April 24, 1995

MEMORANDUM TO: Robert C. Jones, Chief
Reactor Systems Branch
Division of Systems Safety and Analysis

FROM: Warren C. Lyon, Sr. Reactor Systems Engineer
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SUBJECT: STEAM GENERATOR TUBE RUPTURE (SGTR) EVENT TREES FOR COMPARISON OF ISOLATION OF THE AFFECTED SG WITH STEAMING THE AFFECTED SG FOR BABCOCK AND WILCOX NUCLEAR STEAM SUPPLY SYSTEMS (TAC NO. M54946)

REFERENCE: 1. Khericha, S. T., el. al., "A Probabilistic Analysis of the B&W Technical Basis Document's Steam Generator Tube Rupture Recommendations," EG&G Idaho, Inc., EGG-RAAM-11429, August 1994.

SUMMARY

EG&G Idaho (Reference) studied SGTR in the B&W-designed Oconee Unit 3 NSSSs and developed event trees to provide insight into plant response. The staff extended the EG&G work for SGTRs smaller than HPI capacity to address unanalyzed sequences. The EG&G and staff predictions for small break SGTR with offsite power available are as follows:

Item		Frequency, Occurances/Reactor-Year			
		No recovery from equipment failures and operator errors		Recovery from equipment failures and operator errors	
		EG&G	Staff	EG&G	Staff
Steam both SGs	Core damage	6E-4	6E-4	3E-6	3E-6
	Undefined	4E-6	0	4E-6	0
Isolate SG with broken tube(s)	Core damage	6E-4	6E-4	3E-6	4E-6
	Undefined	1E-5	0	1E-5	0

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EG&G concluded there was no difference between core damage frequency with operator guidance to steam both SGs when compared to isolating the affected SG whereas the staff found a 30% increase - but the reader is cautioned that uncertainty is perhaps a factor of ten or more. The major cause for the difference is the staff's extension of EG&G's work to address the undefined sequences in EG&G's event trees. Note the significant difference between recovery and no recovery. Unfortunately, little to no substantiation is available for the recovery actions.

The staff also conducted limited sensitivity calculations. In no case did steaming reduce the core damage frequency by more than a factor of two for small variations in parameters. It appears that one or more parameters must be significantly in error in the staff's event trees for steaming to have an order of magnitude impact upon core damage frequency. The staff emphasizes this may be a possibility - numerous assumptions are contained within the trees. B&W's most powerful arguments in favor of steaming both SGs, such as flexibility and maintaining the plant in a more normal state (as discussed in the SER), are not well quantified and could have greater influence than considered here. The staff also emphasizes that it only analyzed the most likely SGTR and did not study loss of offsite power or SGTRs where the break size was larger than HPI capacity.

Additional information is provided in the attachment.

Attachment:
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DOCUMENT NAME: G:\TREE-RPT.WL

Attachment

EG&G's work used an in-depth data base previously developed for the Oconee Unit 3 IPE (Individual Plant Evaluation), modified for SGTR analyses and further modified so that the condenser was lost if there was a loss of offsite power (LOOP). Other aspects unique to Oconee remained. These included, for example, the standby shutdown facility with its self-contained electrical power supply that can pump lake water into the SGs and provides limited RCS makeup capability, and the two Keowee hydroelectric systems that provide onsite emergency power at Oconee in place of the traditional diesel generators.

EG&G's basic tree modeling included failures or the effect of operator errors at each branch in a sequence. It excluded recovery such as correction of operator errors, regaining previously failed equipment, or use of alternate equipment to prevent core damage. EG&G addressed this by modeling recovery at the end of each sequence in the trees. The three recovery groups that were modeled and their assumed probabilities were:

1. Non-recovery for components outside containment = 0.01

2. Non-recovery for components inside containment = 0.1

3. Non-recovery involving operator actions to establish an alternate cooling path, given an alternate cooling system is available, = 0.1

Items 1 and 2 were included in the computer program for each of the sequence cut sets. Item 3 was generally applied separately to operator errors to further reduce the computer-calculated core damage state (CDS) frequencies.

As shown in the above summary table, these recovery actions are important to determination of CDS frequency. Yet, the recovery actions appear to be assumptions with little substantiation. For example, they do not consider such factors as conditions inside containment. (If a pressurizer pressure operated relief valve (PORV) has been open for some time, it may be impossible to enter containment and the non-recovery frequency for components inside containment may change substantially from what can be accomplished with containment entry.)

The staff had several difficulties in using the EG&G results, including:

1. The case of "no SG cooling - HPI available - failure to open a PORV" is unanalyzed, yet terminates with a frequency of 1.4E-5 for the affected SG isolated and 4E-6 for steaming both SGs. EG&G's predicted total core damage frequency (CDF) for each of these cases is 2.6E-6. The potential for changing the CDF difference between the two cases is obvious.

2. Little attention is given to main steam safety valve (MSSV) response. There are no MSSV open branches and MSSV closure frequency is independent of fluid quality. EG&G used a failure to close frequency of 8.3E-2 based upon a previous staff study of pressurizer safety valves. Other literature shows the frequency to vary from 1E-3 to 1E-2. Further, operating experience contradicts 8.3E-2 for MSSV response.

3. The EG&G calculation does not allow variation of an event's frequency at a branch; all branches for a particular event in a tree must have the same frequency.

4. The human factors development does not appear to adequately reflect key aspects of operator guidance, operator training, and the depth of operator support (other operations personnel, the technical support center). For example, the operator frequency for failing to open a PORV when depressurization is necessary is 8.5E-3 and failure to close it is 1E-2. The staff considers these to be unrealistically high.

Consequently, the staff has rewritten the small break SGTR trees, which constitute most SGTR events. Numerous assumptions are involved and some of the EG&G assumption weaknesses are not strengthened. Consequently, the staff's trees are considered to be unsubstantiated and the frequency values must be treated accordingly. They are limited to providing insights into alternate SGTR mitigation strategies. Evolution of the staff's tree for the affected SG isolated from that provided by EG&G is summarized in Tables B1 and B2. The same process was used for steaming both SGs, except the staff used the Table B1 information whereas EG&G provided sequence-specific modifications that resulted in insignificant changes in the calculated results. (As will be seen, many of the staff's modifications had negligible effect on results as well).

The staff's reference event trees are provided in Figs. B1 and B2. Calculations were performed via LOTUS and the corresponding spread sheet values are shown in Tables B3 and B4. Each row in the spread sheet corresponds to the end line of each sequence and may be used to trace sequence frequency from SGTR initiation to the sequence end. EG&G's event trees are reproduced in Figs. B3 and B4.

The staff's event trees address 80 sequences, but only a few provide a significant contribution to core damage. These are as follows:

Sequence Number	Failures	Frequency x E6	
		Isolate	Steam
3	DHR	1.73	1.61
21	1 HPI, DHR	0.01	0.01
38	2 HPI, DHR	1.05	1.07
41	SG, DHR (MSSV opens)	0.10	0.02
44	SG, Recirc, DHR (MSSV opens)	0.10	0.02
47	SG, MSSV, DHR	0.58	0.15
50	SG, MSSV, Recirc, DHR	0.21	0.06
53	SG, DHR (MSSV doesn't open)	0.16	0.04
58	SG, PORV	0.06	0.02
64	SG, 1 HPI, Recirc, DHR (MSSV opens)	0.01	-
67	SG, 1 HPI, MSSV, DHR	0.01	-
70	SG, 1 HPI, MSSV, Recirc, DHR	0.02	-
80	SG, 2 HPI	0.02	0.01
	Total	4	3

Sequences 3 and 38, failure of DHR, and failure of both HPI systems followed by failure of DHR, respectively, provide the dominant contribution to core damage. Differences between steaming and SG isolation are of secondary importance and generally involve MSSV operation and/or failure, areas where staff predictions are based upon assumptions, not good data.

The staff conducted limited sensitivity studies to assess the effect of selected changes. The following results were obtained:

Perturbation	Isolate	Steam
Base case	4.0E-6	3.0E-6
No recovery	6E-4	6E-4
Use EG&G recovery rather than staff values	3.2E-6	2.2E-6
Use EG&G 11 recovery factor (RF) = 0.001 (staff value = 0.01)	3.8E-6	3.0E-6
Use EG&G 13 RF = 0.07 (staff value = 0.1)	3.8E-6	2.9E-6
Use both 11 and 13, above	3.5E-6	2.9E-6
SG unavailability = 0.06 for isolated SG and = 0.001 for steaming cases (base = 0.03)	5.2E-6	2.8E-6
SG unavailibility = 0.001 for isolated SG and = 0.06 for steaming cases (the reverse of expected behavior)	2.9E-6	5.0E-6
MSSVs always open	4.8E-6	3.2E-6
MSSVs always open and always fail open	6.8E-6	3.7E-6
Eliminate DHR as an option for HPI cooling sequences	9.5E-6	4.4E-6

In no case does steaming reduce the core damage frequency by more than a factor of two from the case of isolating the affected SG.

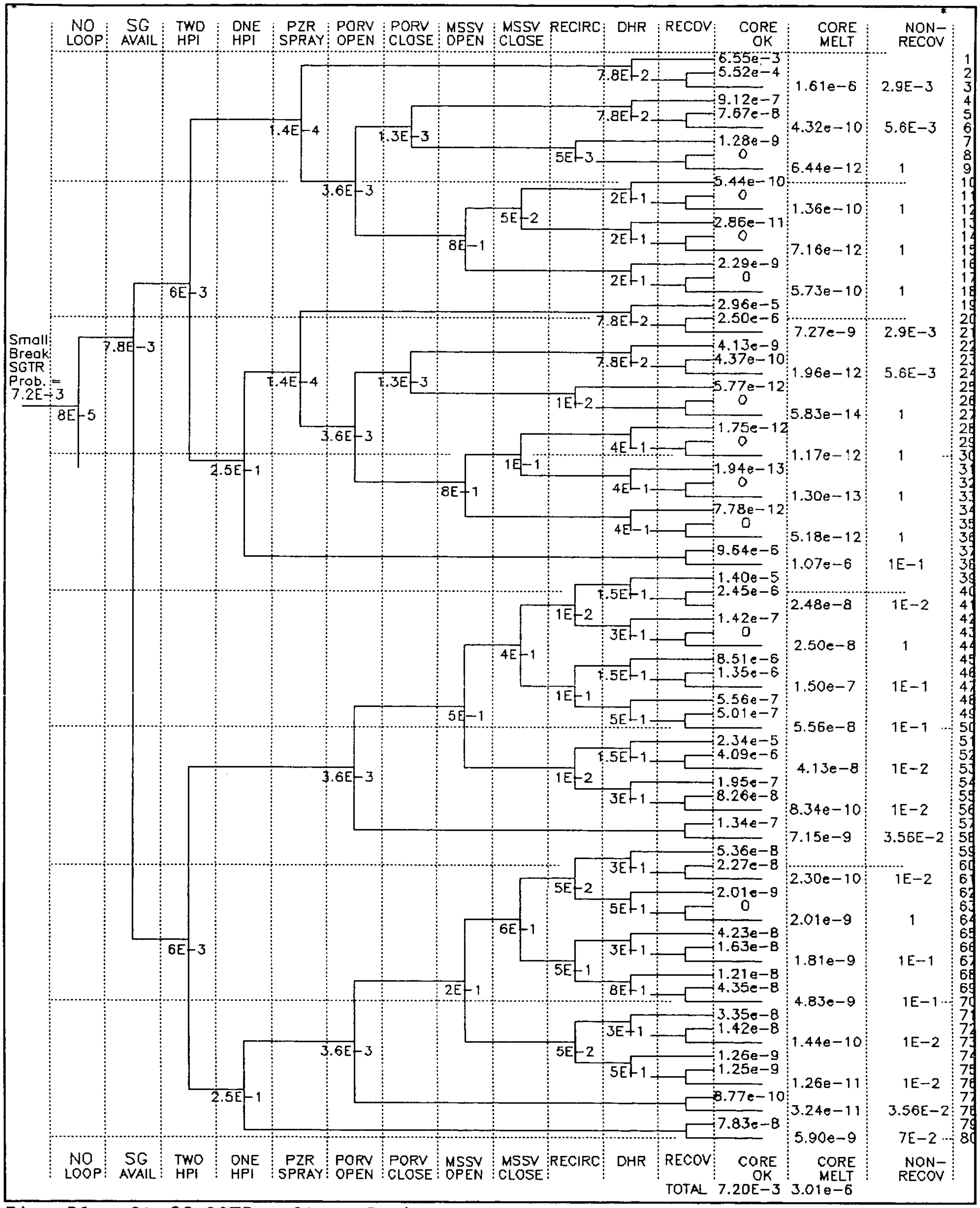


Fig. B1. Staff SGTR - Steam Both

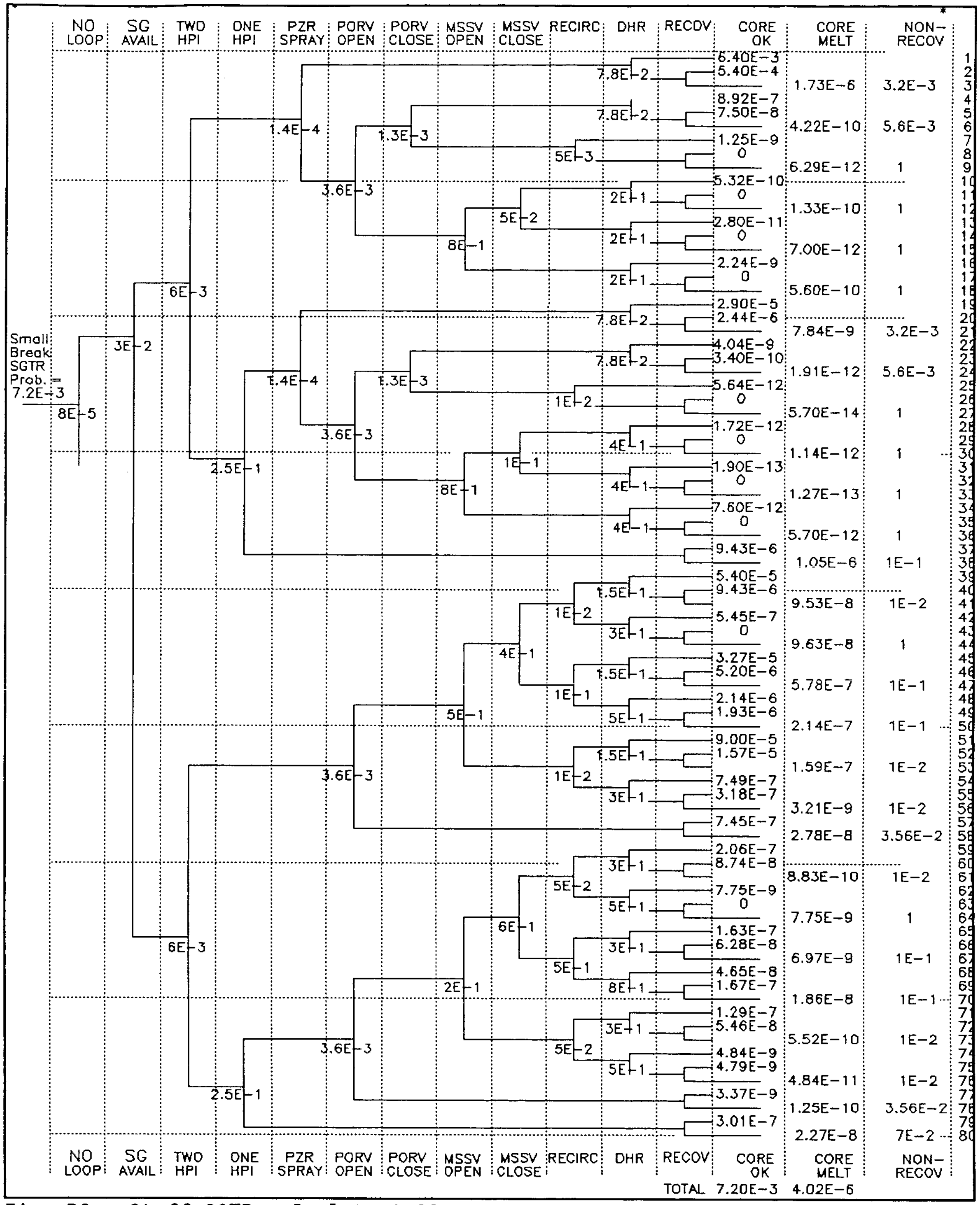
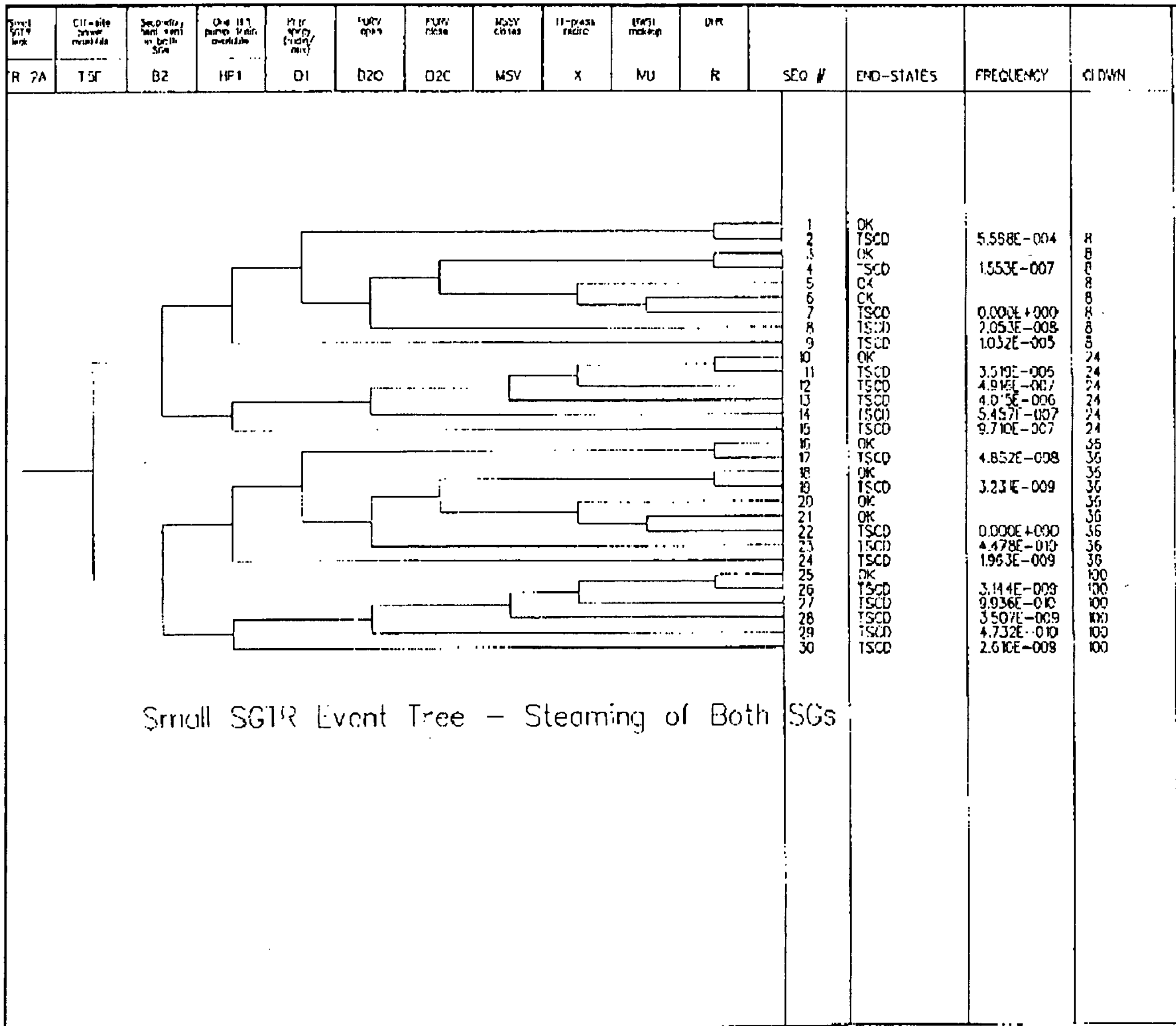


Fig. B2. Staff SGTR - Isolate 1 SG

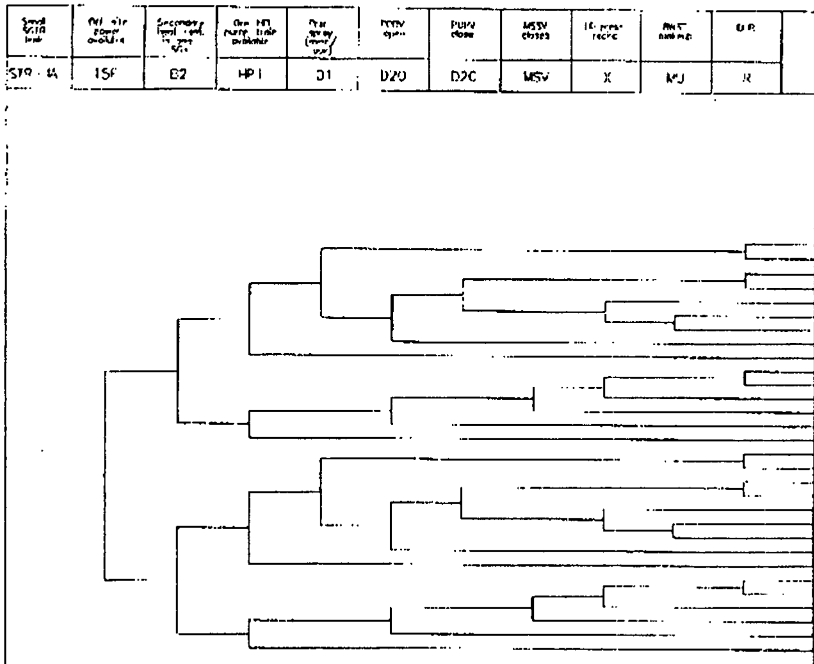
Fig. B3. EG&G SG Steamed



gure 3-3. Small SGTR event tree (TSCD sequences) - Steaming with both SGs.

Fig. B4. EG&G, SG Isolated

SGTR PRA



SEQ #	END-STATES	FREQUENCY	CLDWN
1	OK		8
2	TSCD	5.568E-004	8
3	OK		8
4	TSCD	1.553E-007	8
5	OK		8
6	OK		8
7	TSCD	0.000E+000	8
8	TSCD	2.053E-008	8
9	TSCD	1.032E-005	8
10	OK		24
11	TSCD	1.249E-005	24
12	TSCD	1.632E-006	24
13	TSCD	1.422E-005	24
14	TSCD	1.939E-006	24
15	TSCD	1.147E-006	24
16	OK		300
17	TSCD	4.949E-008	300
18	OK		300
19	TSCD	3.841E-009	300
20	OK		300
21	OK		300
22	TSCD	0.000E+000	300
23	TSCD	5.074E-010	300
24	TSCD	2.034E-009	300
25	OK		300
26	TSCD	2.138E-008	300
27	TSCD	5.034E-009	300
28	TSCD	2.332E-008	300
29	TSCD	3.267E-009	300
30	TSCD	6.459E-009	300

Figure 3-2. Small SGTR event tree (TSCD sequences) - Affected SG isolated.

Table B1. Comparison of EG&G Small Break SGTR Tree with Staff Tree

Item	EG&G	Staff for this Assessment
NO LOOP	Failure rate = 8E-5 per reactor year	No change
SG AVAIL	Failure rate = 3E-2 if 1 SG in use; 7.8E-3 for 2	No change
HPI	EG&G treated as one sequence with failure rate of 1.5E-3. Human error causes 17% of the losses for two HPI; 66% for one.	Staff uses 2 sequences. It first checks for two HPI and then for one so that later branches can reflect different response due to number of HPI trains in operation. Total HPI failure frequency remains the same.
PZR SPRAY	3.5E-4 with human error causing 66% of the failures due to failure to initiate spray.	Staff judges human mistake to be so obvious it will be caught quickly since key long term response is to depressurize and many personnel will be involved, any of whom can flag mistake. Human contribution reduced by 10 for failure rate of 1.4E-4.
PORV OPEN	1.1E-2 with 75% of the failures due to human error. Capability of pumping through pzr safety valves ignored.	Human error treated as above. Failure rate is 3.6E-3. Staff also ignores capability to pump through pzr safety valves.
PORV CLOSE	1.1E-2, 93% due to human error.	Human area too high by above, which also means block valve has no influence. Human error reduced by 20 to compensate for human correction and availability of block valve to obtain failure rate of 1.3E-3.
MSSV OPEN	EG&G did not include.	Staff assumed "not opened" values to represent increasing probability of MSSV opening with decreasing heat removal capability: SG avail, HPI, PORV open: 1 SG avail, 1 or 2 HPI, no PORV: 0.8 No SG, 2 HPI, no PORV: 0.5 No SG, 1 HPI, no PORV: 0.2
MSSV CLOSE	EG&G failure rate of 8.3E-2 too high for steam and ignores change with relief quality.	Staff assumed: SG avail, HPI, PORV open: no MSSV open SG avail, 2 HPI, no PORV: 0.05 SG avail, 1 HPI, no PORV: 0.1 no SG, 2 HPI, PORV: 0.4 no SG, 1 HPI, PORV: 0.6

Item	EG&G	Staff for this Assessment
RECIRC	1E-2 with 79% due to error leading to loss of recirc.	Staff assumed: SG avail, 2 HPI, PORV o: 0.005 SG avail, 1 HPI, PORV o: 0.01 no SG, 2 HPI, PORV o, MSSV c: 0.01 no SG, 2 HPI, PORV o, MSSV o: 0.2 no SG, 1 HPI, PORV o, MSSV c: 0.05 no SG, 1 HPI, PORV o, MSSV o: 0.5
DHR	7.8E-2 with almost all due to valves in the DHR suction pipe from the RCS hot leg.	Staff used 7.8E-2 for straightforward DHR initiations and increased failure rate where initiation time was judged limited or where other complications potentially compromised initiation. See Fig. B1 and Table B2.
RECOV	0.1 failure to recover for items inside containment, 0.01 for outside. Additional 0.1 failure to recover alternate success path where alternates exist.	0.1 for inside containment if environment not degraded, 0.5 if degraded; larger than 0.1 if not enough time to act. 0.01 for outside if time permits, otherwise greater failure to recover. 0.1 for alternate if clear possibility exists, otherwise greater failure to recover. See Fig. B1 and Table B2.
CORE OK	Values generally not provided	All values provided to allow comparisons and evaluation of judgements/assumptions.

Table B2. Comparison of EG&G and Staff Recovery Factors

EG&G		Staff	
Seq No	Comments	Seq No	Comments
2	Recovery (R) 1 (inside containment, 0.1 failures (F) uncorrected) applied to 32% (all % approximate), R2 (outside containment, 0.01 F uncorrected) applied to 27%, 41% operator error (OE) (most loss of DHR) with no R. F from 5.59E-4 to 1.80E-5. R3 of 0.1 applied to everything gives CDF = 1.80E-6. R1, R2, R3 give 1.80E-6/5.59E-4 = 3.2E-3 recovery factor (RF).	2 3 20 21	R1 and R2 applied since adequate time for recovery and no unusual environmental conditions exist. Both continued SG cooling with one operational SG and HPI cooling are backup methods if DHR fails. Staff considers EG&G's R3 to be reasonable and EG&G's CDF RF of 3.2E-3 is used for the isolated SG case. This is reduced by 0.1 to 2.9E-3 for steaming both SGs to compensate for the additional possibilities provided by two SGs rather than one.
4	R1 to 29%, R2 to 31% F from 1.55E-7 to 4.59E-9 36% due to spray error EG&G used no RF since CDF < E-9. RF without R3 is 0.0296.	5 6 23 24	R3 applied at spray branch with staff's failure frequency of 1.4E-4 vs EG&G's 3.5E-4. EG&G's 0.1 not applied to spray twice. Above Seq 2,3 etc rationale applies otherwise. RF of 5.6E-3 results.
7	EG&G includes RWST makeup that staff considers impractical. No data included in computer data base. End state frequency prior to use of R1, R2, R3 < E-12.	8 9 26 27	Staff's end state of same magnitude. Recovery factor of 1 (ie - no recovery actions) used since value makes little difference.
8	EG&G assumed PORV failure to open was a CDF with 0.68 recovery factor.	10 - 18, 28 - 36	Staff addressed other possibilities in its tree. Sequence frequencies small; recovery factor of 1 used.

EG&G		Staff	
Seq No	Comments	Seq No	Comments
9	Loss of HPI gave CD with > 99% due to operator error after R1 and R2 reduced end state frequency from 1.03E-5 to 7.25E-6. EG&G applied R3 to obtain CDF of 7.25E-7. Recovery factor = 0.070.	37 38	Staff considers EG&G's RF too high because containment environment likely degraded and R1 = 0.1 too optimistic. Staff assumed RF = 0.1 without analysis.
11	All significant cut sets contain successful MSSV closure. Code calculated RF of 0.0129, consistent with EG&G application of R2 = 0.01 to almost all cut sets. Code calculated CDF = 1.61E-7. EG&G concluded that final CDF < E-9; apparently applied R1 and R3 to code result leading to CDF = 1.61E-9 (and an RF = 1.29E-4)	40 41 60 61	MSSV opens (assumed by EG&G), then closes. Use of R1 = 0.1 considered inappropriate for HPI cooling and degraded containment. Staff assumed RF = 0.01 without further analysis.
		51 - 56 71 - 76	MSSV never opens (not addressed by EG&G). Same RF used as for 40, 41, 60, 61.
12	Differs from EG&G 11 by failure to achieve recirc causing CDF.	43 44 63 64	Staff addressed achieving DHR if recirc not obtained. Staff assumed RF = 1 without further analysis.
13	Failure of MSSV to close led to unanalyzed EG&G event with frequency of 1.42E-5. Code calc 90% of failures involved MSSV and EG&G used R2. RF = 9.58E-7/1.42E-5 = 0.0675.	45 - 50 65 - 70	Staff added achieving recirc and/or DHR based upon prelim analyses that BWST provides cooldown time. Use of R2 (0.01) recovery to MSSVs passing radioactive, hot steam not considered realistic. Staff assumed RF = 0.1 without further analysis.
14	No SG cooling and no PORV cause core damage. 70% of code calculated end state due to operator error in not opening PORV. RF with R1, R2, and R3 = 0.0356.	57 58 77 78	Staff considers R1 = 0.1 inappropriate to degraded containment. Assumed RF = 0.07 without further analysis.

EG&G		Staff	
Seq No	Comments	Seq No	Comments
15	No SG cooling and no HPI cause core damage. EG&G RF = 0.0139	79 80	Staff used EG&G value.

Table B3. Small SGTR, Isolate Affected SG, Initiation Frequency = 7.2E-3

NO LOOP	SG AVAIL	TWO HPI	ONE HPI	PZR SPRAY	PORV OPEN	PORV CLOSE	MSSV OPEN	MSSV CLOSE	RECIRC	DHR	RECOV	CORE OK	CORE DAMAGE	NON-RECOV. FACTOR	
8.00e-05	3.00e-02	6.00e-03	2.50e-01	1.40e-04	3.60e-03	1.30e-03	8.00e-01 8.00e-01 5.00e-01 2.00e-01	5.00e-02 1.00e-01 4.00e-01 6.00e-01	5.00e-03 5.00e-02 1.00e-02 1.00e-01 5.00e-01	7.80e-02 1.50e-01 2.00e-01 3.00e-01 4.00e-01 5.00e-01 8.00e-01	See non- recov. factor column				
7.20e-03	6.98e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.40e-03	6.40e-03	6.40e-03			1
7.20e-03	6.98e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	5.41e-04	5.40e-04	5.40e-04		3.20e-03	2
7.20e-03	6.98e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	6.94e-03	5.41e-04	1.73e-06		1.73e-06	3.20e-03	3
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	9.68e-07	9.67e-07	9.67e-07	9.67e-07	9.67e-07	8.92e-07	8.92e-07	8.92e-07			4
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	9.68e-07	9.67e-07	9.67e-07	9.67e-07	9.67e-07	7.54e-08	7.50e-08	7.50e-08		5.60e-03	5
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	9.68e-07	9.67e-07	9.67e-07	9.67e-07	9.67e-07	7.54e-08	4.22e-10		4.22e-10	5.60e-03	6
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	9.68e-07	1.26e-09	1.26e-09	1.26e-09	1.25e-09	1.25e-09	1.25e-09	1.25e-09			7
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	9.68e-07	1.26e-09	1.26e-09	1.26e-09	6.29e-12	6.29e-12	0.00	0.00		1.00e+00	8
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	9.68e-07	1.26e-09	1.26e-09	1.26e-09	6.29e-12	6.29e-12	6.29e-12		6.29e-12	1.00e+00	9
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	7.00e-10	6.65e-10	6.65e-10	5.32e-10	5.32e-10	5.32e-10			10
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	7.00e-10	6.65e-10	6.65e-10	1.33e-10	0.00	0.00		1.00e+00	11
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	7.00e-10	6.65e-10	6.65e-10	1.33e-10	1.33e-10		1.33e-10	1.00e+00	12
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	7.00e-10	3.50e-11	3.50e-11	2.80e-11	2.80e-11	2.80e-11			13
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	7.00e-10	3.50e-11	3.50e-11	7.00e-12	0.00	0.00		1.00e+00	14
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	7.00e-10	3.50e-11	3.50e-11	7.00e-12	7.00e-12		7.00e-12	1.00e+00	15
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	2.80e-09	2.80e-09	2.80e-09	2.24e-09	2.24e-09	2.24e-09			16
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	2.80e-09	2.80e-09	2.80e-09	5.60e-10	0.00	0.00		1.00e+00	17
7.20e-03	6.98e-03	6.94e-03	6.94e-03	9.72e-07	3.50e-09	3.50e-09	2.80e-09	2.80e-09	2.80e-09	5.60e-10	5.60e-10		5.60e-10	1.00e+00	18
7.20e-03	6.98e-03	4.19e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	2.90e-05	2.90e-05	2.90e-05			19
7.20e-03	6.98e-03	4.19e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	2.45e-06	2.44e-06	2.44e-06		3.20e-03	20
7.20e-03	6.98e-03	4.19e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	3.14e-05	2.45e-06	7.84e-09		7.84e-09	3.20e-03	21
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	4.38e-09	4.38e-09	4.38e-09	4.38e-09	4.38e-09	4.04e-09	4.04e-09	4.04e-09			22
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	4.38e-09	4.38e-09	4.38e-09	4.38e-09	4.38e-09	3.41e-10	3.40e-10	3.40e-10		5.60e-03	23
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	4.38e-09	4.38e-09	4.38e-09	4.38e-09	4.38e-09	3.41e-10	1.91e-12		1.91e-12	5.60e-03	24
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	4.38e-09	5.70e-12	5.70e-12	5.70e-12	5.64e-12	5.64e-12	5.64e-12	5.64e-12			25
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	4.38e-09	5.70e-12	5.70e-12	5.70e-12	5.70e-14	5.70e-14	0.00	0.00		1.00e+00	26
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	4.38e-09	5.70e-12	5.70e-12	5.70e-12	5.70e-14	5.70e-14	5.70e-14		5.70e-14	1.00e+00	27
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	3.17e-12	2.85e-12	2.85e-12	1.71e-12	1.71e-12	1.71e-12			28
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	3.17e-12	2.85e-12	2.85e-12	1.14e-12	0.00	0.00		1.00e+00	29
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	3.17e-12	2.85e-12	2.85e-12	1.14e-12	1.14e-12		1.14e-12	1.00e+00	30
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	3.17e-12	3.17e-13	3.17e-13	1.90e-13	1.90e-13	1.90e-13			31
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	3.17e-12	3.17e-13	3.17e-13	1.27e-13	0.00	0.00		1.00e+00	32
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	3.17e-12	3.17e-13	3.17e-13	1.27e-13	1.27e-13		1.27e-13	1.00e+00	33
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	1.27e-11	1.27e-11	1.27e-11	7.60e-12	7.60e-12	7.60e-12			34
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	1.27e-11	1.27e-11	1.27e-11	5.07e-12	0.00	0.00		1.00e+00	35
7.20e-03	6.98e-03	4.19e-05	3.14e-05	4.40e-09	1.58e-11	1.58e-11	1.27e-11	1.27e-11	1.27e-11	5.07e-12	5.07e-12		5.07e-12	1.00e+00	36
7.20e-03	6.98e-03	4.19e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	9.43e-06	9.43e-06		1.00e-01	37
7.20e-03	6.98e-03	4.19e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-05	1.05e-06		1.05e-06	1.00e-01	38
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	6.42e-05	6.35e-05	5.40e-05	5.40e-05	5.40e-05			39
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	6.42e-05	6.35e-05	9.53e-06	9.43e-06	9.43e-06		1.00e-02	40
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	6.42e-05	6.35e-05	9.53e-06	9.53e-08		9.53e-08	1.00e-02	41
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	6.42e-05	6.42e-07	5.45e-07	5.45e-07	5.45e-07			42
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	6.42e-05	6.42e-07	9.63e-08	0.00	0.00		1.00e+00	43
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	6.42e-05	6.42e-07	9.63e-08	9.63e-08		9.63e-08	1.00e+00	44
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	4.28e-05	3.85e-05	3.27e-05	3.27e-05	3.27e-05			45
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	4.28e-05	3.85e-05	5.78e-06	5.20e-06	5.20e-06		1.00e-01	46
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	4.28e-05	3.85e-05	5.78e-06	5.78e-07		5.78e-07	1.00e-01	47
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	4.28e-05	4.28e-06	2.14e-06	2.14e-06	2.14e-06			48
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	4.28e-05	4.28e-06	2.14e-06	1.93e-06	1.93e-06		1.00e-01	49
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	4.28e-05	4.28e-06	2.14e-06	2.14e-07		2.14e-07	1.00e-01	50
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	1.07e-04	1.06e-04	9.00e-05	9.00e-05	9.00e-05			51
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	1.07e-04	1.06e-04	1.59e-05	1.57e-05	1.57e-05		1.00e-02	52
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	1.07e-04	1.06e-04	1.59e-05	1.59e-07		1.59e-07	1.00e-02	53
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	1.07e-04	1.07e-06	7.49e-07	7.49e-07	7.49e-07			54
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	1.07e-04	1.07e-06	3.21e-07	3.18e-07	3.18e-07		1.00e-02	55
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	2.14e-04	2.14e-04	1.07e-04	1.07e-04	1.07e-06	3.21e-07	3.21e-09		3.21e-09	1.00e-02	56
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	7.73e-07	7.73e-07	7.73e-07	7.73e-07	7.73e-07	7.73e-07	7.45e-07	7.45e-07		3.56e-02	57
7.20e-03	2.16e-04	2.15e-04	2.15e-04	2.15e-04	7.73e-07	7.73e-07	7.73e-07	7.73e-07	7.73e-07	7.73e-07	2.75e-08		2.75e-08	3.56e-02	58
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	3.10e-07	2.94e-07	2.06e-07	2.06e-07	2.06e-07			59
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	3.10e-07	2.94e-07	8.83e-08	8.74e-08	8.74e-08		1.00e-02	60
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	3.10e-07	2.94e-07	8.83e-08	8.83e-10		8.83e-10	1.00e-02	61
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	3.10e-07	1.55e-08	7.75e-09	7.75e-09	7.75e-09			62
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	3.10e-07	1.55e-08	7.75e-09	0.00	0.00		1.00e+00	63
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	3.10e-07	1.55e-08	7.75e-09	7.75e-09		7.75e-09	1.00e+00	64
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	4.65e-07	2.32e-07	1.63e-07	1.63e-07	1.63e-07			65
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	4.65e-07	2.32e-07	6.97e-08	6.28e-08	6.28e-08		1.00e-01	66
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	4.65e-07	2.32e-07	6.97e-08	6.97e-09		6.97e-09	1.00e-01	67
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	4.65e-07	2.32e-07	4.65e-08	4.65e-08	4.65e-08			68
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	4.65e-07	2.32e-07	1.86e-07	1.67e-07	1.67e-07		1.00e-01	69
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	7.75e-07	4.65e-07	2.32e-07	1.86e-07	1.86e-08		1.86e-08	1.00e-01	70
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	1.94e-07	1.94e-07	1.84e-07	1.29e-07	1.29e-07	1.29e-07			71
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	1.94e-07	1.94e-07	1.84e-07	5.52e-08	5.46e-08	5.46e-08		1.00e-02	72
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	1.94e-07	1.94e-07	1.84e-07	5.52e-08	5.52e-10		5.52e-10	1.00e-02	73
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	1.94e-07	1.94e-07	9.68e-09	4.84e-09	4.84e-09	4.84e-09			74
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	1.94e-07	1.94e-07	9.68e-09	4.84e-09	4.79e-09	4.79e-09		1.00e-02	75
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	9.68e-07	9.68e-07	1.94e-07	1.94e-07	9.68e-09	4.84e-09	4.84e-11		4.84e-11	1.00e-02	76
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	3.50e-09	3.50e-09	3.50e-09	3.50e-09	3.50e-09	3.50e-09	3.37e-09	3.37e-09		3.56e-02	77
7.20e-03	2.16e-04	1.30e-06	9.72e-07	9.72e-07	3.50e-09	3.50e-09	3.50e-09	3.50e-09	3.50e-09	3.50e-09	1.25e-10		1.25e-10	3.56e-02	78
7.20e-03	2.16e-04	1.30e-06	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.01e-07	3.01e-07		7.00e-02	79
7.20e-03	2.16e-04	1.30e-06	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.24e-07	3.24e-07	2.27e-08		2.27e-08	7.00e-02	80
											TOTALS =	7.20e-03	4.02e-06		

Table B4. Small SGTR, Steam Both SGs, Initiation Frequency = 7.2E-03

NO LOOP	SG AVAIL	TWO HPI	ONE HPI	PZR SPRAY	PORV OPEN	PORV CLOSE	MSSV OPEN	MSSV CLOSE	RECIRC	DHR	RECOV	CORE OK	CORE DAMAGE	NON-RECOV. FACTOR	
8.00e-05	7.80e-03	6.00e-03	2.50e-01	1.40e-04	3.60e-03	1.30e-03	8.00e-01 8.00e-01 5.00e-01 2.00e-01	5.00e-02 1.00e-01 4.00e-01 6.00e-01	5.00e-03 5.00e-02 1.00e-02 1.00e-01 5.00e-01	7.80e-02 1.50e-01 2.00e-01 3.00e-01 4.00e-01 5.00e-01 8.00e-01	See non-recov. factor column				
7.20e-03	7.14e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	6.55e-03	6.55e-03	6.55e-03			1
7.20e-03	7.14e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	5.64e-04	5.52e-04	5.52e-04		2.90e-03	2
7.20e-03	7.14e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	7.10e-03	5.64e-04	1.61e-06		1.61e-06	2.90e-03	3
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	9.90e-07	9.89e-07	9.89e-07	9.89e-07	9.89e-07	9.12e-07	9.12e-07	9.12e-07			4
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	9.90e-07	9.89e-07	9.89e-07	9.89e-07	9.89e-07	7.72e-08	7.67e-08	7.67e-08		5.60e-03	5
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	9.90e-07	9.89e-07	9.89e-07	9.89e-07	9.89e-07	7.72e-08	4.32e-10		4.32e-10	5.60e-03	6
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	9.90e-07	1.29e-09	1.29e-09	1.29e-09	1.28e-09	1.28e-09	1.28e-09	1.28e-09			7
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	9.90e-07	1.29e-09	1.29e-09	1.29e-09	6.44e-12	6.44e-12	0.00	0.00		1.00e+00	8
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	9.90e-07	1.29e-09	1.29e-09	1.29e-09	6.44e-12	6.44e-12	6.44e-12		6.44e-12	1.00e+00	9
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	7.16e-10	6.80e-10	6.80e-10	5.44e-10	5.44e-10	5.44e-10			10
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	7.16e-10	6.80e-10	6.80e-10	1.36e-10	0.00	0.00		1.00e+00	11
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	7.16e-10	6.80e-10	6.80e-10	1.36e-10	1.36e-10		1.36e-10	1.00e+00	12
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	7.16e-10	3.58e-11	3.58e-11	2.86e-11	2.86e-11	2.86e-11			13
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	7.16e-10	3.58e-11	3.58e-11	7.16e-12	0.00	0.00		1.00e+00	14
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	7.16e-10	3.58e-11	3.58e-11	7.16e-12	7.16e-12		7.16e-12	1.00e+00	15
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	2.86e-09	2.86e-09	2.86e-09	2.29e-09	2.29e-09	2.29e-09			16
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	2.86e-09	2.86e-09	2.86e-09	5.73e-10	0.00	0.00		1.00e+00	17
7.20e-03	7.14e-03	7.10e-03	7.10e-03	9.94e-07	3.58e-09	3.58e-09	2.86e-09	2.86e-09	2.86e-09	5.73e-10	5.73e-10		5.73e-10	1.00e+00	18
7.20e-03	7.14e-03	4.29e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	2.96e-05	2.96e-05	2.96e-05			19
7.20e-03	7.14e-03	4.29e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	2.51e-06	2.50e-06	2.50e-06		2.90e-03	20
7.20e-03	7.14e-03	4.29e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	3.21e-05	2.51e-06	7.27e-09		7.27e-09	2.90e-03	21
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	4.48e-09	4.48e-09	4.48e-09	4.48e-09	4.48e-09	4.13e-09	4.13e-09	4.13e-09			22
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	4.48e-09	4.48e-09	4.48e-09	4.48e-09	4.48e-09	3.49e-10	3.47e-10	3.47e-10		5.60e-03	23
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	4.48e-09	4.48e-09	4.48e-09	4.48e-09	4.48e-09	3.49e-10	1.96e-12		1.96e-12	5.60e-03	24
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	4.48e-09	5.83e-12	5.83e-12	5.83e-12	5.77e-12	5.77e-12	5.77e-12	5.77e-12			25
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	4.48e-09	5.83e-12	5.83e-12	5.83e-12	5.83e-14	5.83e-14	0.00	0.00		1.00e+00	26
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	4.48e-09	5.83e-12	5.83e-12	5.83e-12	5.83e-14	5.83e-14	5.83e-14		5.83e-14	1.00e+00	27
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	3.24e-12	2.92e-12	2.92e-12	1.75e-12	1.75e-12	1.75e-12			28
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	3.24e-12	2.92e-12	2.92e-12	1.17e-12	0.00	0.00		1.00e+00	29
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	3.24e-12	2.92e-12	2.92e-12	1.17e-12	1.17e-12		1.17e-12	1.00e+00	30
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	3.24e-12	3.24e-13	3.24e-13	1.94e-13	1.94e-13	1.94e-13			31
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	3.24e-12	3.24e-13	3.24e-13	1.30e-13	0.00	0.00		1.00e+00	32
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	3.24e-12	3.24e-13	3.24e-13	1.30e-13	1.30e-13		1.30e-13	1.00e+00	33
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	1.30e-11	1.30e-11	1.30e-11	7.78e-12	7.78e-12	7.78e-12			34
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	1.30e-11	1.30e-11	1.30e-11	5.18e-12	0.00	0.00		1.00e+00	35
7.20e-03	7.14e-03	4.29e-05	3.21e-05	4.50e-09	1.62e-11	1.62e-11	1.30e-11	1.30e-11	1.30e-11	5.18e-12	5.18e-12		5.18e-12	1.00e+00	36
7.20e-03	7.14e-03	4.29e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	9.64e-06	9.64e-06		1.00e-01	37
7.20e-03	7.14e-03	4.29e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-05	1.07e-06		1.07e-06	1.00e-01	38
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.67e-05	1.65e-05	1.40e-05	1.40e-05	1.40e-05			39
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.67e-05	1.65e-05	2.48e-06	2.45e-06	2.45e-06		1.00e-02	40
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.67e-05	1.65e-05	2.48e-06	2.48e-08		2.48e-08	1.00e-02	41
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.67e-05	1.67e-07	1.42e-07	1.42e-07	1.42e-07			42
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.67e-05	1.67e-07	2.50e-08	0.00	0.00		1.00e+00	43
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.67e-05	1.67e-07	2.50e-08	2.50e-08		2.50e-08	1.00e+00	44
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.11e-05	1.00e-05	8.51e-06	8.51e-06	8.51e-06			45
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.11e-05	1.00e-05	1.50e-06	1.35e-06	1.35e-06		1.00e-01	46
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.11e-05	1.00e-05	1.50e-06	1.50e-07		1.50e-07	1.00e-01	47
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.11e-05	1.11e-06	5.56e-07	5.56e-07	5.56e-07			48
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.11e-05	1.11e-06	5.56e-07	5.01e-07	5.01e-07		1.00e-01	49
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	1.11e-05	1.11e-06	5.56e-07	5.56e-08		5.56e-08	1.00e-01	50
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	2.78e-05	2.75e-05	2.34e-05	2.34e-05	2.34e-05			51
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	2.78e-05	2.75e-05	4.13e-06	4.09e-06	4.09e-06		1.00e-02	52
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	2.78e-05	2.75e-05	4.13e-06	4.13e-08		4.13e-08	1.00e-02	53
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	2.78e-05	2.78e-07	1.95e-07	1.95e-07	1.95e-07			54
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	2.78e-05	2.78e-07	8.34e-08	8.26e-08	8.26e-08		1.00e-02	55
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	5.56e-05	5.56e-05	2.78e-05	2.78e-05	2.78e-07	8.34e-08	8.34e-10		8.34e-10	1.00e-02	56
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	2.01e-07	2.01e-07	2.01e-07	2.01e-07	2.01e-07	2.01e-07	1.94e-07	1.94e-07		3.56e-02	57
7.20e-03	5.62e-05	5.58e-05	5.58e-05	5.58e-05	2.01e-07	2.01e-07	2.01e-07	2.01e-07	2.01e-07	2.01e-07	7.15e-09		7.15e-09	3.56e-02	58
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	8.06e-08	7.65e-08	5.36e-08	5.36e-08	5.36e-08			59
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	8.06e-08	7.65e-08	2.30e-08	2.27e-08	2.27e-08		1.00e-02	60
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	8.06e-08	7.65e-08	2.30e-08	2.30e-10		2.30e-10	1.00e-02	61
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	8.06e-08	4.03e-09	2.01e-09	2.01e-09	2.01e-09			62
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	8.06e-08	4.03e-09	2.01e-09	0.00	0.00		1.00e+00	63
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	8.06e-08	4.03e-09	2.01e-09	2.01e-09		2.01e-09	1.00e+00	64
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	1.21e-07	6.04e-08	4.23e-08	4.23e-08	4.23e-08			65
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	1.21e-07	6.04e-08	1.81e-08	1.63e-08	1.63e-08		1.00e-01	66
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	1.21e-07	6.04e-08	1.81e-08	1.81e-09		1.81e-09	1.00e-01	67
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	1.21e-07	6.04e-08	1.21e-08	1.21e-08	1.21e-08			68
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	1.21e-07	6.04e-08	4.83e-08	4.35e-08	4.35e-08		1.00e-01	69
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	2.01e-07	1.21e-07	6.04e-08	4.83e-08	4.83e-09		4.83e-09	1.00e-01	70
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	5.04e-08	5.04e-08	4.78e-08	3.35e-08	3.35e-08	3.35e-08			71
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	5.04e-08	5.04e-08	4.78e-08	1.44e-08	1.42e-08	1.42e-08		1.00e-02	72
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	5.04e-08	5.04e-08	4.78e-08	1.44e-08	1.44e-10		1.44e-10	1.00e-02	73
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	5.04e-08	5.04e-08	2.52e-09	1.26e-09	1.26e-09	1.26e-09			74
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	5.04e-08	5.04e-08	2.52e-09	1.26e-09	1.25e-09	1.25e-09		1.00e-02	75
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	2.52e-07	2.52e-07	5.04e-08	5.04e-08	2.52e-09	1.26e-09	1.26e-11		1.26e-11	1.00e-02	76
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	9.10e-10	9.10e-10	9.10e-10	9.10e-10	9.10e-10	9.10e-10	8.77e-10	8.77e-10		3.56e-02	77
7.20e-03	5.62e-05	3.37e-07	2.53e-07	2.53e-07	9.10e-10	9.10e-10	9.10e-10	9.10e-10	9.10e-10	9.10e-10	3.24e-11		3.24e-11	3.56e-02	78
7.20e-03	5.62e-05	3.37e-07	8.42e-08	8.42e-08	8.42e-08	8.42e-08	8.42e-08	8.42e-08	8.42e-08	8.42e-08	7.83e-08	7.83e-08		7.00e-02	79
7.20e-03	5.62e-05	3.37e-07	8.42e-08	8.42e-08	8.42e-08	8.42e-08	8.42e-08	8.42e-08	8.42e-08	8.42e-08	5.90e-09		5.90e-09	7.00e-02	80
											TOTALS =	7.20e-03	3.01e-06		