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October 1976

MONTICELLO NUCLEAR GENERATING PLANT

SUPPLEMENT TO SHORT TERM PROGRAM PLANT UNIQUE TORUS SUPPORT AND ATTACHED PIPING ANALYSIS

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Revision Control Sheet

SUBJECT: Monticello Nuclear Generating Plant Supplement to Short Term Program Plant Unique Torus Support and Attached Piping Analysis

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SUPPLEMENT TO SHORT TERM PROGRAM
PLANT UNIQUE TORUS SUPPORT AND ATTACHED PIPING ANALYSIS

I. INTRODUCTION

The purpose of this supplement is to respond to two questions raised by the U.S. Nuclear Regulatory Commission (NRC) concerning the effects of maximum downcomer submergence and revised plant unique parameters on the results of the plant unique analysis reported in NUTECH Report NSP-01-140 (Reference 1).

The NRC questions are documented in General Electric Company (GE) letter MI-G-108 dated September 9, 1976, (Reference 2). The questions are summarized as follows:

1. Confirm that the plant unique parameters presented in Table 2-1a of Addendum 2 to the Short Term Program Report (Reference 3) are accurate. If these parameters are inaccurate, how are the results presented in the plant unique analysis report affected by the new parameters?

2. The plant unique analysis report is based on plant operation at minimum downcomer submergence. How are the results presented in the report affected by operation at maximum submergence?

II. REVISED LOADING PARAMETERS

Two of the plant unique geometry parameters presented in Table 2-1a of Addendum 2 to the Short Term Program (STP) Report were found to be inaccurate. The pool area is revised from 8620 sq. ft. to 8432 sq. ft. and the wetwell air volume per torus segment is revised from 7140 cu. ft. to 6688 cu. ft.

For the revised plant unique parameters, GE has provided new load factors M_{up} and M_{down} and new vent system pressures. These were provided to Northern States Power Company (NSP) in GE letter, MI-NSP-22 dated September 20, 1976, (Reference 4). Revised tables for the STP Report Addendum 2 and 3 were provided to NSP with GE letter, MI-G-122, dated September 27, 1976, (Reference 6).

To determine the effects of increased submergence, new load factors M_{up} and M_{down} are computed using the sensitivity curves of Addendum 2 to the STP Report. New vent system pressures and a new vent header impact arrival time are computed using the sensitivity curves of Addendum 3 to the STP Report, (Reference 5).

Given in Table 1 of this supplement is a summary of the revised load factors, vent system pressures and arrival times for the cases of minimum submergence and minimum submergence plus 13 inches (tech. spec. limit). Also given in Table 1 are the load factors, vent system pressures and arrival time used in the plant unique analysis. Table 1 serves as an analysis matrix to define the number of conditions that were investigated to determine the effects of revised plant unique parameters and increase submergence.

III. METHOD OF ANALYSIS

Once the revised loading factors are determined, their effect on the results reported in the plant unique analysis report can be determined. The methods of analysis presented below were used to determine the appropriate modification to the results.

1. Downward Loads, Base Case Analysis:

   New values for the torus support column downward loads are computed as follows:

$$P' = \frac{M'_{down}}{M'_{down}} \left(P_{DYN.}\right) + \left(P_{D.L.} + P_{\Delta H_2O}\right) + \left(P_{E.Q.} + P_{\Delta E.Q.}\right)$$

Where:

- P' = Revised torus support column load.
- M'_{down} = Revised M_{down} factor as a result of revised plant parameters and increases submergence.
- M_{down} = Value of M_{down} factor used in plant unique analysis report.
- $P_{DYN.}$ = Load in torus support column due to the pool swell dynamic loading as reported in the plant unique analysis report.
- $P_{D.L.}$ = Load in torus support column due to the weight of water plus steel as reported in the plant unique analysis report.

$P_{\Delta H_2O}$ = Increase in load in torus support column due to increase in water weight at increased submergence.

$P_{E.Q.}$ = Load in torus support column due to horizontal and vertical seismic as reported in the plant unique analysis report.

$P_{\Delta E.Q.}$ = Increase in load in torus support column due to horizontal and vertical accelerations acting on the increased water mass.

After the revised torus support column loads are determined, a ratio can be computed as follows:

$$R = \frac{P'}{P}$$

The factor "R" can then be used to compute new "strength ratios" (SR) for components in the torus support structure load path, such as:

- Column to Shell Connection
- Torus Support Column
- Torus Shell Adjacent to Column Connection
- Reinforcing Ring at Torus Mitered Joint
- Pin Connection at the Base of Column

2. Upward Loads, Base Case Sensitivity Case:

Since the response of the torus during the upward load phase of the LOCA is nonlinear, the ratioing technique used for the downward load phase can not be used. For the upward load phase, the single degree of freedom (DOF) uplift model was run for the six loading conditions defined in Table 1.

For the single DOF uplift runs, the original forcing functions are modified in the following manner:

a) For the force due to the downward pressure acting on the wetted surface of the torus shell, the total force magnitude at any point in time is taken as F_1 times the force used in the plant unique analysis report.

Where: $$F_1 = \frac{M'_{down}}{M_{down}}$$

b) For the upward air compression force on the torus dry surface, the force used in the plant unique analysis report is multiplied by the factor F_2.

Where: $$F_2 = \frac{M'_{up}}{M_{up}}$$

2.b (cont.)

M'_{up} = Revised M_{up} factor as a result of revised plant parameters and increased submergence

M_{up} = Value of M_{up} factor used in plant unique analysis report

c) The forcing function which represents the force time histories in the vent header support columns is taken as the force time histories used in the plant unique analysis report with the following adjustments:

1) The magnitude of the total force at any point in time is taken as F_3 times the plant unique analysis report value.

Where: $$F_3 = \frac{P'_A + P'_B}{P_A + P_B}$$

P'_A = Revised region A pressure.

P'_B = Revised region B pressure.

P_A = Region A pressure used in plant unique analysis report.

P_B = Region B pressure used in plant unique analysis report.

2.c (cont.)

2) The time of initiation of the forcing function is adjusted to correspond to the time of vent header impact given in Table 1.

3) The inertial mass and dead weight of the single DOF uplift model is adjusted to account for the increased water mass for submergence greater than minimum.

The results obtained from the single DOF model analysis (uplift displacement, post-liftoff column compressive loads and anchor bolt forces) are then used to compute new structural component strength ratios for the upward load phase.

The plant unique analysis performed to determine stresses in the piping system, including pipe/equipment interface stresses, was a linear elastic analysis. Therefore, adjustments in the stress levels can be made by factoring the stresses up or down based on the ratio of the revised displacement to that reported in the plant unique analysis report.

The piping attachment point displacements used in the plant unique analysis report were the algebraic summation of the peak upward elastic deformation from the 3-D model and peak uplift from the single DOF model, irrespective of the time of occurance. This approach gives a conservatively high value for the displacement of the piping attachment points. The displacements used in this supplement to compute piping system stresses are computed by the square root of the sum of the squares (SRSS) method using the peak upward elastic and peak uplift displacement from the single DOF model. The SRSS method is a more realistic procedure for the superposition of two independently computed dynamic responses.

IV. RESULTS

1. Downward Loads: The results of the evaluation of the effects of revised plant parameters and increased submergence on downward loads are presented in a format similar to that used in the plant unique analysis report. Tables of structural component loads and strength ratios are presented for the load cases of minimum submergence and minimum plus 13 inches. Table 2 presents the revised column loads and Table 3 compares the loads to code allowable and ultimate strength capacities.

   The maximum strength ratio (SR) reported in the plant unique analysis report was 0.29. This value increases to 0.31 for minimum submergence plus 13 inches. This is still well below the STP criteria of 0.50 for the base case downward load.

2. Upward Loads: The results of the evaluation of the effects of revised plant parameters and increased submergence on upward loads are also presented in a format similar to that used in the plant unique analysis report.

   Table 4 presents revised upward loads and resulting revised strength ratios. The maximum strength ratio originally reported was 0.81. This increases to 0.89 for minimum submergence plus 13 inches.

2 (cont.)

Table 5 presents revised post-liftoff compression loads and resulting revised strength ratios. The maximum strength ratio originally reported was 0.17. This increases to 0.22 for minimum submergence plus 13 inches. The revised sensitivity case strength ratios are still below the STP criteria of 1.0.

The uplift results from the single DOF model are presented in Table 6. The maximum uplift originally reported was 0.043 inches. This increases to 0.066 inches for minimum submergence plus 13 inches.

Table 7 presents the revised upward displacements of the piping attachment points used to determine stresses in the piping systems. The maximum displacement is revised from 0.77 inches to 0.746 inches due to the SRSS method of combining the single DOF model results with the elastic deformation at the point of piping system attachment to the torus. Table 8 presents the revised pipe and pipe/equipment interface stresses due to the revised displacements. The maximum pipe stress is revised from 21.9 ksi to 21.1 ksi. The maximum pipe/equipment interface stress is revised from 4.6 ksi to 4.4 ksi.

V. SUMMARY AND CONCLUSIONS

Some minor changes have been made to the plant geometry parameters used to compute pool swell loads for Monticello. The effect of these parameter changes and the effect of water level variations equivalent to the full technical specification limits, have been evaluated and reported in this supplement.

The results reported herein show that the Short Term Program Criteria is satisfied for all structural components of the torus support structure and the piping systems attached to the torus, for all water levels within the current technical specification limits.

Table 1

LOAD FACTORS FOR TORUS PRESSURE LOADS,
VENT SYSTEM PRESSURES AND VENT IMPACT TIMING

ITEM	PER PLANT UNIQUE ANALYSIS REPORT	BASE CASE*		CASE NO. 1 SENSITIVITY		CASE NO. 2 SENSITIVITY	
		MIN. SUB. **	MIN. SUB. +13"	MIN. SUB. **	MIN. SUB. +13"	MIN. SUB. **	MIN. SUB. +13"
M_{down}	1.05	1.05	1.13	1.05	1.13	1.05	1.13
MC_{down}	$1.0/_{1.5}$	1.0	1.0	1.5	1.5	1.0	1.0
ΔP_{down}	0.825	0.825	0.825	0.825	0.825	0.825	0.825
M_{up}	1.17	1.27	1.54	1.27	1.54	1.27	1.54
MC_{up}	$1.0/_{1.2}$	1.0	1.0	1.2	1.2	1.2	1.2
ΔP_{up}	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Vent Press Region A	22.7	27.0	27.9	27.0	27.9	27.0	27.9
Vent Press Region B	33.6	32.7	33.9	32.7	33.9	32.7	33.9
Vent Impact Time	.484	.484	.408	.484	.408	.484	.408
Load Case	1	2	3	4	5	6	7

Notes:

* Refer to Reference 1 for "base case" and "sensitivity case" descriptions

** Factors M_{down}, M_{up}, vent pressures in regions A & B and vent impact time taken from Reference 4

Table 2

(Corresponds to Table 6.1.1-1 of Reference 1)

TORUS SUPPORT COLUMN MAXIMUM COMPRESSIVE LOADS FOR MINIMUM SUBMERGENCE AND MAXIMUM SUBMERGENCE

1	2	3	4	5	6	7
LOAD CASE	COLUMN	POOL SWELL LOAD (kips)	STEEL & WATER LOAD (kips)	VERT. SEISMIC LOAD (kips)	HORIZ. SEISMIC LOAD (kips)	TOTAL LOAD (kips)
Load Per Plant Unique Analysis Report (Case 1)	Inside	493.3	147.6	8.8	4.7	654.4
	Outside	655.9	172.6	10.4	8.3	847.2
Minimum Submerg. (Case 2)	Inside	493.3	147.6	8.8	4.7	654.4
	Outside	655.9	172.6	10.4	8.3	847.2
Maximum Submerg. (Case 3)	Inside	530.9	164.0	9.8	5.2	709.9
	Outside	705.9	191.8	11.6	9.2	918.5

Notes: 1) Refer to Table 1 for Load Case definition.

2) Load Case 2 is identical to the Plant Unique Analysis Load Case except the effect of revised plant geometry parameters has been included.

Table 3

(Corresponds to Table 7.1-1 of Reference 1)

BASE CASE ANALYSIS - DOWNWARD LOADS

COMPONENT CAPACITIES AND STRENGTH RATIOS

MINIMUM SUBMERGENCE AND MAXIMUM SUBMERGENCE

1		2			3	4	5	
COMPONENT		LOAD (kips) LOADING CASE			CODE ALLOWABLE (kips)	ULTIMATE CAPACITY (kips)	CONTROLLING STRENGTH RATIOS	
		1	2	3			CODE ALLOWABLE	ULTIMATE CAPACITY
Inside	Shell Connection	654	654	710	765	3150	.93	.23
Inside	Column				1123	3140	.63	.23
Inside	Pin Connection				993	2960	.72	.24
Outside	Shell Connection	847	847	919	765	3150	1.20	.29
Outside	Column				1189	3288	.77	.28
Outside	Pin Connection				993	2960	.93	.31
COMPONENT		STRESS INTENSITY, (P_L) (ksi) LOADING CASE (1)			CODE ALLOWABLE S.I. (P_L) (ksi)	STP ALLOWABLE S.I. (P_L) (ksi)	CONTROLLING STRENGTH RATIOS	
		1	2	3			CODE ALLOWABLE	ULTIMATE CAPACITY
Reinforcing Ring		16.6	16.6	18.0	19.3	76.0	.93	.24
Shell		21.6	21.6	25.4	28.95	76.0	.81	.31

Notes: 1) Refer to Table 1 for load case definitions.

2) The controlling strength ratio for a given component was determined by diving the largest load or stress from cases 1 through 3 by the appropriate allowable value in column 3 (code) or column 4 (ultimate).

Table 4

(Corresponds to Table 7.1-2 of Reference 1)

SENSITIVITY ANALYSIS - UPWARD LOADS

COMPONENT CAPACITIES AND STRENGTH RATIOS FOR

MINIMUM SUBMERGENCE AND MAXIMUM SUBMERGENCE

1		2			3	4	5	
COMPONENT		LOAD (kips) LOADING CASE			CODE ALLOWABLE (kips)	ULTIMATE CAPACITY (kips)	CONTROLLING STRENGTH RATIOS	
		1	4	5			CODE ALLOWABLE	ULTIMATE CAPACITY
Inside	Shell Connection	420	401	439	765	3150	.57	.14
	Column				1221	3678	.36	.12
	Pin Connection				159	496	2.76	.89
	Anchorage				268	536	1.64	.82
Outside	Shell Connection	402	401	439	765	3150	.57	.14
	Column				1397	4508	.31	.10
	Pin Connection				159	496	2.76	.89
	Anchorage				268	536	1.64	.82

Notes: 1) Refer to Table 1 for load case definition.

2) The controlling strength ratio for a given component was determined by dividing the largest load or stress from cases 2 through 7 by the appropriate allowable value in column 3 (code) or column 4 (ultimate).

3) Maximum sensitivity case upward loads reported.

Table 5

(Corresponds to Table 6.2.1-4 of Reference 1)

TORUS SUPPORT COMPONENT CODE ALLOWABLE LOADS
AND STRENGTH RATIOS (POST - LIFTOFF COMPRESSIVE LOAD)
MINIMUM SUBMERGENCE AND MAXIMUM SUBMERGENCE

1		2			3	4	5	
COMPONENT		POST-LIFTOFF COMPRESSIVE LOAD			CODE ALLOWABLE	ULTIMATE CAPACITY	CONTROLLING STRENGTH RATIOS	
		LOADING CASE			(kips)	(kips)	CODE ALLOW.	ULTIMATE CAPACITY
		1	2	3				
Inside	Shell Connection	514	557	657	765	3150	.86	.21
	Column				1123	3140	.59	.21
	Pin Connection				993	2960	.66	.22
Outside	Shell Connection	514	557	657	765	3150	.86	.21
	Column				1189	3288	.55	.20
	Pin Connection				993	2960	.66	.22

NOTES: 1) Refer to Table 1 for Load Case definitions.

2) Maximum sensitivity case downward loads reported.

3) The controlling strength ratio for a given component determined by dividing the largest load from column 2 by the appropriate allowable value in column 3 (code) or column 4 (ultimate).

Table 6

RESULTS OF SINGLE DEGREE OF FREEDOM UPLIFT MODEL

CASE	LOAD CASE	UPLIFT (in)
PUA	1	.042
Base Case	2	.054
	3	.057
Sensitivity Case 1	4	.057
	5	.066
Sensitivity Case 2	6	.056
	7	.062

NOTES: 1) PUA = Plant Unique Analysis Report

2) Refer to Table 1 for Load Case definition.

Table 7

(Corresponds to Table 6.2.1-5 of Reference 1)

UPWARD DISPLACEMENT FOR ATTACHED

PIPING SYSTEM EVALUATION

1	2	3	4	5
TORUS PENETRATION	SHELL MODEL NODE	1.2* ELASTIC TORUS DEFORMATION (in.)	TORUS UPLIFT (in.)	TOTAL DISPLACEMENT @ UPLIFT $2\sqrt{(3)^2+(4)^2}+.12$ (in.)
X210A	404	.0146	.066	.255
X210B	427	.0114	.066	.254
X211A	379	.0514	.066	.287
X211B	383	.0400	.066	.274
X204A,B,C,D	199	.3060	.066	.746
X218	349	.0400	.066	.274
X205	327	.0163	.066	.256
X212 & X221	259	.0708	.066	.314

NOTES: 1) Maximum torus uplift obtained from Table 6.

Table 8

(Corresponds to Table 7.2-1 of Reference 1)

PIPING SYSTEM LINE AND EQUIPMENT

STRESS SUMMARY

LINE DESCRIPTION	MAXIMUM PIPE STRESS (psi)	ALLOWABLE STRESS (psi)	MAXIMUM PIPING-EQUIPMENT INTERFACE STRESS (psi)
Pump Suction Header Torus Pene - X204A, B, C, D	1,677	45,000	N/A
Core Spray Pump Suction Header Pene - X226A	9,629	45,000	1,087
RCIC Pump Suction Header Pene - X227	21,136	45,000	4,409
HPCI Pump Suction Header Pene - X225	7,774	45,000	761
Core Spray Pump Suction Header Pene - X226B	3,792	45,000	733
RHR Pump Suction Header Pene - X224A	12,565	45,000	1,492
RHR Pump Suction Header Pene - X224B	9,950	45,000	1,192
RHR & Core Spray Discharge Torus Pene - X210A & 211A	17,586	45,000	2,753
RHR & Core Spray Discharge Torus Pene - X210B & 211B	5,142	45,000	804
RCIC Turbine Exhaust Torus Pene - X212	651	45,000	202
HPCI Turbine Exhaust Torus Pene - X221	1,195	45,000	171
Torus Vent Line Torus Pene - X205	716	75,000	140
Torus Vent Line Torus Pene - X218	740	75,000	102

Notes:

(1) Allowable piping-equipment interface stress is 20,000 psi.

VI. REFERENCES

1. NUTECH Report NSP-01-140, "Monticello Nuclear Generating Plant Short Term Program Plant Unique Torus Support and Attached Piping Analysis", dated August, 1976.

2. GE letter, B. W. Smith to Mark I Utilities, dated September 9, 1976, Subject: Short Term Program Final Reports - NRC Questions Relative to Addenda 2 and 3.

3. GE Report NEDC-20989-P, "Mark I Containment Evaluation Short Term Program, Addendum 2, Loads and Their Application for Torus Support System Evaluation", June, 1976.

4. GE Letter, B. W. Smith to G. H. Neils, Northern States Power Company, dated September 20, 1976, Subject: Mark I Containment - Revised Addenda 2 and 3 Loads Based Upon Revised Parameters.

5. GE Report NEDC-20989-P, "Mark I Containment Evaluation Short Term Program Final Report, Addendum 3, Vent Header and Vent Pipe Impact Loads", August, 1976.

6. GE Letter, B. W. Smith to Mark I Utilities, dated September 27, 1976, Subject: Transmittal of Documents from 9/24/76 A/E Seminar. (Pertinent portions of this Reference attached as Appendix A).

7. GE Letter, B. W. Smith to Mark I Utilities, dated September 28, 1976, Subject: Mark I Containment Plant Unique Analysis References. (This Reference attached as Appendix B).

APPENDIX A

GENERAL ELECTRIC

ACTION REQUIRED

MI-G-122
September 27, 1976

RECEIVED
SEP 28 1976
NUTECH

To: Mark I Utilities

From: B. W. Smith

Subject: MARK I CONTAINMENT PROGRAM -
TRANSMITTAL OF DOCUMENTS FROM 9/24/76 A/E SEMINAR

Enclosures:
(1) Meeting Minutes from 9/24/76 A/E Seminar
(2) Revised Addendum 2 Tables
(3) Revised Addendum 3 Tables

This letter transmits Enclosures (1) through (3) for your information and use. Please note that the paragraph entitled "Course of Action" in Enclosure (1) describes the action required by each utility to ensure a uniform approach in the resolutions of outstanding commitments with the NRC.

Also, transmittal herewith of Enclosures (2) and (3) satisfies the commitment made by GE at the 9/24/76 A/E Seminar to transmit revised tabular information relative to Addenda 2 and 3. It should be noted that the revised tabular information either repeats or provides further backup of the revised loading information recently telecopied to all utilities (except Power Authority of the State of New York, Detroit Edison and Carolina Power and Light with whom revised loading information was not applicable). It is important that each utility and/or their A/E review and agree with Enclosures (2) and (3) since each utility must address the effects of the revised plant parameters in written documentation to the NRC.

To help ensure that maximum effort is applied in meeting the NRC Short Term Program close out date of October 1, this letter is being distributed simultaneously to all Mark I utilities and their A/E's.

Please call if you have any questions.

B. W. Smith

B. W. Smith, Senior Engineer
Mark I Program
MC 850, phone (408) 925-1498

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Attachments

Table 2-1a

INDIVIDUAL PLANT PARAMETERS AFFECTING TORUS LOADS

	DBA Break Area (ft^2)	Drywell Volume (ft^3 x 1000)	Break Area / Drywell Volume x 10^{-5} ft^{-1}	Pool Area (ft^2 x 1000)	Pool Area / Vent Area	Downcomer Submergence at Minimum Water Level (ft)	Calculated Wetwell Air Volume Per Torus Segment (ft^3)	Torus Air Volume / Torus Projected Area (ft)
Reference Plant	4.84	159	3.04	11.0	36.5	4.0	8359	12.34
Browns Ferry	4.28	159	2.69	11.0	36.5	4.17	8359	12.34
Peach Bottom	4.28	159	2.69	10.977	36.1	4.0	8260	12.0
Oyster Creek	4.69	180	2.61	9.54	25.3	4.3	6774	14.27
Nine Mile Point	5.446	180	3.03	10.66	26.9	3.8	6362	11.9
Dresden 2/3	4.29	158	2.72	10.4	33.1	3.67	7062	10.
Quad Cities	4.29	158	2.72	10.4	32.8	3.21	2358	11.
Millstone	4.35	162	2.69	9.306	29.9	4.25	7153	12.0
Monticello	3.9	134	2.91	8.432	28.0	4.54	6688	12.4
Vermont Yankee	4.43	151	2.93	8.62	28.6	4.71	7140	13.24
Pilgrim	4.35	147	2.96	9.41	30.0	3.25	7781	13.8
Fitzpatrick	4.45	150	2.97	10.1	34.9	4.17	8320	15.5
Cooper Station	4.2	132	3.18	9.31	37.1	4.21	7150	17.24
Duane Arnold	2.64	144	1.83	7.878	51.2	3.26	6894	17.2
Batch 1	4.38	146	3.00	9.45	37.8	3.67	7127	15.9
Batch 2	4.38	146	3.00	9.69	37.8	4.0	7036	15.2
Fermi 2	4.28	164	2.61	10.93	45.4	4.0	8432	17.34
Brunswick	4.28	164	2.61	10.93	35.5	4.0	8258	13.39

NOTE: 1) See Table 2-1b for a definition of the plant parameters.

2) These plant parameters, based upon the available torus geometry information, were used in developing the plant unique load multipliers. In the development of load multipliers, reasonable approximations were made in the calculation of pool area and vent area. Each utility has the responsibility to confirm that their plant configuration (specifically DBA break area, drywell volume, vent area minimum downcomer submergence, pool area at minimum submergence, torus air volume at minimum submergence, and water weight at minimum submergence) is accurately represented by the values in this table. If required, they should reevaluate their respective load multipliers.

Table 2-3

PLANT-UNIQUE RESULTANT LOAD MULTIPLIERS AT

NO DRYWELL PRESSURIZATION AND MINIMUM ALLOWABLE SUBMERGENCE

Plant	Resultant M_{up}	Resultant M_{down}
Reference Plant	1.00	1.00
Browns Ferry	1.02	.98
Peach Bottom	.99	0.94
Oyster Creek	1.17	.97
Nine Mile Point	1.01	0.78
Dresden 2/3	1.05	.90
Quad Cities	.95	.80
Millstone	1.26	1.02
Monticello	1.27	1.05
Vermont Yankee	1.18	1.07
Pilgrim	1.05	.95
Fitzpatrick	1.11	1.00
Cooper Station	1.03	1.05
Duane Arnold	.70	.78
Hatch 1	.94	0.95
Hatch 2	1.0	1.00
Fermi 2	0.85	0.93
Brunswick	0.95	0.93

Table 6.1

PLANT UNIQUE CONTAINMENT GEOMETRY AND OPERATING CONDITIONS

	Pilgrim	Fitz-Patrick	Peach Bottom 2,3	Hatch 1	Duane Arnold	Cooper Station	Quad Cities 1,2	Browns Ferry 1,2,3	Oyster Creek	Nine Mile Point	Dresden 2,3	Mill-stone	Monti-cello	Vermont Yankee	Hatch 2	Fermi 2	Brunswick 1
DBA Break Area, ft^2	4.35	4.45	4.28	4.38	2.64	4.2	4.17	4.28	4.69	5.446	4.2	4.85	3.9	4.43	4.38	4.285	4.29
Drywell Air Volume $ft^3 \times 10^{-3}$	147	150	159	148	144	132	158	159	180	180	158	147	134	136	145	164	146
Min. Submergence ft	3.75	3.21	4.0	3.67	4.18	4.04	3.21	4.20	4.4	3.0	3.67	4.75	4.54	4.29	4.0	4.8	4.0
Volume Torus Air Space $ft^3 \times 10^{-3}$	124.8	117.1	120.7	111.6	96.6	114.5	121.6	133.7	135.5	126.1	111.0	119.5	114.2	114.2	112.1	134.9	112.1
Projected Pool Area $ft^2 \times 10^{-3}$	9.568	10.1	11.0	9.568	8.048	9.31	10.4	11.0	9.54	10.56	10.4	9.584	8.62	8.62	9.568	10.928	10.048
Projected Torus Area $ft^2 \times 10^{-3}$	9.568	10.144	11.008	9.568	8.048	9.312	10.4	11.008	9.54	10.56	10.4	9.584	8.624	8.624	9.568	10.928	10.048
Total Vent Area (based on downcomer OD) ft^2	314	301	314	251	154	251	317	301	377	377	314	314	301	301	241	241	171
Total Vent Area (based on downcomer ID) ft^2	301	289	301	241	148	241	305	289	361	377	301	302	289	289	241	241	308
Drywell-Wetwell Pressure Differential, psid	1.0	1.0	1.0	1.3	1.3	1.5	1.2	1.0	1.0	1.0	1.0	1.0	1.0	1.7	1.0	1.0	0
Vent Header Outside Diameter, Inches	57.5	57.5	58.5	57.5	42.5	58.5	58.5	58.0	55.5	58.13	58.5	57.5	57.5	57.5	54.5	57.5	54.5
Distance from Minimum Water level to Bottom of Vent Header, ft	3.96	3.96	2.96	3.92	3.53	3.99	4.48	4.26	3.79	3.69	4.02	3.21	4.07	4.61	3.83	3.92	3.88

Note: See the Glossary for a definition of the geometry terms used above.

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Table 6.2

Plant Unique Vent Header Impact Characteristics

Plant	(V Impact avg) S.P. / (V Impact avg) R.P.	(V Impact avg) S.P. ft/sec	V Impact, ft/sec Region A	V Impact, ft/sec Region B	Impulse, psi-sec Region A	Impulse, psi-sec Region B	Impact Duration, sec Region A	Impact Duration, sec Region B	Peak Average Impact Pressures, ps Region A	Peak Average Impact Pressures, ps Region B
ilgrim	1.14	29.26	26.04	31.61	0.254	0.308	0.015	0.015	25.4	30.8
itz- trick	1.06	27.21	24.21	29.39	0.244	0.297	0.015	0.015	24.4	29.7
ach ttom 2,3	0.99	25.41	22.61	27.45	0.232	0.282	0.015	0.015	23.2	28.2
tch 1	0.99	25.41	22.61	27.45	0.203	0.247	0.015	0.015	20.3	24.7
ane nold	0.80	17.92	15.98	19.41	0.119	0.144	0.015	0.015	11.9	14.4
ooper ation	1.05	26.95	23.99	29.11	0.213	0.258	0.015	0.015	21.3	25.8
ad Cities ,2	0.95	24.39	21.70	26.34	0.148	0.180	0.015	0.015	14.8	18.0
owns Ferry ,2,3	0.99	26.41	22.62	27.45	0.230	0.279	0.015	0.015	23.0	27.9
yster Creek	1.17	30.03	26.72	32.44	0.260	0.316	0.015	0.015	26.0	31.6
ine Mile oint	1.14	29.26	26.04	31.60	0.100	0.122	0.015	0.015	10.0	12.2
resden ,3	0.94	24.13	21.47	26.07	0.207	0.251	0.015	0.015	20.7	25.1
illstone	1.11	28.49	25.35	30.78	0.256	0.311	0.015	0.015	25.6	31.1
onticello	1.17	30.03	26.72	32.44	0.270	0.327	0.015	0.015	27.0	32.7
ermant ankee	1.21	31.06	27.64	33.55	0.279	0.339	0.015	0.015	27.9	33.9
tch 2	1.03	26.44	23.53	28.56	0.225	0.273	0.015	0.015	22.5	27.3
erol 2	0.94	24.13	21.48	26.06	0.194	0.236	0.015	0.015	19.4	23.6
unswick ,2	0.99	25.41	22.62	27.45	0.216	0.262	0.015	0.015	21.6	26.2

TABLE 6.3

Pool Swell Arrival Time at Vent Header, Corrections and Totals

Plant	Δt (Vent Header Height) sec	Δt ($\Delta P_{D/W}$) sec	Δt (Submergence) sec	Δt (Region B) sec	Δt Total (Region B) sec	Arrival Time (Region B) sec
Pilgrim	-.015	+.038	+0.012	-.015	+.020	.514
FitzPatrick	-.019	+.038	-.008	-.015	-.004	.490
Peach Bottom 2,3	-.074	+.038	0.0	-.015	-.051	.443
Hatch 1	-.016	+.059	+.016	-.015	+.044	.538
Duane Arnold	-.023	+.059	-.002	-.015	+.029	.517
Cooper Station	-.021	+.074	.009	-.015	+.029	.523
Quad Cities 1,2	+.004	+.052	+.041	-.015	+.082	.576
Browns Ferry 1,2,3	-.006	+.038	-.008	-.015	+.010	.504
Oyster Creek	-.021	+.038	-.017	-.015	-.013	.479
Nine Mile Point	-.029	+.038	+.057	-.015	+.051	.545
Dresden 2,3	-.013	+.038	+.010	-.015	+.085	.520
Millstone	-.046	+.038	-.030	-.015	-.053	.442
Monticello	-.011	+.038	-.022	-.015	-.010	.484
Vermont Yankee	+.008	+.091	-.012	-.015	+.072	.566
Hatch 2	-.018	+.038	0	-.015	+.007	.501
Fermi 2	-.013	+.038	0	-.015	+.010	.504
Brunswick 1,2	-.047	0	0	-.015	-.062	.432

Note: See Figure 3 variation in impact time due to position in Region A.

9/27/75

APPENDIX B

APPENDIX B

The Plant Unique Analysis Report referenced a GE letter, B. W. Smith/R. H. Buchholz to Mark I Utilities, dated June 25, 1976, having the following subject: Pool Swell Vent Header and Vent Pipe Impact Characteristics, Methods and Results for all Domestic Plants. The GE letter attached as Appendix B (MI-G-117) indicates that the contents of the June 25th letter are identical to the information presented for Monticello in Addendum 3 to the Short Term Program Final Report, August 1976, NEDC-20989-P. Therefore, the reference in the Plant Unique Analysis Report to the June 25th letter should be replaced with a reference to Addendum 3.

GENERAL ELECTRIC

"ACTION REQUIRED"

September 28, 1976
MI-G-117

To: MARK I UTILITIES

From: B. W. Smith

Subject: MARK I CONTAINMENT -
PLANT UNIQUE ANALYSIS REFERENCES

Reference: (a) GE Letter MI-G-118 dated September 21, 1976

This letter clarifies and expands upon the GE/NRC telecon dated September 14, 1976 which was forwarded by Reference (a). The telecon indicated that NRC preferred that each utility write to the NRC identifying the Addendum which is being used (2 or 3) for the plant unique evaluation reports and include a statement that reference to June 18 and June 25 letters is incorrect.

To facilitate resolution of this item by the utilities, GE is hereby informing all utilities that Addendum 3 and the June 18 and June 25 letters are identical in content with the exception of the Cooper Station and Pilgrim plants. For these two plants, changes were made to certain plant parameters which affected the resulting vent header impact characteristics. The plant parameter changes were reported to GE subsequent to the time of the June 25 letter but prior to the issue of Addendum 3, and both utilities were notified by GE of the resulting changes to the reported impact characteristics.

In light of the above discussion, each utility should notify the NRC in writing that any Plant Unique Analysis reference to the June 18 or June 25 letters should be changed to Addendum 3.

B. W. Smith, Senior Engineer
Mark I Program
MC 860, phone (408) 925-1498

pl

NRC FORM #195 (2-76)

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