	539	1089	490	62	1	0	0	2470

Number of calms for D Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2000 00:00:00 TO 12/31/2000 23:59:59
CLASS E

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	3	9	13	56	70	21	0	0	0	0	172
NNE	0	1	2	15	16	46	71	17	6	0	0	0	174
NE	0	0	1	12	20	80	82	7	3	0	0	0	205
ENE	0	0	1	9	11	37	56	12	0	0	0	0	126
E	0	0	2	9	4	24	31	3	0	0	0	0	73
ESE	0	2	1	7	6	38	70	5	0	0	0	0	129
SE	0	3	2	9	20	69	96	12	0	0	0	0	211
SSE	0	3	2	12	39	117	72	4	0	0	0	0	249
S	0	5	4	33	67	90	58	4	0	0	0	0	261
SSW	1	4	7	26	38	48	34	5	0	0	0	0	163
SW	1	5	8	29	56	61	21	2	0	0	0	0	183
WSW	0	3	12	68	74	47	6	0	0	0	0	0	210
W	0	4	12	38	23	10	6	2	0	0	0	0	95
WNW	1	3	10	22	17	16	6	2	0	0	0	0	77
NW	0	0	5	9	11	17	3	1	0	0	0	0	46
NNW	1	0	2	8	13	33	31	4	0	0	0	0	92
Total	4	33	74	315	428	789	713	101	9	0	0	0	2466

Number of calms for E Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2000 00:00:00 TO 12/31/2000 23:59:59
CLASS F

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	2	4	3	10	13	18	1	0	0	0	0	0	51
NNE	1	1	3	11	10	11	4	0	0	0	0	0	41
NE	0	2	6	14	6	36	2	0	0	0	0	0	66
ENE	1	1	3	8	3	10	4	0	0	0	0	0	30
E	0	2	2	7	5	1	0	0	0	0	0	0	17
ESE	0	2	4	5	3	2	1	0	0	0	0	0	17
SE	0	1	4	11	14	9	4	1	0	0	0	0	44
SSE	1	2	10	29	75	57	4	0	0	0	0	0	178
S	4	17	22	60	64	21	0	0	0	0	0	0	188
SSW	5	14	27	67	37	9	2	0	0	0	0	0	161
SW	3	12	24	69	36	11	0	0	0	0	0	0	155
WSW	1	18	23	70	20	1	0	0	0	0	0	0	133
W	0	6	18	23	5	1	1	0	0	0	0	0	54
WNW	1	3	7	17	9	0	1	0	0	0	0	0	38
NW	1	2	3	5	4	2	1	0	0	0	0	0	18
NNW	0	3	0	7	9	11	2	1	0	0	0	0	33
Total	20	90	159	413	313	200	27	2	0	0	0	0	1224

Number of calms for F Stability: 1

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2000 00:00:00 TO 12/31/2000 23:59:59
CLASS G

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	2	7	8	4	2	1	0	0	0	0	0	0	24
NNE	2	9	9	7	3	1	0	0	0	0	0	0	31
NE	3	3	9	4	5	2	1	0	0	0	0	0	27
ENE	1	2	3	3	1	0	0	0	0	0	0	0	10
E	1	0	0	0	1	0	0	0	0	0	0	0	2
ESE	0	5	1	1	0	0	0	0	0	0	0	0	7
SE	2	3	1	1	0	3	1	0	0	0	0	0	11
SSE	1	3	5	15	26	12	1	0	0	0	0	0	63
S	1	4	18	53	26	0	0	0	0	0	0	0	102
SSW	2	14	32	76	20	1	0	0	0	0	0	0	145
SW	11	28	54	49	4	1	0	0	0	0	0	0	147
WSW	15	30	27	19	1	0	0	0	0	0	0	0	92
W	14	54	21	12	2	1	0	0	0	0	0	0	104
WNW	10	22	12	7	9	2	0	0	1	0	0	0	63
NW	9	14	7	9	2	0	0	0	0	0	0	0	41
NNW	8	12	11	8	1	0	0	0	0	0	0	0	40
Total	82	210	218	268	103	24	3	0	1	0	0	0	909

Number of calms for G Stability: 10
Total valid hours for all stabilities = 8784
Total invalid hours for all stabilities = 0

Joint Frequency Distribution of Wind Speed and Wind Direction for 2001 by Pasquill Stability Class

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2001 00:00:00 TO 12/31/2001 23:59:59

CLASS A

Wind Speed (M/S) at 10-m Level

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	0	2	16	12	3	0	0	0	33
NNE	0	0	0	0	0	6	21	7	0	0	0	0	34
NE	0	0	0	0	1	24	112	39	0	0	0	0	176
ENE	0	0	0	0	0	1	10	6	2	0	0	0	19
E	0	0	0	0	0	0	2	6	0	0	0	0	8
ESE	0	0	0	0	0	0	6	8	0	0	0	0	14
SE	0	0	0	0	0	1	9	10	1	0	0	0	21
SSE	0	0	0	0	0	0	23	17	1	0	0	0	41
S	0	0	0	1	0	1	12	8	0	0	0	0	22
SSW	0	0	0	0	0	2	14	2	0	0	0	0	18
SW	0	0	0	0	2	2	17	10	0	0	0	0	31
WSW	0	0	0	1	0	2	2	2	0	0	0	0	7
W	0	0	0	0	0	1	5	2	0	0	0	0	8
WNW	0	0	0	0	0	1	12	3	0	0	0	0	16
NW	0	0	0	0	0	0	6	2	0	0	0	0	8
NNW	0	0	0	0	0	3	15	11	2	0	0	0	31
Total	0	0	0	2	3	46	282	145	9	0	0	0	487

Number of calms for A Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2001 00:00:00 TO 12/31/2001 23:59:59
CLASS B

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	0	15	8	6	0	0	0	0	29
NNE	0	0	0	0	0	6	12	3	0	0	0	0	21
NE	0	0	0	0	0	23	83	14	1	0	0	0	121
ENE	0	0	0	0	1	4	12	5	0	0	0	0	22
E	0	0	0	0	2	1	1	5	0	0	0	0	9
ESE	0	0	0	0	0	0	11	5	0	0	0	0	16
SE	0	0	0	0	0	3	10	9	0	0	0	0	22
SSE	0	0	0	1	0	3	24	11	0	0	0	0	39
S	0	0	0	0	0	2	16	12	0	0	0	0	30
SSW	0	0	0	0	1	2	6	4	0	1	0	0	14
SW	0	0	0	0	0	2	10	4	0	0	0	0	16
WSW	0	0	0	0	2	0	1	1	0	0	0	0	4
W	0	0	0	0	0	0	1	0	0	0	0	0	1
WNW	0	0	0	0	0	2	6	0	0	0	0	0	8
NW	0	0	0	0	0	1	7	1	0	0	0	0	9
NNW	0	0	0	0	2	8	8	1	1	0	0	0	20
Total	0	0	0	1	8	72	216	81	2	1	0	0	381

Number of calms for B Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2001 00:00:00 TO 12/31/2001 23:59:59
CLASS C

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	0	0	2	16	9	4	1	0	0	0	32
NNE	0	0	0	0	4	12	16	2	0	0	0	0	34
NE	0	0	0	0	0	40	66	11	1	0	0	0	118
ENE	0	0	0	0	1	9	10	4	2	0	0	0	26
E	0	0	0	0	1	1	1	2	0	0	0	0	5
ESE	0	0	0	0	0	1	5	4	0	0	0	0	10
SE	0	0	0	0	1	3	18	10	0	0	0	0	32
SSE	0	0	0	0	0	2	19	15	1	0	0	0	37
S	0	0	0	0	1	7	14	11	1	0	0	0	34
SSW	0	0	0	1	2	4	15	6	1	2	0	0	31
SW	0	0	0	1	2	7	8	1	0	0	0	0	19
WSW	0	0	0	1	1	4	2	0	0	0	0	0	8
W	0	0	0	0	1	2	3	1	0	0	0	0	7
WNW	0	0	0	0	1	7	3	1	0	0	0	0	12
NW	0	0	0	0	0	1	9	2	0	0	0	0	12
NNW	0	0	0	0	1	10	14	3	0	0	0	0	28
Total	0	0	0	3	18	126	212	77	7	2	0	0	445

Number of calms for C Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2001 00:00:00 TO 12/31/2001 23:59:59
CLASS D

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	2	4	14	58	78	56	6	0	0	0	218
NNE	0	0	2	8	24	57	101	33	1	0	0	0	226
NE	0	0	1	6	16	119	202	44	8	0	0	0	396
ENE	0	0	0	2	8	28	73	27	5	0	0	0	143
E	0	0	0	0	2	9	34	17	5	0	0	0	67
ESE	0	1	0	3	5	9	60	43	1	0	0	0	122
SE	0	0	0	0	3	22	78	60	7	1	0	0	171
SSE	0	0	0	2	10	43	152	55	7	0	0	0	269
S	0	0	2	6	13	36	82	65	14	2	0	0	220
SSW	0	1	6	5	14	29	42	21	5	1	0	0	124
SW	0	0	0	8	9	38	40	11	1	1	0	0	108
WSW	0	2	2	15	26	47	18	3	0	0	0	0	113
W	0	3	0	8	18	32	30	2	1	0	0	0	94
WNW	0	0	2	8	10	24	30	1	0	0	0	0	75
NW	0	0	1	6	3	27	26	9	0	0	0	0	72
NNW	0	1	1	1	13	42	59	30	5	2	0	0	154
Total	0	8	19	82	188	620	1105	477	66	7	0	0	2572

Number of calms for D Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2001 00:00:00 TO 12/31/2001 23:59:59
CLASS E

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	0	0	5	14	32	75	97	15	1	0	0	0	239
NNE	1	1	5	22	27	77	99	13	0	0	0	0	245
NE	0	1	2	8	24	113	118	9	1	0	0	0	276
ENE	0	1	3	5	20	78	71	12	1	0	0	0	191
E	0	1	0	2	7	38	40	6	0	0	0	0	94
ESE	0	1	2	8	13	11	82	15	0	0	0	0	132
SE	1	0	5	6	25	72	82	12	0	0	0	0	203
SSE	1	1	2	17	52	140	92	10	1	0	0	0	316
S	0	5	4	35	55	70	51	5	0	0	0	0	225
SSW	0	4	11	25	41	55	30	8	1	0	0	0	175
SW	0	3	9	30	22	35	13	5	0	0	0	0	117
WSW	0	1	14	38	43	28	6	3	0	0	0	0	133
W	0	9	9	24	20	19	3	0	0	0	0	0	84
WNW	0	1	4	27	19	13	4	0	0	0	0	0	68
NW	0	0	2	12	18	35	14	0	0	0	0	0	81
NNW	1	3	1	12	19	49	34	6	0	0	0	0	125
Total	4	32	78	285	437	908	836	119	5	0	0	0	2704

Number of calms for E Stability: 0

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2001 00:00:00 TO 12/31/2001 23:59:59
CLASS F

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	1	4	3	21	25	30	12	0	0	0	0	0	96
NNE	0	4	8	13	18	26	1	0	0	0	0	0	70
NE	1	0	6	12	24	40	5	0	0	0	0	0	88
ENE	0	1	3	9	6	19	6	0	0	0	0	0	44
E	1	1	1	6	2	5	0	0	0	0	0	0	16
ESE	0	1	8	3	1	0	0	0	0	0	0	0	13
SE	0	3	6	12	12	15	3	0	0	0	0	0	51
SSE	3	5	8	30	60	29	1	0	0	0	0	0	136
S	4	10	15	72	51	9	0	0	0	0	0	0	161
SSW	6	9	29	68	34	13	0	0	0	0	0	0	159
SW	7	12	22	48	10	5	2	0	0	0	0	0	106
WSW	1	18	18	44	11	2	0	0	0	0	0	0	94
W	0	10	16	30	4	3	0	0	0	0	0	0	63
WNW	0	9	7	19	15	7	0	0	0	0	0	0	57
NW	0	2	5	8	3	7	0	0	0	0	0	0	25
NNW	1	2	8	11	18	11	0	0	0	0	0	0	51
Total	25	91	163	406	294	221	30	0	0	0	0	0	1230

Number of calms for F Stability: 1

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION IN HOURS 01/01/2001 00:00:00 TO 12/31/2001 23:59:59
CLASS G

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0	Total
N	8	11	15	16	4	1	0	0	0	0	0	0	55
NNE	2	5	4	7	2	1	0	0	0	0	0	0	21
NE	4	4	7	8	3	5	1	0	0	0	0	0	32
ENE	1	1	3	5	0	2	1	0	0	0	0	0	13
E	1	2	2	0	1	1	0	0	0	0	0	0	7
ESE	0	2	2	1	0	0	0	0	0	0	0	0	5
SE	3	3	4	3	0	0	0	0	0	0	0	0	13
SSE	2	2	6	13	15	8	0	0	0	0	0	0	46
S	2	11	17	34	17	2	0	0	0	0	0	0	83
SSW	1	13	16	41	19	5	0	0	0	0	0	0	95
SW	7	19	35	30	5	0	0	0	0	0	0	0	96
WSW	16	34	25	22	2	1	0	0	0	0	0	0	100
W	20	46	29	23	3	0	0	0	0	0	0	0	121
WNW	15	36	22	21	1	1	0	0	0	0	0	0	96
NW	16	14	19	16	3	3	1	0	0	0	0	0	72
NNW	2	23	21	23	7	4	1	0	0	0	0	0	81
Total	100	226	227	263	82	34	4	0	0	0	0	0	936

Number of calms for G Stability: 4
Total valid hours for all stabilities = 8760
Total invalid hours for all stabilities = 0

The above joint frequency distributions were combined to produce joint frequency distributions for a representative year for use in the PAVAN computer code.

Data is measured at 10 meter (lower level instrument) and 60 meter (upper level instrument) levels.

The stability class was determined as a function of delta-temperature from the 10 meter and 60 meter instrument measurements. The delta-temperature measurements based on a 50 meter change in height were converted to units of °C/100 meter to determine the stability class. Stability classes were based on the classification system given in Regulatory Guide 1.23, "Onsite Meteorological Programs."

The units of wind speed are meters/second.

The valid wind directions ranged from 1° to 360°. The data was reviewed for wind directions greater than 360° and any data above 360° was corrected by subtracting 360°. All invalid data was identified by completely filling the field with 9's.

In general, the data used in the atmospheric dispersion calculations was provided by the primary meteorological tower. However, if the primary meteorological tower was out of service, the backup (secondary) meteorological tower was used as the data source. (Reference technical specification figure 5.1-1 for approximate locations of the primary and secondary meteorological towers.) Separate data files are generated for both the primary and backup towers with the composite data file representing the best available data set. The data source for each hourly averaged data parameter is provided in the composite yearly meteorological data file. This composite yearly meteorological data files were used to generate the ARCON96 format data files.

Question 2:

For control room X/Q calculations, please provide a figure or figures showing the assumed locations of release and control room intakes with respect to the overall plant layout. Provide a quantitative list of all inputs used in estimating the postulated transport of effluents from each of the release locations to the intakes. A copy of the ARCON96 printouts is acceptable to show inputs. Was the physical height of the release location assumed or was an effective release height used in any calculation? If flow rates were assumed when making X/Q calculations, were they based on technical specification (TS) values? If more than one release to the environment or more than one transport scenario could occur (e.g., loss-of-offsite power and non-loss of site power, single failure), were comparative XQ calculations made to ensure consideration of the limiting dose?

X/Q values have been calculated for two intakes. Were the X/Q values used in the dose assessment based upon the more limiting release and intake pair, upon a weighted average (e.g., as described in RG 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants,") or some other criteria? If weighted values were used, describe how estimates were calculated, including inflow rates of each intake and any reduction factors (e.g., due to automatic selection of the least

contaminated outside air intake). Provide justification for the use of any reduction factors. If applicable, are control room air intake inflow rates based upon measured values? Confirm that each of the control room intakes meet applicable design criteria of an engineered safeguards feature, including single-failure criterion, missile protection, seismic criteria, and operability TS to merit reduction credit as dual intakes.

Response 2:

See diagram at the end of Attachment 1 for the approximate locations of the assumed release points and approximate locations of the control room intakes. The intervening structures between the release point and the control room intakes were ignored for calculational simplicity, thereby underestimating the true distance to the control room intakes.

Note that Section 3.4 of RG 1.194 states that, "If the distance to receptor is less than about 10 meters, the ARCON96 code and the procedures in Regulatory Position 4 should not be used to assess X/Q values. These situations will need to be addressed on a case-by-case basis." RG 1.194, however, does not provide alternative method for calculation of the X/Q values for these conditions. There is one release location at Waterford 3 (East atmospheric dump valve (ADV) to East Control Room (CR) intake, distance = 6.6 meters) that does not meet this guidance. The X/Q result for this location was compared with a location in a similar direction with a distance close to 10 meters. The comparisons indicated that the X/Q values for this location are reasonable for use in the dose calculation.

The reasonableness of the X/Q values for this location is also supported by the following:

- The flow velocity out of the ADVs is ignored in the calculation of X/Qs. This is very conservative, since the flow velocity adds to the release height.
- ARCON96 allows for the calculation of the X/Q values for distances from 0 to 100 meters and does not specify any restrictions for the calculation of X/Q values for distances under 10 meters.

The following ARCON96 input data files, used to calculate various X/Qs, are provided with filenames *.RSF (Run Specification Files) on the enclosed compact disc.

File Name	Description
MSSVW1.RSF:	West side Main Steam Safety Valve (MSSV) to East Control Room (CR) Intake
MSSVE1.RSF:	East side MSSV to East CR Intake
MSSVW2.RSF:	West side MSSV to West CR Intake
MSSVE2.RSF:	East side MSSV to West CR Intake
ADVW1.RSF:	West side Atmospheric Dump Valve (ADV) to East CR Intake
ADVE1.RSF:	East side ADV to East CR Intake
ADVW2.RSF:	West side ADV to West CR Intake
ADVE2.RSF:	East side ADV to West CR Intake
MSLE1.RSF:	East side Steam Line to East CR Intake
MSLW1.RSF:	West side Steam Line to East CR Intake

File Name	Description
MSLE2.RSF:	East side Steam Line to West CR Intake
MSLW2.RSF:	West side Steam Line to West CR Intake
PS1.RSF:	Plant Stack to East CR Intake
PS2.RSF:	Plant Stack to West CR Intake
FHBPD1.RSF:	Fuel Handling Building (FHB) Personnel Door to East CR Intake
FHBPD2.RSF:	FHB Personnel Door to West CR Intake
FHBTR1.RSF:	FHB Truck Bay to East CR Intake
FHBTR2.RSF:	FHB Truck Bay to West CR Intake
HATCH1.RSF:	Containment Hatch to East CR Intake
HATCH2.RSF:	Containment Hatch to West CR Intake
PURGE1.RSF:	Containment Purge Intake to East CR Intake
PURGE2.RSF:	Containment Purge Intake to West CR Intake

The physical height of the release location was assumed for all of the control room X/Q calculations.

Flow rates were not assumed in the X/Q calculations.

The X/Qs were calculated for all possible release points (e.g., east and west side ADVs and main steam safety valves (MSSVs)) to both control room emergency air intakes.

The fuel handling accident (FHA) was previously analyzed using the current (old) X/Q values and EPU source terms. A conservative scaling approach has been applied to the previous FHA control room dose analysis to demonstrate that it remains acceptable for EPU. See PUR Section 2.13.7.3.4 for further discussion. The LOCA dose analysis used the new X/Q values, used the control room intake with the worst X/Q values (i.e., limiting release and intake pair), and did not credit any operator action to switch to the more favorable air intake. Reduction factors were not used in the FHA or LOCA dose analysis.

Waterford 3 assumes 200 cfm filtered flow into the control room in the design basis accident (DBA) dose analyses. This flow rate is confirmed per TS surveillance requirement 4.7.6.5. This surveillance requires that the control room pressurization test be performed every 18 months to demonstrate that the control room envelope can be maintained at a positive pressure of greater than or equal to 1/8 inch water gauge relative to the outside atmosphere with a make-up air flow rate less than or equal to 200 cfm. The flow is measured with safety related flow meters via control room indications.

While Waterford 3 is designed with two independent emergency air intakes, no reduction (e.g., as allowed for dual intakes) was credited in the FHA and LOCA analysis. The control room habitability systems are discussed in Waterford 3 Final Safety Analysis Report Sections 6.4, "Habitability Systems" and Section 9.4.1, "Control Room Air Conditioning System".

Question 3:

Provide a list of all inputs and assumptions used in the PAVAN calculations. A copy of the summary pages of the PAVAN outputs is acceptable to show inputs.

Response 3:

The PAVAN input and output data files are provided on the enclosed compact disc under the following file names.

File Name	Description
Att2.doc	PAVAN Input Data File
Att3.doc	PAVAN Output Data File

The Waterford 3 average joint frequency distributions (1997 – 2001) by Pasquill stability class are provided below.

Waterford 3 Average Joint Frequency Distribution Tables 1997 - 2001

Class A

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0
N	0	0	0	0	1	2	20	8	2	0	0	0
NNE	0	0	0	0	0	3	13	3	0	0	0	0
NE	0	0	0	0	0	14	86	15	0	0	0	0
ENE	0	0	0	0	0	4	13	5	0	0	0	0
E	0	0	0	0	0	2	1	2	0	0	0	0
ESE	0	0	0	0	0	1	4	3	0	0	0	0
SE	0	0	0	0	0	1	8	8	0	0	0	0
SSE	0	0	0	0	0	2	14	13	2	0	0	0
S	0	0	0	0	0	2	14	21	3	0	0	0
SSW	0	0	0	0	0	1	9	4	0	0	0	0
SW	0	0	0	0	1	4	19	9	1	0	0	0
WSW	0	0	0	0	0	2	4	2	0	0	0	0
W	0	0	0	0	0	1	6	1	0	0	0	0
WNW	0	0	0	0	0	2	10	3	0	0	0	0
NW	0	0	0	0	0	0	7	3	0	0	0	0
NNW	0	0	0	0	0	2	15	10	2	0	0	0

Calms 0

Waterford 3 Average Joint Frequency Distribution Tables 1997 - 2001

Class B

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0
N	0	0	0	0	1	10	12	7	1	0	0	0
NNE	0	0	0	0	1	6	8	2	0	0	0	0
NE	0	0	0	0	0	21	61	10	1	0	0	0
ENE	0	0	0	0	1	9	17	4	0	0	0	0
E	0	0	0	0	0	1	2	2	0	0	0	0
ESE	0	0	0	0	0	0	6	3	0	0	0	0
SE	0	0	0	0	0	2	12	10	1	0	0	0
SSE	0	0	0	0	0	3	18	10	2	0	0	0
S	0	0	0	0	1	5	18	10	2	0	0	0
SSW	0	0	0	0	1	5	9	5	0	0	0	0
SW	0	0	0	0	0	8	18	5	0	0	0	0
WSW	0	0	0	0	2	8	7	2	0	0	0	0
W	0	0	0	0	1	4	5	1	0	0	0	0
WNW	0	0	0	0	1	5	9	1	0	0	0	0
NW	0	0	0	0	0	1	6	2	0	0	0	0
NNW	0	0	0	0	1	5	12	6	1	0	0	0

Calms 0

Waterford 3 Average Joint Frequency Distribution Tables 1997 - 2001

Class C

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0
N	0	0	0	0	4	16	12	6	1	0	0	0
NNE	0	0	0	0	4	11	9	2	1	0	0	0
NE	0	0	0	1	4	27	56	8	1	0	0	0
ENE	0	0	0	0	2	10	19	4	0	0	0	0
E	0	0	0	0	1	3	3	1	0	0	0	0
ESE	0	0	0	0	1	2	5	3	0	0	0	0
SE	0	0	0	0	1	3	14	11	1	0	0	0
SSE	0	0	0	0	1	4	21	13	1	0	0	0
S	0	0	0	0	1	7	21	12	4	0	0	0
SSW	0	0	0	1	2	7	18	6	2	0	0	0
SW	0	0	0	0	3	14	25	5	0	0	0	0
WSW	0	0	0	2	3	13	11	4	0	0	0	0
W	0	0	0	0	3	8	9	1	0	0	0	0
WNW	0	0	0	0	2	11	7	1	0	0	0	0
NW	0	0	0	0	1	4	10	2	0	0	0	0
NNW	0	0	0	0	3	10	16	8	1	0	0	0

Calms 0

Waterford 3 Average Joint Frequency Distribution Tables 1997 - 2001

Class D

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0
N	0	0	1	8	21	55	99	69	11	1	0	0
NNE	0	0	1	11	23	44	76	47	7	0	0	0
NE	0	0	2	8	22	94	149	60	5	0	0	0
ENE	0	0	1	5	12	45	90	44	8	1	0	0
E	0	0	1	2	5	11	40	20	4	0	0	0
ESE	0	0	0	2	4	12	59	44	2	0	0	0
SE	0	0	0	2	4	19	83	49	5	0	0	0
SSE	0	0	1	3	9	40	127	48	9	0	0	0
S	0	0	1	5	11	42	89	49	14	3	0	0
SSW	0	0	3	6	12	38	52	24	9	0	0	0
SW	0	0	1	8	13	38	58	16	2	0	0	0
WSW	0	0	2	12	23	51	44	10	1	0	0	0
W	0	1	1	11	20	39	30	2	0	0	0	0
WNW	0	0	1	9	15	30	31	5	0	0	0	0
NW	0	0	1	5	8	26	33	11	2	1	0	0
NNW	0	0	1	5	11	46	93	43	8	1	0	0

Calms 0

Waterford 3 Average Joint Frequency Distribution Tables 1997 - 2001

Class E

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0
N	0	1	4	12	18	60	77	13	1	0	0	0
NNE	0	2	3	17	19	53	70	13	2	0	0	0
NE	0	1	2	12	30	84	84	10	2	0	0	0
ENE	0	1	2	7	17	64	74	11	1	0	0	0
E	0	1	1	5	6	42	61	8	0	0	0	0
ESE	0	1	2	6	10	36	82	10	0	0	0	0
SE	0	1	2	7	20	67	89	14	1	0	0	0
SSE	1	3	3	14	43	123	76	6	0	0	0	0
S	0	4	5	27	50	87	59	5	1	0	0	0
SSW	1	3	7	27	35	56	37	7	1	0	0	0
SW	1	5	9	30	40	58	25	2	0	0	0	0
WSW	0	3	11	50	50	37	14	1	0	0	0	0
W	0	5	12	41	28	17	8	1	0	0	0	0
WNW	0	2	7	22	20	16	8	1	0	0	0	0
NW	0	1	4	13	17	30	10	1	0	0	0	0
NNW	0	2	3	12	15	37	33	5	2	0	0	0

Calms 0

Waterford 3 Average Joint Frequency Distribution Tables 1997 - 2001

Class F

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0
N	1	3	5	13	12	15	5	0	0	0	0	0
NNE	1	2	6	12	12	15	1	0	0	0	0	0
NE	0	2	6	12	14	31	5	0	0	0	0	0
ENE	0	2	3	8	6	19	5	0	0	0	0	0
E	0	1	1	6	4	4	1	0	0	0	0	0
ESE	0	2	4	4	2	1	0	0	0	0	0	0
SE	0	2	4	8	10	13	3	0	0	0	0	0
SSE	1	3	7	25	45	36	2	0	0	0	0	0
S	2	10	17	60	57	18	0	0	0	0	0	0
SSW	3	12	24	73	32	12	1	0	0	0	0	0
SW	2	13	22	53	23	6	1	0	0	0	0	0
WSW	1	15	28	49	19	3	0	0	0	0	0	0
W	0	9	19	39	8	1	0	0	0	0	0	0
WNW	0	6	12	21	12	5	0	0	0	0	0	0
NW	0	4	5	11	7	4	1	0	0	0	0	0
NNW	1	3	6	11	11	10	1	0	0	0	0	0

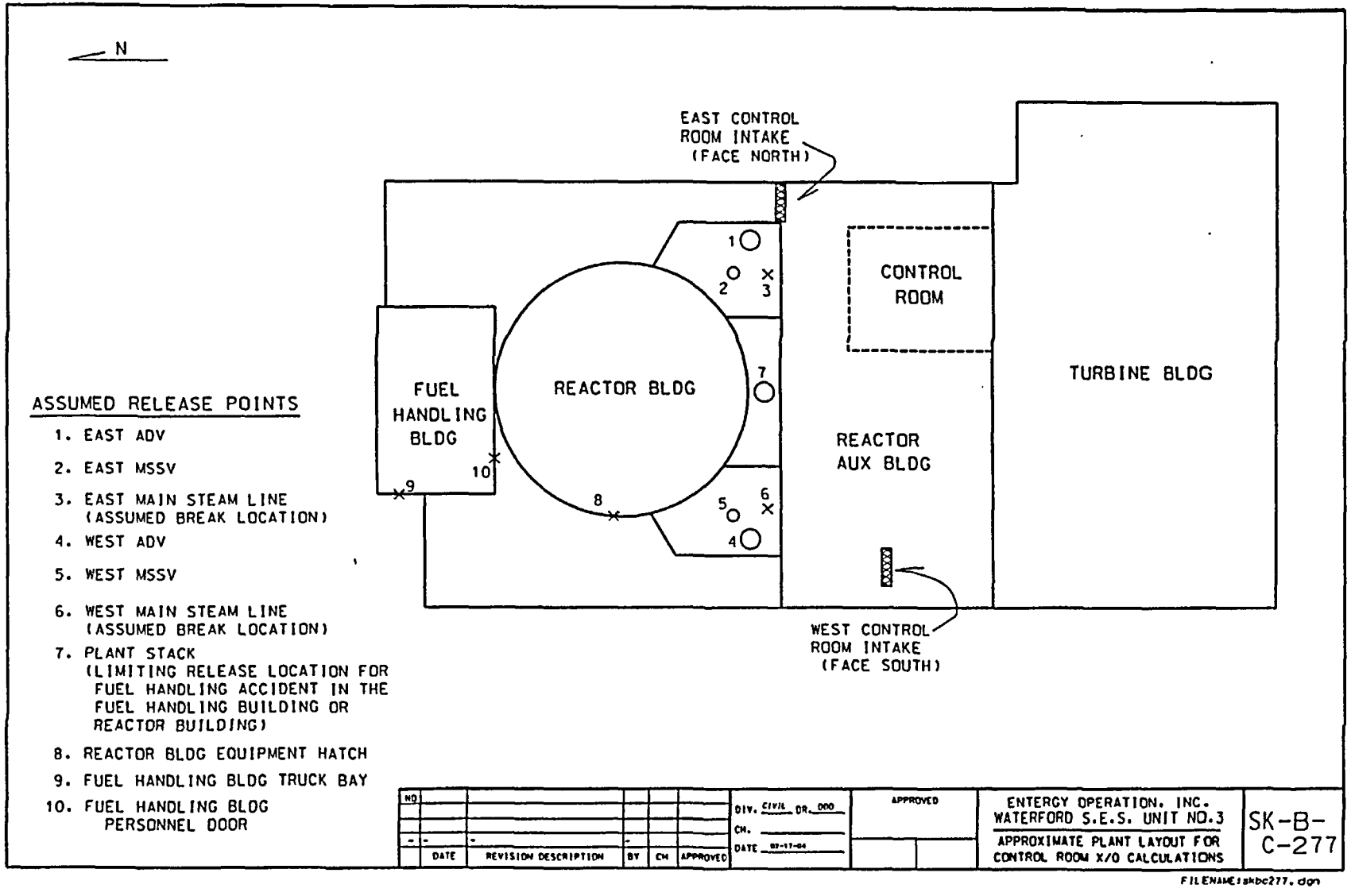
Calms 0

Waterford 3 Average Joint Frequency Distribution Tables 1997 - 2001

Class G

Direction	.22-.50	.51-.75	.76-1.0	1.1-1.5	1.6-2.0	2.1-3.0	3.1-5.0	5.1-7.0	7.1-10.	10.1-13	13.1-18.0	>18.0
N	3	7	8	9	2	1	0	0	0	0	0	0
NNE	1	4	6	7	2	0	0	0	0	0	0	0
NE	2	2	5	5	4	2	0	0	0	0	0	0
ENE	1	2	2	3	1	1	0	0	0	0	0	0
E	1	2	1	1	1	0	0	0	0	0	0	0
ESE	0	3	2	1	0	0	0	0	0	0	0	0
SE	1	2	2	1	1	2	0	0	0	0	0	0
SSE	2	3	4	12	13	7	0	0	0	0	0	0
S	1	7	14	36	17	2	0	0	0	0	0	0
SSW	2	11	25	55	17	2	0	0	0	0	0	0
SW	6	20	36	40	5	1	0	0	0	0	0	0
WSW	10	33	34	24	2	0	0	0	0	0	0	0
W	12	45	32	23	3	0	0	0	0	0	0	0
WNW	9	25	20	16	4	1	0	0	0	0	0	0
NW	8	14	11	11	2	1	0	0	0	0	0	0
NNW	4	12	15	11	3	1	0	0	0	0	0	0

Calms 3


N
EAST CONTROL ROOM INTAKE (FACE NORTH)
CONTROL ROOM
TURBINE BLDG
FUEL HANDLING BLDG
REACTOR BLDG
REACTOR AUX BLDG
WEST CONTROL ROOM INTAKE (FACE SOUTH)
1
2
3
4
5
6
7
8
9
10
ASSUMED RELEASE POINTS
1. EAST ADV
2. EAST MSSV
3. EAST MAIN STEAM LINE (ASSUMED BREAK LOCATION)
4. WEST ADV
5. WEST MSSV
6. WEST MAIN STEAM LINE (ASSUMED BREAK LOCATION)
7. PLANT STACK (LIMITING RELEASE LOCATION FOR FUEL HANDLING ACCIDENT IN THE FUEL HANDLING BUILDING OR REACTOR BUILDING)
8. REACTOR BLDG EQUIPMENT HATCH
9. FUEL HANDLING BLDG TRUCK BAY
10. FUEL HANDLING BLDG PERSONNEL DOOR
NO
DATE
REVISION DESCRIPTION
BY
CH
APPROVED
DIV. CIVIL DR. DDD
CH.
DATE 02-17-04
APPROVED
ENTERGY OPERATION, INC.
WATERFORD S.E.S. UNIT NO.3
APPROXIMATE PLANT LAYOUT FOR CONTROL ROOM X/O CALCULATIONS
SK-B-C-277
FILENAME: skbc277.dgn

Attachment 2

To

W3F1-2004-0017

Response to Request for Additional Information
Steam Generator Integrity and Chemical Engineering

Response to Request for Additional Information
Steam Generator Integrity and Chemical Engineering

Question 1:

In order for the staff to evaluate the acceptability of the flow-accelerated corrosion (FAC) program, please provide a list of the components in the program most susceptible to FAC. The list should include initial wall thickness (nominal), current wall thicknesses and future predicted wall thickness. Table 2.1-3 of the application shows the most significant increases in wear rate. Please clarify whether the piping listed in Table 2.1-3 are the most susceptible piping to FAC. If they are, provide initial and current wall thickness of these piping and predicted wall thickness of these piping in the current operating conditions and post-uprated conditions. If they are not, please provide the aforementioned wall thickness data of a sample of the most susceptible piping systems.

Response 1:

The Waterford 3 FAC Program Pre / Post Power Uprate Wear Rate Summary (see below) was populated using CHECWORKS (CW) model data and provides a list of those components with the highest wear rates (i.e., most susceptible to FAC.) The summary provides the nominal, current and future wall thickness for these components. These components are modeled in the CW program as run definition ES03 which encompasses lines ES-18, 19, 20, 21, and 22. These lines provide extraction steam (heating steam) from the high pressure turbine exhaust (crossunder (CU) piping) to the #2 intermediate pressure (IP) feedwater heaters. Lines ES-18, 19 and 20 make up the 34" header which has three - 20" lines feeding each of the three IP heaters. The header upstream of ES 18 was replaced with FAC resistant material in refueling (RF)-06. Crossunder and small bore piping cannot be modeled in CW. Inspection of CU and small bore piping are based on the following: Results from previous refueling outage exams, Industry events, Operating Experience (OE), engineering judgment, requests by plant personnel to examine specific components or systems, results from non-typical operation, and EPRI Plant Events database. The W3 FAC Program Pre / Post Power Uprate Wear Rate Summary was populated using CW model data.

PUR Table 2.1-3 does not list the most susceptible components in the program, it represents the lines with the most significant change in wear rates.

Question 2:

The pipe wall thinning caused by FAC is predicted by the Electric Power Research Institute's CHECWORKS computer code. In order to allow the staff to evaluate the accuracy of these predictions, please provide examples of the piping components for which wall thinning is predicted by the code based on the current operating conditions and at the same time measured by ultrasonic testing or any other method employed in Waterford 3. This procedure (predicted wall thickness vs. measured wall thickness comparison) will show the effectiveness of CHECWORKS in predicting the as-found condition.

Response 2:

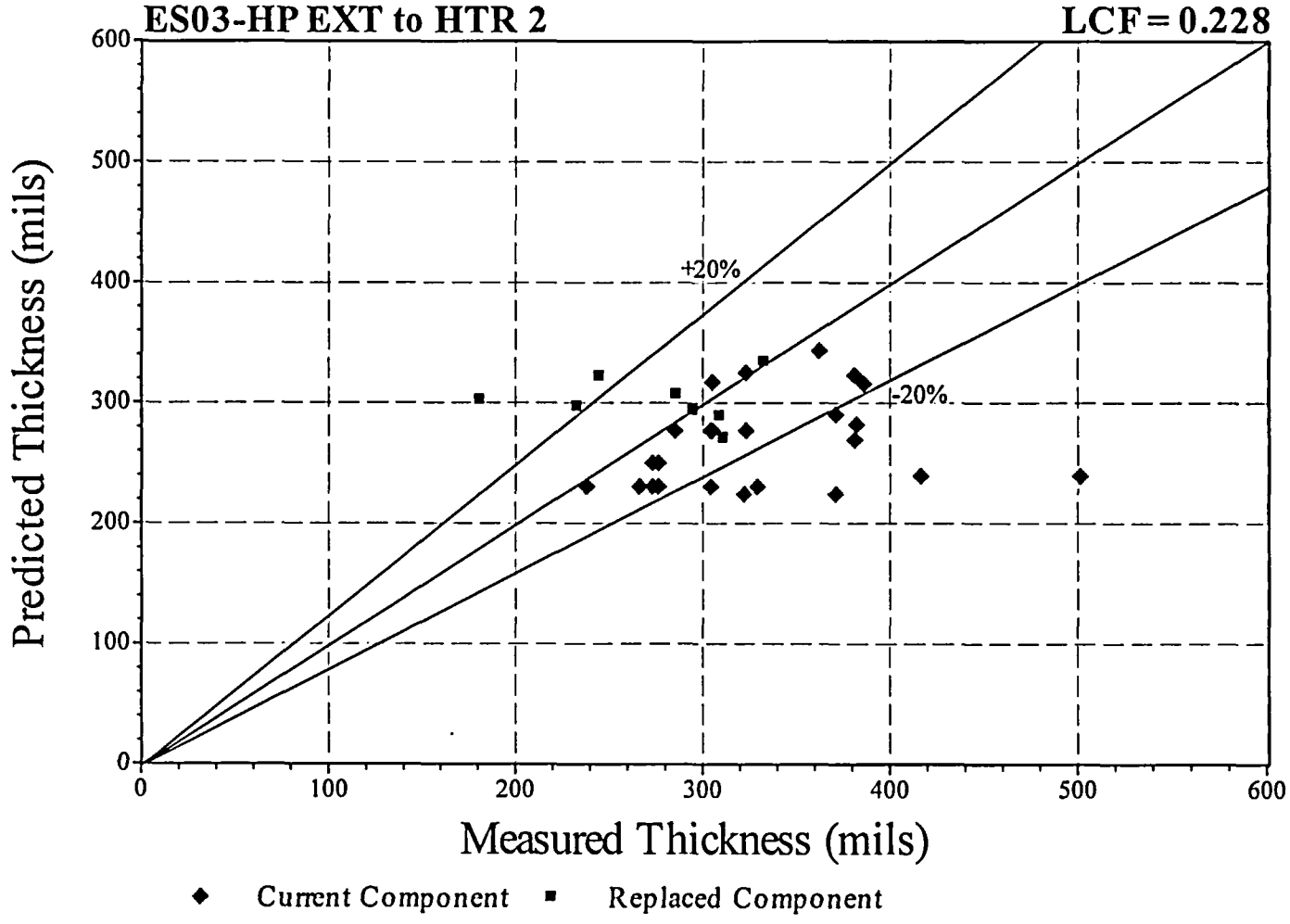
The data in the Waterford 3 FAC Program Pre / Post Power Uprate Wear Rate Summary (see below) shows the predicted vs. measured data on the piping. Additionally, the CHECWORKS "Comparison of Thickness Predictions" scatter plot (see below) gives a visual representation of the measured vs. predicted thickness for the CHECWORKS run ES03. The plot compares the predicted thickness (as adjusted by the line correction factor) with the measured thickness along the +/- 20% boundary lines and shows that CHECWORKS conservatively predicts the wear.

Waterford 3 FAC Program Pre / Post Power Uprate Wear Rate Summary												
Comp Name	12 Pre-Uprate WR(MPY)	12 Pre-Uprate WR(IPY)	14 Post-Uprate WR(MPY)	14 Pre-Uprate WR(IPY)	Tnom	Tmin measured	RFO	CW T pred @ RF-12	Calc. T@ RF-13 using CW wear rate	Calc. T@ RF-14 using CW wear rate	CW T pred. @ RF14	Tcrit
105-201	15.015	0.015	12.607	0.013	0.922	No Data		0.593	0.922	0.922	0.550	0.331
105-203	11.565	0.012	9.851	0.010	0.922	0.922	12	0.815	0.922	0.922	0.782	0.372
105-196	9.465	0.009	7.946	0.008	0.375	No Data		0.168	0.375	0.375	0.141	0.263
105-198	9.060	0.009	7.474	0.007	0.375	No Data		0.176	0.375	0.375	0.151	0.298
105-217	7.861	0.008	6.612	0.007	0.375	0.416	9	0.382	0.416	0.416	0.360	0.263
105-229	7.861	0.008	6.612	0.007	0.375	No Data		0.203	0.375	0.375	0.180	0.263
105-243	7.861	0.008	6.612	0.007	0.375	0.494	9	0.467	0.494	0.494	0.445	0.263
105-207	7.545	0.008	6.346	0.006	0.375	No Data		0.213	0.375	0.375	0.188	0.263
105-219	7.545	0.008	6.346	0.006	0.375	No Data		0.310	0.375	0.375	0.289	0.263
105-231	7.545	0.008	6.346	0.006	0.375	0.366	11	0.359	0.366	0.366	0.338	0.263
105-206	7.237	0.007	6.087	0.006	0.375	No Data		0.216	0.375	0.375	0.196	0.263
105-208	7.237	0.007	6.087	0.006	0.375	0.304	11	0.318	0.304	0.304	0.297	0.263
105-210	7.237	0.007	6.087	0.006	0.375	No Data		0.216	0.375	0.375	0.196	0.263
105-212	7.237	0.007	6.087	0.006	0.375	0.299	11	0.293	0.299	0.299	0.272	0.263
105-214	7.237	0.007	6.087	0.006	0.375	0.276	9	0.245	0.276	0.276	0.224	0.225

Spreadsheet Column Descriptions

COLUMN	DESCRIPTION
Comp Name	CHECWORKS FAC component name
Pre Uprate WR (MPY)	Pre-Uprate Wear Rate (Mils Per Year)
Pre Uprate WR (IPY)	Pre Uprate Wear Rate (Inches Per Year)
Post Uprate WR (MPY)	Post Uprate Wear Rate (Mils Per Year)
Post Uprate WR (IPY)	Post Uprate Wear Rate (Inches Per Year)
Tnom	Thickness – nominal
Tmin. meas.	Thickness – Minimum Measured
RFO	Refueling Outage Tmin. measured was taken
CW Tpred @ RF12	CHECWORKS Predicted Thickness @ RF12
Calc.T@ RF-13 using CW wear rate	Calculated Thickness using the CW Wear Rate X time
Calc.T@ RF-14 using CW wear rate	Calculated Thickness using the CW Wear Rate X time
CW Tpred @ RF14	CHECWORKS Predicted Thickness @ RF14
Tcrit	Critical Thickness as determined by Design Engineering

Comparison of Thickness Predictions



Question 3:

The last paragraph on page 2.1-11 states that during each outage, inspections are performed based on an aggressive program to identify piping in need of replacement.

(a) Please discuss the inspection technique and inspection scope (e.g., how many piping systems are inspected) in the Waterford 3 FAC program.

(b) As for the statement "...Repairs are performed to preclude falling below minimum wall thickness ...," please discuss the specific subsection in the American Society of Mechanical Engineers (ASME) Code from which the minimum wall thickness is calculated.

Response 3:

Response (3a):

Inspection Technique Summary

Ultrasonic testing (UT) is the primary means of gathering examination data. Waterford 3 uses the Panametrics 36DL – Plus digital thickness meter to gather and store UT readings. All examinations are performed by non-destructive examination (NDE) technicians certified in accordance with the applicable Entergy Quality Assurance procedures. CHECWORKS modeled components are gridded to assure examination repeatability.

Small bore piping is scanned 100% to determine acceptability. Design engineering provides the minimum acceptable thickness required for all piping examined in the FAC program.

Crossunder (CU) piping and piping 2" and below are not gridded. Sections of CU piping are visually inspected, evaluated and repaired as required at every refueling outage.

The FAC program inspections are performed in accordance with the corporate and site procedures consistent with the recommendations found in the industry standard EPRI NSAC 202-L "Recommendations for an Effective Flow Accelerated Corrosion Program". Outage inspection scope is developed using the following information:

Inspection Scope Summary

The following are monitored in the Waterford 3 FAC program:

1. feedwater,
2. blowdown,
3. feedwater heater drains,
4. extraction steam,
5. main steam drain headers,
6. condensate,
7. steam bypass,

8. crossunder pipe, and
9. main steam.

The Waterford 3 FAC program scope is based on the "Waterford 3 System Susceptibility Evaluation" (SSE). The SSE was performed to determine the piping susceptible to the FAC mechanism under both pre- and post-power uprate conditions. The SSE was developed by reviewing the system descriptions, flow diagrams, and other plant documents to determine plant configuration and operation to determine the susceptibility category.

The SSE divides the piping into three groups:

- Lines to be modeled using EPRI's computer code CHECWORKS FAC
- Lines that are susceptible, but not modeled (SNM) in CHECWORKS – small bore piping 2" and under usually socket welded.
- Lines not sufficiently susceptible to require further analysis.

The following are also considered in determining the scope and priority of inspections.

- Priority ranking based on CHECWORKS predictive analysis.
- Results from previous refueling outage exams.
- Industry events
- Operating Experience (OE)
- Engineering judgment
- Requests by plant personnel to examine specific components or systems.
- Results from Non-Typical Operation
- EPRI Plant Events database

Response (3b):

The minimum wall thickness (t_{min}) of a component as defined in the ASME Code (NB/NC-3600) is based on hoop pressure stress only, since bending moments and other loads are assumed not to produce a stress component in the hoop direction. The ASME Code puts additional restrictions on combined axial stress due to primary and secondary membrane and bending loads, and these restrictions may affect $t_{min.}$. That is, t_{min} may be required to be increased until these equations are satisfied.

The t_{min} equations refer to a global minimum thickness throughout the entire cross section of the pipe or component. For wall thinning in piping due to FAC that occurs in a localized region, the decision to replace the piping is based on comparing measured or projected wall thickness at the localized region with the allowable localized wall thickness (t_{aloc}). t_{aloc} is the minimum thickness, based on the geometry of the thinned location, calculated from ASME Code proximity criteria, equations and allowables for Class 1 piping (NB-3200, Alternate Design Rule by analysis). Although the rules of NB-3200 are only strictly applicable to ASME Section III, Class 1 piping, it is felt that application of the rule to piping systems designed to other Code is technically justified, as long as the component stresses and constituent equations and the allowable stress values are used appropriately and equal to those contained in the original code of construction.

Since ASME Code does not address degraded piping, EPRI developed acceptance criteria using Class1 Code design rules that dictate screening criteria for identifying wall thinning which is acceptable without further evaluation and thinning for which immediate repair or replacement is required.

Based on the above guidance, Entergy has developed acceptance criteria for degraded piping to evaluate when repair or replacement is required.

Question 4:

The first paragraph on page 2.1-12 states that "...if the measured wall thickness at the current refueling outage, and/or, the projected wall thickness at the next refueling outage falls below the code allowable wall thickness, the piping should be replaced..."

(a) Since the ASME code does allow pipe wall thickness to fall below the nominal wall thickness but not the minimum wall thickness, please clarify the terminology "code allowable wall thickness" on page 2.1-12.

(b) Discuss the limit on the percentage of wall thickness below which the pipe is replaced.

(c) Discuss whether the pipe replacement due to FAC is consistent with (1) ASME Code, Section XI, Case N-597-1, which is referenced in RG 1.147. Revision 13, "Inservice Inspection Code Case Acceptability-ASME Section XI, Division 1," June 2003; and (2) EPRI Report, "Recommendations for an Effective Flow-Accelerated Corrosion Program," NSAC-202L-R2, April 1999.

Response 4:

Response (4a)

See response to 3b above.

Response (4b)

Decision of piping replacement is based on comparing the calculated projected wall thickness with the acceptable minimum wall thickness of the pipe.

The calculation of projected wall thickness (t_p) is based upon an established rate of wear to some point in time (e.g. next refueling, next scheduled examination). The calculation of projected wall thickness use a safety factor as recommended in EPRI NSAC-202L. Waterford 3 has used a safety factor of 1.1 (additional 10% over calculated projected wall thickness).

Entergy replacement criteria meets the intent of the EPRI Guideline Document (NP-5911SP) that recommends to replace the piping component when measured or projected wall thickness falls below 20% of nominal wall thickness. At Waterford 3 the replacement or repair of piping components is performed when:

- The projected wall thickness is below 30% of nominal wall thickness (ASME Class 1 and 2 Piping).

- The projected wall thickness is below 20% of nominal wall thickness (ASME Class 3 Piping).
- The projected wall thickness is lesser of $0.3t_{nominal}$ and $0.5t_{minimum}$ for Class 3 Low Energy and B31.1 Piping (Non-safety).

Response (4c):

The existing piping replacement criteria at Waterford 3 are consistent with the EPRI Guideline and/or NRC requirements as specified in EPRI-NSAC-202L, Revision 2 document.

ASME Section XI (Division 1), Code Case N-597-1, provides the requirements for analytical evaluation of pipe wall thinning. This code case must be supplemented by the provisions of EPRI nuclear safety analysis center report 202L-R2, April 1999 for developing the inspection requirements, the method of predicting the rate of wall thickness loss, and the value of predicted remaining wall thickness. Further, components affected by flow-accelerated corrosion to which this code case is applied must be repaired or replaced in accordance with the construction code of record and owner's requirements or a later NRC approved edition of Section III of the ASME Code prior to the value of t_p (projected wall thickness) reaching the allowable minimum wall thickness, t_{min}, as specified in the above code case ((3622.1(a) (1)).

At Waterford 3, for the flow-accelerated corrosion program, the inspection requirements, and the method of predicting the rate of wall thickness loss (wear rate), and the value of predicted remaining wall thickness meet the intent of NSAC-202L, Revision 2.

The measured/projected wall thickness as obtained during the outage is evaluated and compared to the calculated acceptable minimum wall thickness as discussed previously. If the projected wall thickness is below the acceptable minimum wall thickness, then a detailed engineering evaluation is performed following the Entergy standard. This standard provides a unified methodology for evaluating localized thinning in piping for ASME Section III, ANSI B31.7, and ANSI B31.1 carbon steel piping.

The decision to repairing or replacing a component is based on detailed evaluation results:

- Replacement of the pipe in the area of local thinning.
- Local repair of pipe wall.
- Use of load bearing overlays.
- Use of non-Code but qualified repair technique based on ASME Relief Request.
- Increased re-inspections of local pipe wall area.
- Inspection of other susceptible locations.

Per review of the ASME Code Case N-597-1 and NRC requirement document NSAC-202L, Rev 2, the acceptance criteria and replacement/repair criteria used at Waterford 3 meet the intent of the above code case and NRC criteria document.

Question 5:

Section 2.1.9 states that Waterford 3 has implemented the requirement of Nuclear Energy Institute (NEI) 97-06 SG Program Guidelines. It is recommended in NEI 97-06, Revision 1, January 2001, that primary-to-secondary operational leakage be limited to 150 gallons per day per SG. However, in the proposed changes to TS 3/4.5.2c it is proposed to change the primary-to-secondary operational leakage from 720 gallons per day per SG to 540 gallons per day per SG. Discuss why NEI 97-06 recommended operational leakage limit of 150 gallons per day per SG is not being adopted even though NEI 97-06 is implemented at Waterford 3.

Response 5:

The TS change provided to reduce the primary-to-secondary operational leakage limit in TS 3/4.5.2c from 720 gallons per day to 540 gallons per day will be revised to reduce the primary-to-secondary operational leakage to 150 gallons per day in agreement with NEI 97-06. The 1 gpm total primary-to-secondary operational leakage limit will also be revised accordingly. Due to the required administrative reviews for a TS change, this change will be provided in a future supplement to the EPU submittal to be submitted by the middle of July 2004.

Question 6:

The licensee states that feedwater flow will be increased as a result of extended power uprate, and the capacity of the SG blowdown system under power uprated conditions will still be adequate to maintain chemistry in the secondary systems.

(a) Please discuss the feedwater flow increase in the power uprated conditions as a percentage of the original rated flow.

(b) If the blowdown flow is increased as a result of increased feedwater flow rate, provide a percentage of the increase in terms of original rated flow.

(c) Discuss whether the blowdown demineralizers are adequate to treat the increased blowdown flow rate under the power uprated conditions.

Response 6:

Response (6a):

The original rated feedwater flow is 15855370 lbm/hour at maximum "not guaranteed" conditions. The calculated EPU feedwater flowrate at the same conditions is 17030736 lbm/hour. The power uprate calculated flow rate results in a 7.4% increase from the original rated flow. However, with respect to the blowdown flow, the increase in feedwater flow is independent from the blowdown flow.

Response (6b):

The steam generator blowdown system is designed to provide a flow to each blowdown demineralizer bed between 60 to 425 gpm. This design flow range is not changing as a result of the increased feedwater flow. Chemistry personnel will continue to operate the steam generator blowdown system within this flow range which has been determined to be an acceptable flow range to maintain water chemistry parameters for the power uprate. Blowdown flow rate is regulated in accordance with Chemistry Department instructions.

Response (6c):

As discussed previously, rated blowdown flowrates are not increased for power uprate conditions. The blowdown demineralizers beds are designed to accept a maximum flow rate of 700 gpm each which is greater than the maximum normal design flow of 425 gpm. Therefore the maximum demineralizer bed capacity exceeds the normal blowdown flowrates necessary to maintain proper secondary water chemistry.

Question 7:

Please clarify whether the primary and secondary water chemistry programs follow the primary and secondary water chemistry guidelines in EPRI reports TR.105714 and TR-102134, respectively.

(a) Clarify which revision of the EPRI reports are currently being used at Waterford 3.

(b) Clarify whether procedures are implemented at Waterford 3 to adopt the latest version of the EPRI water chemistry reports, if they are revised in the future.

Response 7:

Response (7a):

1. Primary Chemistry program is currently based on, EPRI PWR Primary Water Chemistry Guidelines, Revision 4, EPRI TR-105714-V1R4 and EPRI TR-105714-V2R4, March 1999. (Note: EPRI issued Revision 5 to the PWR Primary Water Chemistry Guidelines in September 2003, EPRI 1002884 Volumes 1 and 2, which is currently scheduled for implementation at Waterford 3 by June 2004.)

2. Secondary Chemistry program is currently based on, EPRI PWR Secondary Water Chemistry Guidelines, Revision 5, EPRI TR-102134, May 2000 and EPRI Interim PWR Secondary Water Chemistry Recommendations for IGA/SCC Control, EPRI TR-101230, September 1992.

3. Primary to Secondary Leakage program is currently based on EPRI PWR, Primary-to-Secondary Leak Guidelines, Revision 2, EPRI TR-104788, April 2000.

Response (7b):

There is currently no specific procedure which directs the implementation of revisions to these guidelines. The current process is to use the paperless condition report system (PCRS) to generate a Waterford learning organization (WLO) Condition Report documenting the revised guideline with corrective actions generated to the specific site departments (e.g., Operations, Radiation Protection, Design Engineering, System Engineering, and Chemistry) to review the revised guideline for impact to their respective programs. The review is currently documented as a Snapshot Assessment and any programmatic changes necessary will be identified as an Area for Improvement (AFI), with specific scheduled implementation dates.

Attachment 3

To

W3F1-2004-0017

Reactor Vessel Material Surveillance Program -
Surveillance Capsule Removal Schedule

**Reactor Vessel Material Surveillance Program -
Surveillance Capsule Removal Schedule**

By letter dated March 28, 2003, Entergy Operations, Inc. (Entergy) submitted the "Second Reactor Vessel Surveillance Capsule Report" for Waterford Steam Electric Station, Unit 3 (Waterford 3) in accordance with 10CFR50, Appendix H, Section IV. A revision to the current surveillance capsule withdrawal schedule was recommended in Section 7, "Surveillance Capsule Removal Schedule" of the report. Entergy requests NRC approval, as required by 10CFR50, Appendix H, Section III.B.3, to implement the capsule withdrawal schedule as recommended in Table 7-1 of the March 28, 2003 letter.

Attachment 4

To

W3F1-2004-0017

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
The TS change provided to reduce the primary-to-secondary operational leakage limit in TS 3/4.5.2c from 720 gallons per day to 540 gallons per day will be revised to reduce the primary-to-secondary operational leakage to 150 gallons per day in agreement with NEI 97-06. The 1 gpm total primary-to-secondary operational leakage limit will also be changed accordingly. Due to the required administrative reviews for a TS change, this change will be provided in a future supplement to the EPU submittal to be submitted by the middle of July 2004.	X		July 15, 2004