Attachments not included

Total number of pages: 22 + 21 = 43

MP3 Maintenance Performance Criteria

TITLE

PRA96NQA-01093-S3	2	
CALCULATION #	REV #	Vendor Calc #

System MSC Structure N/A Component N/A

Executive Summary

Does this calculation:	
1. Support a DCR, MMOD, an independent review method for a DCR, or confirm test results for an installed DCR? If yes, indicate the DCR, MMOD number and/or Test Procedure number.	Yes ☐ No ☒
2. Support independent analysis? If yes, indicate the procedure or work control reference it supports.	Yes ☐ No ☒
3. Revise, supersede, or void existing calculations? If yes, indicate the calculation number and revisions. PRA96NQA-01093-S3 Rev. 1, Rev. 0	Yes ☒ No ☐
4. Involve QA or QA-related systems, components or structures?	Yes ☒ No ☐
5. Impact the Unit licensing basis, including technical specifications, FSAR, procedures or licensing commitments? If yes, identify appropriate change documents.	Yes ☐ No ☒

Approvals (Print/Signature)	
Preparer: [illegible]	Date: 10-30-96
Independent Reviewer: [illegible]	Date: 10-30-96
Supervisor: [illegible]	Date: 10-30-96

CTP DATA BASE INPUTS [CT Unit Only]

NUSCO Calculation Number: PRA96NQA (prefix) 01093 (sequence number) S3 (suffix) Revision 2

Date 10/30/96

Vendor Calculation Number/Other:

Title: MP3 Maintenance Performance Criteria

CCN# Superseded By: QA (y/n) N

Supercedes Calculation: PRA96NQA-01093-S3 Rev. 1, Rev. 0

Unit	EWR Number	Component Id	Computer Code	Rev. #/Level
MP3				
			CAFTA	3.1a

PMMS CODES					
Structure	System	Component	Reference Calculation	Reference Drawings	Sheet
N A	MSC	N A	Rev. 1, Rev. 0		

Comments:

NUC DCM FORM 5-1B
Rev. 03

TABLE OF CONTENTS

1.0 Purpose:

The purpose of this calc. file is to document the procedure in generating the Millstone Unit 3's maintenance performance criteria for PRA modeled systems from version 5A of the MP3 model. This PRA input would be only one factor used in determining the final MP3 system performance criteria. Performance criteria refers to the recommended amount of time a MP3 system may be out for maintenance in order to minimize plant risk. Revision 1 incorporated performance criteria for the quench spray and RPCCW systems. Revision 2 was performed based on the final signoff of PRA model M3PRA5A. This resulted in updated importance measures and consequently new system/train performance criteria. The risk significance of all systems modeled in the PRA was determined based on three criteria: (1) cutsets within the top 90% of the coremelt sequence cutsets, (2) system train RRW of 1.005 or higher, and/or (3) system train RAW of 2.0 or more.

2.0 Scope:

The scope of this calculation includes only PRA modeled systems for which FV (Fussell-Vessely) importance measures could be determined.

3.0 Summary of Results:

First of all, the Risk Reduction Worth (RRW) and the Risk Achievement Worth (RAW) for each system/train were determined. From the RRW the Fussell-Vessly (FV) was readily calculated as:

$$FV = 1 - 1/RRW$$

The RRW came about by setting basic events pertaining to the system/train along with their common cause counterparts in the coremelt sequence cutset file to **false** and dividing the resultant frequency into the base case frequency. On the other hand, the RAW was determined by setting basic events pertaining to the system/train to **true** and dividing the resultant frequency by the base case frequency. Common cause related basic events were set equal to their corresponding Beta (β) factor instead of being set equal to **true**. Human error probabilities (HEPs) were unaffected by both RRW and RAW determinations.

In the past, several alternative methods have been devised and used by PRA in generating PRA inputs to the system performance criteria. These are documented in References 1 thru 4. The inputs to the MP3 performance criteria were generated based on a slightly modified version of the approach discussed in Reference 1. Even though different methods were used in References 1 thru 4, consistency has been maintained by:

a) Assuring that the increase in the core damage frequency (CDF) due to allowable increase in maintenance unavailability is limited to 2%, and

b) Limiting the factor multiplier on Q_m to 10 regardless of the Fussell-Vessely (FV) importance parameter.

We emphasize the following:

1) The numbers provided are <u>not</u> final performance criteria. They represent PRA input to show the impact of Q_m's on CDF, and thereby demonstrate the flexibility available in selecting the Final Performance Criteria.

2) The System Engineers and the Expert Panel may choose Final Performance Criteria that exceed PRA input. In some cases, depending on the scatter of the Q_m's by year or the nature of the root causes of the system failures, selecting performance criteria that exceed PRA input are strongly recommended.

In order to accomplish conformance to the above two criteria [$\Delta CDF < 2\%$ and $FV(Q_m) < 0.05$], some of the inputs in Table 2 had to be re-calculated using the equation:

$$\text{Performance Criteria} = 8760 * \{0.02 * (\frac{Q_i}{FV})\}$$

where,

> Q_i is the total unavailability of the system train, and
>
> FV = 1 - 1/RRW where RRW came about by setting basic events pertaining to the system/train along with their common cause counterparts in the coremelt sequence cutset file to **<u>false</u>** and dividing the resultant core damage frequency into the base case core damage frequency.

The bases for utilizing the factor of 4 (when FV > 0.01) and the factor of 10 (when FV < 0.01) in Reference 1 goes as follows. Our objective was to devise an extremely simple approach to accomplish the overall objectives of the maintenance rule. Using the definition of FV importance for train 'i':

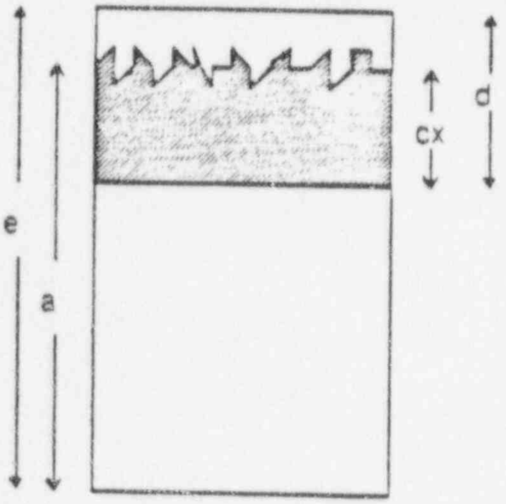
$$FV_i = \frac{a - b}{a} = 1 - (b/a)$$

or

$$\frac{b}{a} = 1 - FV_i \qquad (1)$$

where,

$$a = CDF_{old} \qquad b = CDF_{Q_i=0}$$



If Q_i is increased by a factor of x (x>1), then the summation of the probabilities of the subset of cutsets that contain train 'i' will increase by at least a factor of x. Notice it doesn't increase by exactly a factor of x due to truncation effects.

That is,

$$d \geq cx$$

with $e = Q_{i,new}$ gives:

$$e - b \geq x(a - b)$$

or

$$x \leq \frac{e - b}{a - b}$$

$$x \leq \frac{e/a - b/a}{1 - b/a} \qquad (2)$$

If the CDF increase from $Q_{i,old}$ to $Q_{i,new}$ is "y%" then:

$$y = 100 * \frac{e - a}{a}$$

$$e/a = 1 + y/100 \qquad (3)$$

Substituting for "b/a" and "e/a" in equation (2) from equations (1) and (3) respectively yields:

$$x \leq \frac{[1 + y/100] - [1 - FV_i]}{1 - [1 - FV_i]}$$

$$x \leq \frac{FV_i + y/100}{FV_i}$$

$$x = \frac{Q_{i,new}}{Q_{i,old}} \leq 1 + \frac{y}{100 * FV_i}$$

Hence, the allowable increase to $Q_{i,new}$ is given by:

$$\frac{y}{100 * FV_i} * Q_{i,old}$$

and considering $Q_{tr,old} = 1/4\ Q_{i,old}$ the equation above reveals the allowable increase to $Q_{i,new}$ to be:

$$\frac{4 * y}{100 * FV_i} * Q_{tr,old}$$

With a 2% change in CDF and a FV of 0.01 this amounts to:

$$\frac{4 * 2}{100 * (0.01)} * Q_{tr,old} = 8Q_{tr,old}$$

an eight (8) fold increase in the unavailability of the system train. Therefore in general the factor of ten (10) is justified when the FV is approximately 0.01 or lower.

In light of the fact that:

(a) A simple adjustment factor is desired for this interim value with PRA input to performance criteria, and

(b) $Q_{tr} = 1/4\ Q$ is not a strict rule.

factors 4 and 10 anchored around a FV of 0.01 was deemed to be applicable. Other additional qualitative justifications may be found in Reference 1.

The following two tables detail which basic events were used in the determination of the FV and the performance criteria for each system/train considered in the M3PRA5A model. The pump train lead flags were renamed but this later turn out not to be necessary; hence, the reason for the CAFTA database M3PERFCR.BE. Needless to say the calculations were unaffected.

Table 1: MP3 Basic Events Used In FV Determinations

System/Train Description	***Cutset Prefix***	***Basic Events Changed***
Accumulator Train A	ACCB	rcmoda1
Accumulator Train B	ACCB	rcmoda1
Accumulator Train C	ACCC	rcmodb1
Accumulator Train D	ACCD	rcmodb2
Auxiliary Feedwater MD Pump Train A	AFWA	fwap0fwp1ann,fwccv3of3dnn,fwccv3of4cnn,fwccv3v88xnn,fwccvdisc3nn, fwcpofwap1fn,fwcpofwap1nn,fwmoda1
Auxiliary Feedwater MD Pump Train B	AFWB	fwbp0fwp1bnn,fwccv3of3dnn,fwccv3of4cnn,fwccv3v88xnn,fwccvdisc3nn, fwcpofwap1fn,fwcpofwap1nn,fwmodb1
Auxiliary Feedwater TD Pump Train	AFWX	fwccv3of3dnn,fwccv3of4cnn,fwccv3v88xnn,fwccvdisc3nn,fwmodx4
AFW and Mech Room HVAC Train A	HVAA	hvmodc1
AFW and Mech Room HVAC Train B	HVAB	hvmodc1
Charging Train A	CHA	chacp8511aff,chacp8512aff,chmoda13,chmoda15,chmoda17,chmodc01
Charging Train B	CHB	chbcp8511bff,chbcp8512bff,chmodb14,chmodb16,chmodb18,chmodc01
Charging Lube Oil Cooling Train A	CHLA	(basic events below trucation)
Charging Lube Oil Cooling Train B	CHLA	(basic events below trucation)
Charging and CCW Area HVAC Train A	CHCA	(basic events below trucation)
Charging and CCW Area HVAC Train B	CHCA	(basic events below trucation)
Control Building Chilled Water Train A	CWA	hva8phvkp1nq,hva8phvkp3nq,hvachchl1anq,hvmoda10,hvmoda11,hvmodc3, hvmodc4,swa2pswp2aaq
Control Building Chilled Water Train B	CWB	hvb8phvkp1nq,hvb8phvkp3nq,hvbchchl1bnq,hvmodb10,hvmodb11,hvmodc3, hvmodc4,swb2pswjp2bq
DC Power Train A	DCA	%dcbsi301afn
DC Power Train B	DCB	%dcbsi301bfn

Table 1: MP3 Basic Events Used In FV Determinations

System/Train Description	*Cutset Prefix*	*Basic Events Changed*
Diesel Generator Train A	DGA	acadg3eqsaaq,acmoda3,acmoda4,acmodc1
Diesel Generator Train B	DGB	acbdg3eqsbbq,acmodb33,acmodb4,acmodc1
SBO Diesel Generator Train	SBO	acxdqsbodgnn,acxdqsbodgxq,oasbo[illegible]
Diesel Generator Enclosure HVAC Train A	DGHA	acmoda15
Diesel Generator Enclosure HVAC Train B	DGHB	acmodb15
DWST	DWST	fwxtkfdwsttn
ESFAS Train A	ESFA	esaesesftaaq
ESFAS Train B	ESFB	esbesesftbbq
High Pressure Safety Injection Train A	HPSA	simodc1
High Pressure Safety Injection Train B	HPSB	simodc1
SI Pump Lube Oil Cooling Train A	SILA	simoda2,simodc1
SI Pump Lube Oil Cooling Train B	SILB	simodb2,simodc1
Intake Structure (SW) HVAC Train A	ISHA	hvafnefn2afn,hvaswmod1,hvcswmod1,hvcfnfn2abfn
Intake Structure (SW) HVAC Train B	ISHB	hvbfnefn2bfn,hvbswmod1,hvcswmod1,hvcfnfn2abfn
Main Feedwater Train A/B	MFW	%lmfw,mfwt
Main Steam System Train A	MSSA	mscmic20l4ff,msxavpv20aff,msxrvrv22aff,msxrvrv23aff
Main Steam System Train B	MSSB	mscmic20l4ff,msxavpv20bff,msxrvrv22bff,msxrvrv23bff
Main Steam System Train C	MSSC	mscmic20l4ff,msxavpv20cff,msxrvrv22cff,msxrvrv23cff
Main Steam System Train D	MSSD	mscmic20l4ff,msxavpv20dff,msxrvrv22dff,msxrvrv23dff
Main Steam System - Steam Dump to Condenser	DUMP	msxavpv47aff,msxavpv47bff,msxavpv47cff,msxavpv48aff,msxavpv48bff, msxavpv48cff, msxavpv49aff,msxavpv49bff,msxavpv49cff

Table 1: MP3 Basic Events Used In FV Determinations

System/Train Description	Cutset Prefix	Basic Events Changed
MCC/RCA Room HVAC Train A	RCAA	hvcacac1abfn,hvmccmodx2,hvxacacu1anq
MCC/RCA Room HVAC Train B	RCAB	hvcacac1abfn,hvmccmodx1,hvxacacu1bnq
PORV Train A	PORA	esabip455enf,esarcrk711ff,rcapvv455ann,rcapvv455anq,rcmoda11,rcmoda2
PORV Train B	PORB	esbdip456enf,esbrcrk711ff,rcbpvpv456nn,rcbpvpv456nq,rcmodb11,rcmodb12
Quench Spray Train A	QSSA	(basic events below trucation)
Quench Spray Train B	QSSA	(basic events below trucation)
RCS Safety Relief Valves (SV8010A, B, C)	RCSV	rcmodx1,rcmodx2,rcmodx3
RPCCW Train A	RPCA	(basic events below trucation)
RPCCW Train B	RPCA	(basic events below trucation)
Reactor Protection System	RPS	rtelec,rtmech
Residual Heat Removal Train A	RHRA	(basic events below trucation)
Residual Heat Removal Train B	RHRA	(basic events below trucation)
RHR, QSS and SI Area HVAC (ACUS1A) Train A	QSHA	hvmoda1
RHR, QSS and SI Area HVAC (ACUS1B) Train B	QSHB	hvmodb1
Recirculation Spray Train A	RSSA	rhacv8969ann,rhcmv812abff,rsccvv3536nn,rscp6rp1abnn,rsmoda11, rsmoda16,rsmoda2,rsmoda3,rsmoda4,rsmoda5,rsmoda6,rsmoda7,rsmoda8, rsmoda9,rsmoda12,rsmodc2,rsmodc4,rsmodc5,rsmodc6,swcmvv54abnn
Recirculation Spray Train B	RSSB	rhbcv8969bnn,rhcmv812abff,rsccvv3536nn,rscp6rp1abnn,rsmodb10, rsmodb11,rsmodb12,rsmodb13,rsmodb16,rsmodb2,rsmodb3,rsmodb4,rsmodb5

Table 1: MP3 Basic Events Used In FV Determinations

System/Train Description	*Cutset Prefix*	*Basic Events Changed*
		rsmodb7,rsmodb8,rsmodc2,rsmodc4,rsmodc5,rsmodc6,swcmvv54abnn
RSS HVAC Train A	RSHA	hvachacs2anq,rsmoda4,rsmodc7
RSS HVAC Train B	RSHB	hvbchacs2bnq,rsmodb6,rsmodc7
RWST	RWST	qsxtkqrwstln,sixvmsilv1nx
Service Water Pump Train A	SWA	%swmoda23,%swp3i34abfn,%swp3i34adfn,%swp3i4of4fn,%swp3ipmacfn, swacp63x12ff,swap3swp1aaq,swap3swp1afn,swmoda8,swmodc1
Service Water Pump Train B	SWB	%swmodb23,%swp3i34abfn,%swp3i34cbfn,%swp3i4of4fn,%swp3ipmbdfn, swbcp63x12ff,swbp3swp1bbq,swbp3swp1bfn,swmodb8,swmodc2
Service Water Pump Train C	SWC	%swmoda24%swp3i34cbfn,%swp3i34cdfn,%swp3i4of4fn,%swp3ipmacfn, swcp3pmpacfn,swmodc1
Service Water Pump Train D	SWD	%swmodb24,%swp3i34adfn,%swp3i34cdfn,%swp3i4of4fn,%swp3ipmbdfn
SWGR HVAC Train A	SWGA	hvcaca3a3bnn,hvmodaca2
SWGR HVAC Train B	SWGB	hvcaca3a3bnn,hvmodacb2
120v Vital AC Power Train A (VIAC-1)	VITA	(basic events below trucation)
120v Vital AC Power Train A (VIAC-2)	VITA	(basic events below trucation)
120v Vital AC Power Train A (VIAC-3)	VITA	(basic events below trucation)
120v Vital AC Power Train A (VIAC-4)	VITA	(basic events below trucation)

Table 2: MP3 Maintenance Rule Importance by System/Train

System/Train Description	Top 90% CMF?	FV	RRW	RAW	Maint. Unavail.	Sys./Train Unavail.	Criteria (hrs/yr)
Accumulator Train A(2,10)	Y	0.014	1.014	12.56	3.00E-04	1.20E-03	13
Accumulator Train B(2,10)	Y	0.014	1.014	12.56	3.00E-04	1.20E-03	13
Accumulator Train C(2,10)	Y	0.014	1.014	12.56	3.00E-04	1.20E-03	13
Accumulator Train D(2,10)	Y	0.014	1.014	12.56	3.00E-04	1.20E-03	13
Auxiliary Feedwater MD Pump Train A	Y	0.026	1.026	11.73	1.50E-03	9.30E-03	53
Auxiliary Feedwater MD Pump Train B	Y	0.026	1.026	11.73	1.90E-03	9.70E-03	50
Auxiliary Feedwater TD Pump Train	Y	0.052	1.055	7.80	3.90E-04	2.30E-02	34
AFW and Mech Room HVAC Train A(3)	Y	0.003	1.003	11.62	1.13E-03	3.55E-03	99
AFW and Mech Room HVAC Train B(3)	Y	0.003	1.003	11.62	1.13E-03	3.55E-03	99
Charging Train A	Y	0.030	1.031	2.00	2.60E-03	5.40E-03	23
Charging Train B	Y	0.030	1.031	1.99	2.50E-03	5.30E-03	22
Charging Lube Oil Cooling Train A(1)	N	0.000	1.000	2.51	7.50E-04	3.90E-03	66
Charging Lube Oil Cooling Train B(1)	N	0.000	1.000	2.51	5.10E-04	3.60E-03	45
Charging and CCW Area HVAC Train A(1,3)	N	0.000	1.000	9.02	1.13E-03	1.60E-03	99
Charging and CCW Area HVAC Train B(1,3)	N	0.000	1.000	9.02	1.13E-03	1.60E-03	99
Control Building Chilled Water Train A(3)	Y	0.062	1.066	32.50	8.78E-03	4.61E-02	77
Control Building Chilled Water Train B(3)	Y	0.061	1.065	32.59	8.78E-03	4.61E-02	77
DC Power Train A	Y	0.010	1.010	6.50	NA	NA	NA
DC Power Train B	Y	0.010	1.010	6.50	NA	NA	NA

Table 2: MP3 Maintenance Rule Importance by System/Train

System/Train Description	Top 90% CMF?	FV	RRW	RAW	Maint. Unavail.	Sys./Train Unavail.	Criteria (hrs/yr)
Diesel Generator Train A(4)	Y	0.028	1.028	4.49	1.10E-02	3.80E-02	193
Diesel Generator Train B(4)	Y	0.026	1.026	3.96	9.10E-03	3.60E-02	239
SBO Diesel Generator Train(4)	Y	0.008	1.008	1.44	2.10E-03	1.90E-02	184
Diesel Generator Enclosure HVAC Train A	Y	0.007	1.007	1.41	1.13E-03	2.10E-02	99
Diesel Generator Enclosure HVAC Train B	Y	0.007	1.007	1.41	1.13E-03	2.10E-02	99
DWST	Y	0.002	1.002	799.32	NA	NA	NA
ESFAS Train A	Y	0.004	1.004	2.27	NA	NA	NA
ESFAS Train B	Y	0.004	1.004	2.27	NA	NA	NA
High Pressure Safety Injection Train A(5,11)	N	0.000	1.000	1.25	1.50E-03	4.30E-03	131
High Pressure Safety Injection Train B(5,11)	N	0.000	1.000	1.25	9.00E-04	3.70E-03	79
SI Pump Lube Oil Cooling Train A	Y	0.006	1.006	1.45	5.10E-04	2.10E-02	45
SI Pump Lube Oil Cooling Train B	Y	0.006	1.006	1.45	3.10E-04	2.10E-02	27
Intake Structure (SW) HVAC Train A(3,10)	Y	0.040	1.041	34.13	4.73E-05	1.89E-04	1
Intake Structure (SW) HVAC Train B(3,10)	Y	0.040	1.042	34.23	4.73E-05	1.89E-04	1
Main Feedwater Train A/B(6)	Y	0.013	1.014	1.31	NA	NA	NA
Main Steam System Train A(9)	Y	0.010	1.010	2.79	NA	NA	NA
Main Steam System Train B(9)	Y	0.010	1.010	2.79	NA	NA	NA
Main Steam System Train C(9)	Y	0.010	1.010	2.79	NA	NA	NA

Table 2: MP3 Maintenance Rule Importance by System/Train

System/Train Description	Top 90% CMF?	FV	RRW	RAW	Maint. Unavail.	Sys./Train Unavail.	Criteria (hrs/yr)
Main Steam System Train D(9)	Y	0.010	1.010	2.79	NA	NA	NA
Main Steam System - Steam Dump to Condenser(7)	Y	0.025	1.026	2.30	NA	NA	NA
MCC/RCA Room HVAC Train A	Y	0.004	1.004	7.29	3.09E-03	6.90E-03	271
MCC/RCA Room HVAC Train B	Y	0.004	1.004	7.29	3.09E-03	6.90E-03	271
PORV Train A(10)	Y	0.040	1.042	2.23	6.50E-03	2.60E-02	114
PORV Train B(10)	Y	0.040	1.042	2.23	6.50E-03	2.60E-02	114
Quench Spray Train A(1,11)	N	0.000	1.000	1.65	2.00E-03	1.32E-02	175
Quench Spray Train B(1,11)	N	0.000	1.000	1.65	1.70E-03	1.32E-02	149
RCS Safety Relief Valves (SV8010A,B, C)(8)	Y	0.032	1.033	1.13	NA	NA	NA
RPCCW Train A(1,11)	N	0.000	1.000	1.11	2.40E-03	3.14E-03	210
RPCCW Train B(1,11)	N	0.000	1.000	1.11	4.70E-03	3.14E-03	412
Reactor Protection System	Y	0.118	1.134	6606.98	NA	NA	NA
Residual Heat Removal Train A(1,11)	N	0.000	1.000	1.00	2.20E-03	5.50E-03	193
Residual Heat Removal Train B(1,11)	N	0.000	1.000	1.00	1.30E-03	4.60E-03	114
RHR, QSS and SI Area HVAC (ACUS1A) Train A(11)	N	0.000	1.000	1.02	5.58E-03	2.55E-02	489
RHR, QSS and SI Area HVAC (ACUS1B) Train B(11)	N	0.000	1.000	1.02	5.58E-03	2.55E-02	489

Table 2: MP3 Maintenance Rule Importance by System/Train

System/Train Description	Top 90% CMF?	FV	RRW	RAW	Maint. Unavail.	Sys./Train Unavail.	Criteria (hrs/yr)
Recirculation Spray Train A	Y	0.189	1.232	42.60	1.20E-03	3.60E-02	32
Recirculation Spray Train B	Y	0.188	1.231	42.11	1.00E-03	3.60E-02	26
RSS HVAC Train A(3)	Y	0.006	1.006	1.35	5.58E-03	1.59E-02	489
RSS HVAC Train B(3)	Y	0.006	1.006	1.35	5.58E-03	1.59E-02	489
RWST	Y	0.010	1.010	790.38	NA	NA	NA
Service Water Pump Train A	Y	0.148	1.174	2.48	1.10E-02	1.90E-02	96
Service Water Pump Train B	Y	0.149	1.175	2.47	9.40E-03	1.80E-02	82
Service Water Pump Train C	Y	0.146	1.171	2.13	9.00E-04	9.20E-03	8
Service Water Pump Train D	Y	0.145	1.169	1.37	3.30E-03	1.20E-02	29
SWGR HVAC Train A(3,10)	Y	0.001	1.001	1.43	6.60E-06	2.64E-05	1
SWGR HVAC Train B(3,10)	Y	0.001	1.001	1.43	6.60E-06	2.64E-05	1
120v Vital AC Power Train A (VIAC-1)(1,11)	N	0.000	1.000	15.29	NA	NA	NA
120v Vital AC Power Train A (VIAC-2)(1,11)	N	0.000	1.000	15.29	NA	NA	NA
120v Vital AC Power Train A (VIAC-3)(1,11)	N	0.000	1.000	15.29	NA	NA	NA
120v Vital AC Power Train A (VIAC-4)(1,11)	N	0.000	1.000	15.29	NA	NA	NA

Table 3: MP3 System/Train Maintenance Rule Importance Footnotes

1) Computed by requantification of the whole model rather than using the cutset method.

2) Relatively high RRW/RAW values are resulting from conservative accumulator success criteria.

3) HVAC system train value exceeds the NEI criteria; however, the PRA section recommends that the expert panel determine the actual risk significance since the common cause factor dominates the result. These systems were included in the PRA model as required support systems since room heat-up calculations to determine otherwise were not available. In addition, operator action was assumed as a screening value and more detailed input could be provided by the panel.

4) Based on ACR #1892 "Limited capacity of the SBO Diesel Battery", the RRW and RAW values for the DGs 'A' & 'B' as well as the SBO DG would be different; however, they would all be considered risk significant. Reference: Memo to M. H. Brothers From S. D. Weerakkody, NE-96-SAB-150, "PRA Review of ACR #1892: Limited Capacity of Station Blackout Diesel Battery", 5/31/96.

5) Although the table does not show that the HPSI trains 'A' and 'B' as risk significant the associated support system SI pump lube oil cooling train is risk significant under the category of 90% CMF and RRW. The 'zero' value for HPSI's FV is a result of truncation. The FV of the dedicated lube oil cooling trains (.006) must be representative of the FV of the HPSI trains as well. Therefore, the HPSI trains should also be considered risk significant.

6) MFW system risk significance is based on the need of MFW to remove secondary side heat following the initial phase of an ATWS event.

7) Steam dump to condenser models failure of any 1 of 9 steam dump valves to reclose following a transient - CSLBO.

8) Relatively high RRW/RAW values based on conservative overpressure relief success criteria following an ATWS. Results in Function 1.03 of Reactor Coolant System being considered risk significant.

9) A main steam train consists of the MSIV, CTV 27A(B, C, D) atmospheric relief valve, PV 20A(B, C, D) and the SG safety relief valves SRVs 22A(B, C, D) and 23A(B, C, D).

10) Train/system maintenance unavailability based on 25% of train/system unavailability due to a lack of historical data.

11) Assumed Fussell-Vessely (FV) of 5.0E-04 because FV calculation falls below 1.0E-08 truncation level.

ED4297 5-80

NORTHEAST UTILITIES SERVICE COMPANY

SUBJECT MP3 Maintenance Performance Criteria	BY J. D. Caivano	DATE 10/29/96	
	CHKD. BY [illegible]	DATE 10/29/96	
	CALC. NO. PRA96NOA-01093-S3	REV. 2	
	SHEET NO. 18	OF 22	

4.0 References/Design Inputs:

1) NE-94-SAB-386, Memo. from James M. Powers to K. B. Hastings, Nov. 1, 1994.
2) NE-95-SAB-054, Memo. from Jack R. Barnett to K. B. Hastings, Feb. 1, 1995.
3) NE-94-SAB-448, Memo. from Fred O. Cietek to K. B. Hastings, Nov. 29, 1994.
4) NE-95-SAB-137, Memo. from James M. Powers to Gene McNatt, Mar. 30, 1995.

5.0 Assumptions:

1. In cases where there was no plant specific maintenance historical data available the maintenance unavailabilities in Table 1 were based on generic maintenance historical data if known or taken at 25% of the total train/system unavailability if unknown.
2. Charging check valves CVs (CHMODX02) were not included in the charging pump train boundaries since they cannot be divided up into a specfic train (common to both).
3. HPSI check valves CVs (SIMODX1) were not included in the HPSI pump train boundaries since they cannot be divided up into a specfic train (common to both).
4. RHR check valves CVs 8818A-D, 8847A-D, 8948A-D were not included in the RHR pump train boundaries since they are not train specific (common to both).
5. AFW check valves CVs (FWCCV3V88XNN, FWCCV3OF4CNN) were not included in the AFW pump boundaries since they are not train specific.
6. Service water MOVs (50,54,71), RHR MOVs (8812, 8801), RHR CV 8969, and SIH MOVs (8920, 8814, 8813) are considered part of the RSS train boundaries.
7. ESFAS bistable and relay coil (K711) specfic to the operation of the PORVs were considered to be part of the PORV boundary.
8. Check valves 8815 and 8546 which result in a failure of the total charging system were not included in the specific train calculations.
9. Cutset %LOOP ACAININV1AFN CHALEAD RSMODB10 OARECIRCMOV4 which equals 2.81e-08 should be an order of magnitude lower (modeling error) so Vital AC should not be considered in the top 90% of the cutsets.

6.0 Reviewer's Comments and Resolution:

1) **Comment:** On page 6, Q_m is the unavailability of a system train due to maintenance and test.

Resolution: Agree, changed in calc. file.

2) **Comment:** What version of MP3 PRA model was used?

Resolution: Answered in Objective section as version M3PRA5A.

3) **Comment:** Still do not understand how SW train 'C' has a much lower criteria (32 hrs.) than other SW trains.

Resolution: Historical data indicates that SW train 'C' has a lower probability of being out of service for test or maintenance.

4) **Comment:** The charging and SI pumps cooling trains have a much lower criteria (# of hrs.) than the actual charging and SI pumps. Why is this?

Resolution: Historical data indicates that charging and SI pumps cooling trains have a lower probability of being out of service for test or maintenance.

5) **Comment:** Discussion should be added to text regarding risk significance determination as well as performance criteria. Restate Rev. 2 sentence in Section 1.0 to include the full scope of this revision.

Resolution: Done.

6) **Comment:** Section 3.0 sentence "Common cause counterparts for the RAW calculation..." is not correct. Instead, state that "Common cause related basic events were set equal to their corresponding Beta factor instead of being set equal to true. This will represent the potential of common cause falure of the other train given that one train is assumed to be failed."

Resolution: Done.

7) **Comment:** Section 3.0 should have a discussion on how the dominant sequence cutset file was modified to represent the system train importance. In addition, provide the basic event listing which made up the selected system trains.

Resolution: Done.

8) **Comment:** After reviewing the importance measure results it was noticed that the FV value for the service water pump trains were large as compared to the original results - the probable reason being the treatment of the CCF basic events. For example in the RRW calculation for SW the CCF events were set equal to zero. So if one had a CCF basic event representing 4 of 4 SW pumps to run it was set to zero; where as if the 'A' SW pump train was considered totally reliable there would still be a CCF event amongst the other three pumps which could have been added. To get an idea of how important of a contribution this is to the FV please run a case where the CCF events are not set equal to zero and determine the FV value.

Resolution: For SW the CCF basic event for the 'A' and 'C' trains is SWMODC1 and for the 'B' and 'D' trains it is SWMODC2. Both of these basic events appear in only one cutset representing 1.10E-08 probability. Hence, not setting these events to zero would result in a negligible change in FV.

EAO 8/20/96

MP3 Performance Criteria QA Comments

1) Pg 4 Revision 2 was performed based on the final signoff of PRA model MP3PRA5A. This resulted in updated importance measures for all the systems. In addition, the risk significance of all systems modeled in the PRA was determined based on three criteria: in the top 90% of the cutsets, train RAW greater than 2.0 and/or Train RRW of greater than 1.005. Discussion should be added to text regarding risk significance determination as well as performance criteria. Restate Rev. 2 sentence in Section 1.0 to include the full scope of this revision.

2) Pg 5 Section 3.0 sentence "Common cause counterparts for the RAW calculation..." is not correct. Instead, state that "Common cause related basic events were set equal to their corresponding Beta factor instead being set equal to true. This will represent the potential of common cause failure of the other train given that one train is assumed to be failed."

3) Pg 5 Section 3.0, shouldn't there be a discussion on how the dominant sequence cutset file were modified to represent the system train. In addition, provide the basic event listing which made up the selected system trains.

4) Pg 6 The FV decription on the top of the page is no longer true.

5) The orginal footnotes on the performance criteria table are no longer in the table only the ones regarding risk significance. These should be added in pertinent.

6) Also involving the risk significance determination of a train valves which were common to both trains were not included in etiher train (ex RHR injection check valves - 4 loops). Need to state with verbage from comment #3.

7) After reviewing the importance measure results, noticed that the FV value for the service water pump trains were large as compared to orginal results - the reason being the modification in calculating the CCF basic events. For RRW, the CCF events were set equal to 0. So if you had CCF of 4 of 4 SW pumps to run, this was set equal to 0.0. Where if the A SW pump train was considered totally reliable, there is still a CCF event amongst the other three pumps which should have been added. To get an idea of how this impacts the FV, please run a case where the CCF events are not set equal to 0.0 and determine the FV value.

8) When examining the results, the FV for the charging pump trains appears quite high compared to other systems. Charging is used for seal cooling, injection and recirculation; however, RPCCW is also used for RCP seal cooling

and HPSI is used for injection and recirculation. Both these systems have much lower FV values. If the FV value is compared to AFW and DG trains it is slightly higher which does not appear to be right. Please check the calc. and state what basic events are resulting in this high FV value.

7.0 Attachments:

A) See Reference 1.

B) See Reference 2.

C) See Reference 3.

D) See Reference 4.