SAFETY PARAMETER DISPLAY SYSTEM ACCIDENT MONITORING INSTRUMENTATION DATABASE IDENTIFICATION STUDY FOR RIVER BEND STATION UNIT 1

GULF STATES UTILITIES COMPANY

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POST OFFICE BOX 2431 BATON ROUGE, LOUISIANA 70821
AREA CODE 504 767-1802

April 24, 1984
RBG- 17,668
File Nos. G9.5, G9.33.4,
G9.8.6.2

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulations
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Denton:

River Bend Station - Unit 1
Docket No. 50-458

In Gulf States Utilities Company (GSU) August 31, 1983 submittal concerning Generic Letter 82-33, "Supplement 1 to NUREG-0737-Requirements for Emergency Response Capability," a Safety Parameter Display System (SPDS) implementation plan and operability schedule (item 4.2.b) was provided based on the currently projected River Bend Station (RBS) fuel load date of April 1985. The schedule identified the SPDS safety analysis report to be submitted in May 1984. In support of the RBS Safety Evaluation Report issuance, the RBS SPDS safety analysis report is attached for Nuclear Regulatory Commission Staff review to demonstrate compliance with Generic Letter 82-33 item 4.2.a. Additional submittals addressing Detailed Control Room Design Review, Regulatory Guide 1.97, Revision 3 and Emergency Operating Procedures Generation Package will follow.

Sincerely,

J. E. Booker

J. E. Booker
Manager-Engineering
Nuclear Fuel & Licensing
River Bend Nuclear Group

JEB/WJR/RJK/je

Attachment

A003 1/1

SAFETY PARAMETER DISPLAY SYSTEM
ACCIDENT MONITORING INSTRUMENTATION DATABASE
IDENTIFICATION STUDY FOR RIVER BEND STATION UNIT 1

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INTRODUCTION

The accident at Three Mile Island Unit 2 has served to focus Industry attention on the need for adequate instrumentation and human-factored displays for plant operators to follow and help mitigate the consequences of various plant transients. The NRC Staff and the Industry have commissioned several studies (References 1 through 5) to identify the subject instrumentation. River Bend Station (RBS) has reviewed the existing literature on this subject and has within this study documented a listing of needed instrumentation which is specific to the plant. This report establishes a listing of RBS-specific plant variables which is used as a basis upon which to compare the Safety Parameter Display System (SPDS) database and the inventory of main control room instrumentation to be reviewed by the Detailed Control Room Design Review (DCRDR) study.

OBJECTIVE

The objective of this study is to validate an RBS-specific listing of parameters that will be available for monitoring to furnish control room operators with sufficient information to mitigate or limit the consequences of abnormal and accident events. Additionally, the study endeavors to describe the basis upon which RBS believes that the listing is necessary and sufficient to assess the safety status of the plant. The listing delineates specific instruments which are used to monitor each identified parameter.

It is intended that this study will serve as the licensing basis for demonstrating compliance with the guidance provided by the NRC Staff in Generic Letter 82-33 Item 4.2.a.

METHODOLOGY

The validation of an RBS-specific listing of accident monitoring variables required an action plan depicted in Figure 1 and described below to insure a necessary and sufficient list of variables:

1) Several event tree analysis studies (References 1 and 2) were reviewed for information and a tabulation of variables to be monitored was developed.

   Additionally, the RBS emergency operating procedures (EOP's) were reviewed to define specific instrumentation needs for implementing required operator actions defined therein.

2) The two lists generated (Appendix A and B) were merged with the variable list identified in Table 2 of Regulatory Guide 1.97, Revision 3 to form a composite variable list (Table 1) which would encompass the monitoring of a large number of possible events.

3) RBS-specific information such as instrument identification numbers and location of benchboard displays was added to the list compilation.

   A separate review (Appendix D) was performed to verify the categorization of each variable identified in the composite list in terms of importance of its function. This data was entered into the list.

4) The composite variable list (Table 1) was compared to the SPDS database of monitored variables to insure its adequacy based on the study results.

   Further, the plant design was reviewed against Table 1 to identify specific deviations from regulatory direction. While every effort was made to identify RBS deviations, there still remains equipment qualification-related work to confirm required accuracies, operability times, and response times for the subject instruments identified in Table 1. Therefore, RBS will continue to appraise the existing plant design for equipment qualification-related anomolies as part of the RBS equipment qualification program.

FINDINGS

RBS has identified several differences in the plant design with the regulatory direction provided by R.G. 1.97, Revision 3 as well as the results of this study. Table 2 provides a formal listing of the findings together with an evaluation of each. Specific design revisions, if required, and an implementation schedule for same shall be developed and documented as a part of the DCRDR Summary Report to be submitted to the NRC Staff for review during October, 1984.

The findings were generated as a result of a sequential review of each variable in the composite variable list against regulatory and technical guidance which RBS has committed to comply with. The review criteria consisted of, but were not limited to, the following:

1) The variable was reviewed to insure that the necessary information was transmitted to the SPDS database.

2) The implementation of the variable (i.e., proper range, acceptable power supply, redundancy as required, etc.) was checked against R.G. 1.97, Revision 3 criteria for agreement.

3) Additionally, the implementation of the variable was reviewed against the study results which include variables identified by the event tree analysis and the emergency operating procedures.

CONCLUSIONS

The existing design of RBS accident monitoring instrumentation and the completeness of the SPDS database in conjunction with the resolution of the findings identified herein are deemed sufficient to safely operate the plant given current design bases.

FIGURE 1

ACCIDENT MONITORING INSTRUMENTATION STUDY

IMPLEMENTATION METHODOLOGY

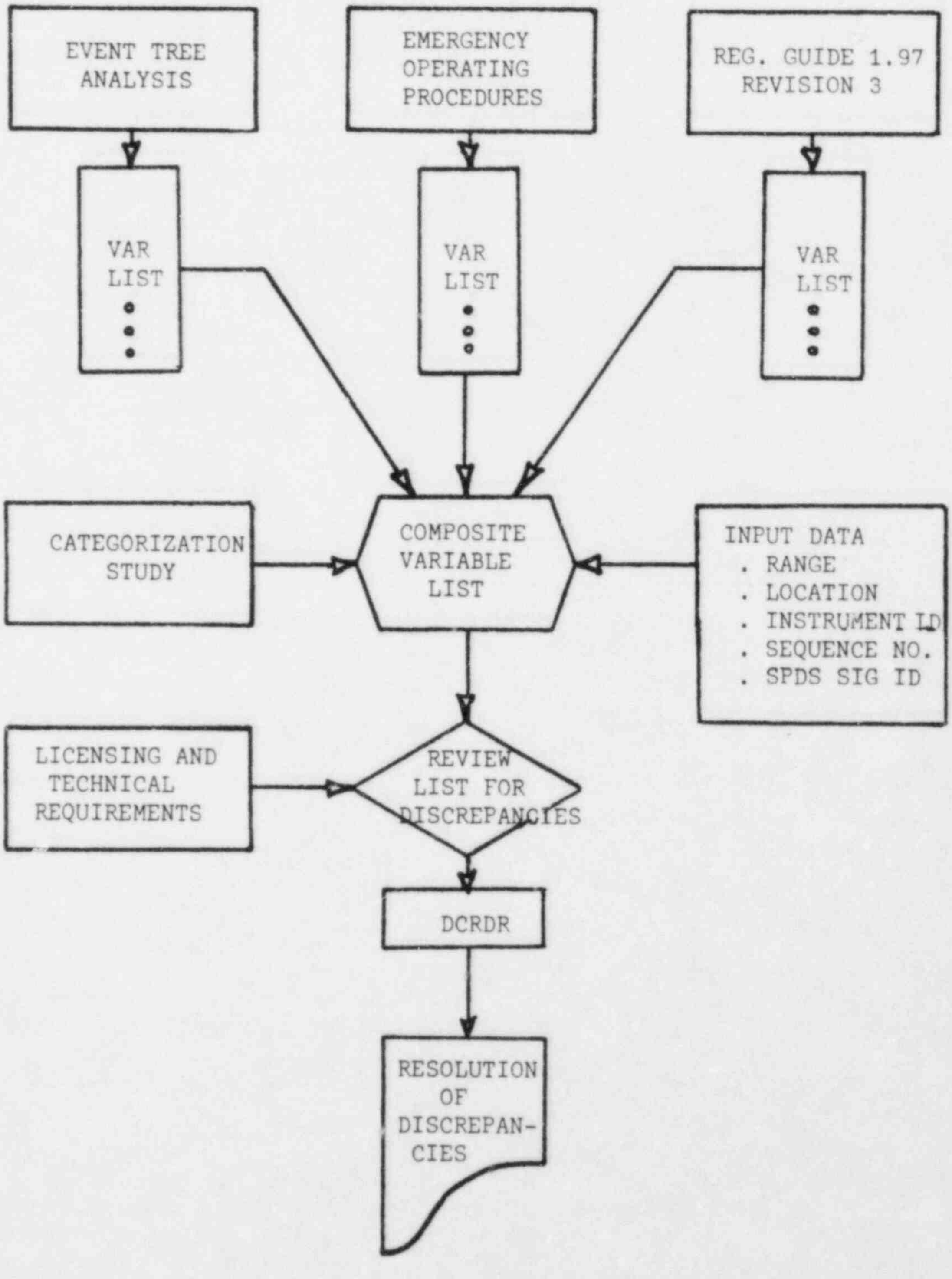


TABLE 1 LEGEND

SEQUENCE NO. - Each distinct variable is identified by a unique sequence number for reference purposes.

SOURCE - An "X" is placed in the appropriate column if a variable was identified by the particular method shown.

INSTRUMENT ID - This is the alphanumeric designator assigned by Stone & Webster Engineering Corporation (SWEC) for the sending instrument(s).

CATEGORY - This is the category designation assigned by GSU Engineering from its independent review delineated in Appendix D. The numbering convention definitions are the same as those used in R.G. 1.97, Revision 3.

MCR DISPLAY BENCHBOARD - The SWEC identification number is shown for the panel(s) where the instrument channel display is located.

SPDS SIG ID - This alphanumeric number is the unique identifier assigned by General Electric (GE) to identify the variable monitored by the SPDS database. GE is furnishing the RBS SPDS.

RANGE - The current design range of each listed instrument is given.

DIVERSE BACKUP - This column identifies any variable(s) which serves as a diverse backup for the present variable. The diverse backup variable is shown by referencing its sequence number as indicated in Table 1.

REFERENCE NOTES - Table 1 is furnished with a REFERENCE NOTES section at the end of the table for inclusion of technical comments.

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE: RG 1.97	SOURCE: EOP	SOURCE: TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
1	**Reactor Vessel Water Level**	X	X	X	1B21*LTN044C,D *PTN062A,B *LTN081C *LTN027 1C33*LTN017 *LTN004A,B,C	1	1H13*P601 1H13*P680	B21EA001 007 C33EA024 027	209 - 409 in (Fuel Zone) 521 - 581 in (Narrow) 361 - 581 in (Wide Range) 521 - 921 in (Shutdown) 521 - 701 in (Upset)	1
2	**Reactor Vessel Pressure**	X	X	X	1C33*PTN005 *PTN008A	1	1H13*P680	B21EA008	0-1200 psig 850-1050 psig	
					1B21*PTN062A,B		1H13*P601	013 C33EA028 033	0-1500 psig	
3	**Drywell Pressure**	X	X	X	1CMS*PT2A,B	1	1H13*P808	CMSPY024 025	0-50 psia	
4	**Containment/Drywell Hydrogen Concentration**	X	X	X	1CMS*AT25A,B	1	1H13*P808	CMSYY001 002	0 - 10% Hydrogen (Narrow) 0 - 30% Hydrogen (Wide)	2
5	**Suppression Pool Level**	X	X	X	1CMS*LIT23A,B	1	1H13*P808	CMSLY028 029	minus 18 - 4 ft measured from normal pool level	3

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
6	Suppression Pool Temperature	X	X	X	1CMS*TT24A,C,E *TT24B,D,F *TT24G,J *TT24H,K *TT40A,C *TT40B,D	1	1H13*P808	CMSTY005 018	0-200°F	
7	Control Rod Position (Typical for 145 Rods)	X	X	X	1B13-D124 Channel A & B	3	1H13*P680	C11EC004	Full In/Discrete Intermediate Positions/Full Out	4
8	LPCS Flow	X	X	X	1E21*FTN003	2	1H13*P601	E21EA001	0-7000 gpm	
9	Condensate Storage Tank Level	X	X	X	1CNS-LT110	3	1H13*P680	CNMLY006	Top to Bottom	20
10	SLCS Tank Level	X	X	X	1C41*LTN001	2	1H13*P601	C41EA002	0-5000 gal	
11	SRV Position	X	X	X	1SVV*ZE10 A-H, J-N, P-R	2	1H13*P601	B21EC042 060	Full Closed/Intermediate/Full Open	19

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
12	Primary Containment Radiation	X	X	X		1	1H13*P879 *P878			5
	Primary Containment Atmosphere				1RMS*RE16A,B *RE111				1.0 - 10^{7} R/hr 10^{-11} - 10^{-1} Ci/cc	
	Drywell Atmosphere				1RMS*RE112				10^{-11} - 10^{-1} Ci/cc	
	Drywell Area				1RMS*RE20A,B				1.0 - 10^{7} R/hr	
	Drywell Personnel Airlock				1RMS-RE138				1.0 - 10^{5} mr/hr	
13	Containment Effluent Radioactivity	X	X	X	1RMS*RE125 *RE5A,B	2			10^{-7} - 10^{5} Ci/cc	6
14	Radiation Level in Circulating Primary Coolant	X								21
15	Drywell Atmosphere Temperature	X	X		1CMS*RTD41A,B,C,D	1	1H13*P808	CMSTY026 027	0 - 446°F	29
16	Containment/Drywell Oxygen Concentration	X	X							7

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
17	Drywell Equipment and Floor Drain Sump Water Level	X	X		1E31*LTN093 *LTN094 *LTN095 *LTN096 *LTN097	2	1H13*P632	DFRLY001 005 DERLY003	5 - 25 gpm	
18	Neutron Flux	X	X	X		1	1H13*P680	C51EA003		8
	LPRM Detectors				1C51*JEN011 *JEN012 *JEN013 *JEN014				1 - 120 percent full power	
	IRM Detectors				1C51*JEN002A *JEN002B *JEN002C *JEN002D *JEN002E *JEN002F *JEN002G *JEN002H			010 021 024	5 X 10^{-4} - 10.0 percent full power	
	SRM Detectors				1C51*JEN001A,B,C,D				10^{-7} - 10^{-3} percent full power	

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
19	Main Steam Line Radiation		X		1D17*REN003A,B,C,D	3	1H13*P680		1.0 - 10^6 mr/hr	9
20	Status of HPCS DG			X		3	1H13*P601		Available/Unavailable	10
21	RHR HX Inlet/Outlet Temperatures	X		X	1E12*TEN004A,B *TEN002A,B *TEN027A,B *TEN005A,B *TEN003A,B 1RHS*RTD47A,B	2	1H13*P601	E12EA124 129	0° - 600°F	
22	Containment Isolation Valve Positions	X		X		1	1H13*P863 *P601 *P870		Open/Intermediate/Closed	11
23	RPV Boron Concentration (grab)	X		X		3				12
24	RHR Flow	X	X		1E12*FTN015A,B,C	2	1H13*P601	E12EA005 007	0 - 8,000 gpm	

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE: RG 1.97	SOURCE: EOP	SOURCE: TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
25	MSIV Positions		X	X	1B21*AOVF022A,B,C,D *AOVF028A,B,C,D	1	1H13*P601	B21EC070 074 076 077 079 080 082 083 085 086 088 089 091 092	Open/Closed	13
26	RCIC Flow	X		X	1E51*FTN003	2	1H13*P601	E51EA005 006	0-800 gpm	
27	Feedwater Flow Pump A Pump B	X		X	 1C33-FTN002A -FTN002B	3	1H13*P680	C33EA019 020	0 - 8 X 10^6 lbm/hr	

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
28	HPCS Flow	X		X	1E22*FTN005	2	1H13*P601	E22EA001 006	0-7000 gpm	
29	Area Radiation	X	X			3	1RMS-DSPL230			14
30	Airborne Radioactivity Releases	X	X		1RMS*RE125 *RE5A,B -RE6A	2	1RMS-DSPL230		10^{-7} - 10^{5} Ci/cc	15
31	Core Temperature	X		X						16
32	Suppression Pool Hydrogen/ Oxygen Concentration		X			3				27
33	Containment Water Level		X			3				17
34	Containment Atmosphere Temperature		X	X	1CMS*RTD42A-G,J	3	1H13*P808	CMSTY028 037	0^{c} - 200^{0}F	

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
35	Primary Containment Pressure	X	X	X		1				
	Annulus Differential				1HVR*PDT60A thru F			HVRPY222 223		25
	Drywell Differential				1CMS*PDT29A,B		1H13*P808	CMSPY019 020	minus 15 - 30 psid	
	Absolute				1CMS*PT4A,B		1H13*P808		0 - 75 psia	
36	RCIC Turbine Speed		X		1E51*PC002-1	3	1H13*P601	E51EA014	0 - 6000 rpm	
*37	Reactor Cooldown Rate		X		1B21-N029A,B -N030A,B -N050A,B	3	1H13*P614	B21EA022	0 - 600°F	26
38	Turbine Stop Valve Positions		X		1C71*ZSN006A-H	3	1H13*P870	N32EA001 002 003 004	Open/Closed	9
39	Turbine Control Valve Positions		X		1MSS-HYVCV1 -HYVCV4	3	1H13*P870	N32EA005 008	Open/Closed	9

TABLE 1

C' IPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
40	Turbine Bypass Valve Position		X	X	1C85-VF001	3	1H13*P870	C85EA011 012 013	Open/Closed	9
41	MSIV Leakage Control System Pressure	X			1E33*PTN004 *PTN005	2	1H13*P601		0 - 100 psia	
42	SCRAM Discharge Volume Level		X		1C11*LSN013A,B,C,D *LTN012A,B,C,D	3	1H13*P680		Level High	9
43	SRV Discharge Line Flow			X		3				22
44	Feedwater Controller Position			X	1C33-I/PF001A,B,C -I/PF002	3	1H13*P680	C33EA002	0 - 100% full open	
45	Condenser Hotwell Water Level			X	1CNS-LT102	3	1H13*P680	CNSLY090	0 - 100% full level	
46	Condenser Pressure		X	X	1CNM-PT45A,B	3	1H13*P680	CNMPY001 002	0 - 30 in Hg vacuum	
47	Air Ejector Line Flow			X	1CNM-PT105	3	1H13*P680	CNMFY191	0 - 800 psig	

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
48	Steam Flow to RCIC Turbine			X	1E51-PTN007	3	1H13*P601	E51EA007	0-1500 psig	
49	RHR Key Valve Positions			X		3	1H13*P601	E12EC004 006 008 012 014 016 018	Open/Closed	18
50	LPCS Key Valve Positions			X		3	1H13*P601		Open/Closed	18
51	Recirculation Line Flow			X	1B33-FTN011A,B	3	1H13*P680	B33EA021 024 025	0 - 40,000 gpm	
52	Main Steam Line Flow			X	1B21-FTN003A,B,C,D	3	1H13*P680		0 - 4 X 10^6 lbm/hr	
53	Circulating Water Flow			X	1CWS-PDT101	3	1H13*P680			20
54	SSW Discharge Pressure/ Flow	X		X	1SWP*PT50A,B *FT60A,B	2	1H13*P870	SWPFY004 005 006	0 - 150 psig 0 - 18,000 gpm	

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
55	SLCS Discharge Pressure	X		X	1C41*PTN004	2	1H13*P601	C41EA003	0-1800 psig	31
56	Condensate Pump Discharge Pressure			X	1CNM-PT105	3	1H13*P680	CNMPY010	0-800 psig	
57	Cumulative Boron Injected		X		1C41*LTN001	3	1H13*P601		0-5000 gal	30
58	HPCS Key Valve Positions			X		3	1H13*P601		Open/Closed	18
59	SSW Key Valve Positions			X		3	1H13*P870		Open/Closed	18
60	RCIC Key Valve Positions			X		3	1H13*P601		Open/Closed	18
61	Liquid Effluent Radioactivity		X			3				
	RHR HX Service Water Cooling Tower Blowdown Liquid Radwaste Effluent				1RMS*RE15A,B -RE108 -RE107		1H13*P879 *P878		10^{-7} to 10^{-2} Ci/cc	
62	SSW Temperature to ESF Components	X			1SWP*TT31A,B	2	1H13*P870	SWPTY017 018	0-125°F	

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE: RG 1.97	SOURCE: EOP	SOURCE: TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
63	Meteorology	X				3				25
	Wind Direction								0° - 360°	
	Wind Speed								0 - 100 mph	
	Atmospheric Stability Estimate								minus 10 - $20^\circ F$	
64	Accident Grab Sampling	X				3				12
	Primary Coolant and Sump									
	. Gross Activity									
	. Gamma Spectrum									
	. Boron Content									
	. Chloride Content									
	. Dissolved Hydrogen or Total Gas									
	. Dissolved Oxygen									
	. pH									
	Containment Air									
	. Hydrogen Content									
	. Oxygen Content									
	. Gamma Spectrum									

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
65	Liquid Radwaste Tank Levels	X			1LWS-LT13A,B,C -LT8A,B,C,D -LT26A,B -LT521A,B,C,D -LT320 -LT24A,B	3			Top to bottom of tank	25
66	Emergency Ventilation Damper Positions	X				2	1H13*P863	HVRBX001 004 009 010 HVWBX001	Open/Closed	23
67	Status of Standby Power	X				2	1H13*P808 *P877			24

TABLE 1

COMPOSITE LIST OF ACCIDENT MONITORING VARIABLES

SEQUENCE NO.	VARIABLE	SOURCE RG 1.97	SOURCE EOP	SOURCE TREE	INSTRUMENT ID	CATEGORY	MCR DISPLAY BENCHBOARD	SPDS SIG ID	RANGE	REFERENCE NOTES
68	Room Temperatures for Detection of Leakage from Containment Breach		X	X	1E31*TEN001A,B *TEN004A,B *TEN015A,B,C,D *TEN017A,B,C,D *TEN018A,B *TEN031A,B,C,D *TEN034A,B *TEN037A,B *TEN040A,B *TEN043A,B *TEN046A,B *TEN049A,B *TEN052A,B *TEN055A,B	3	1H13*P632		50° to 350°F	28

TABLE 1 NOTES

GENERAL NOTES

1. The design and qualification criteria defined by Regulatory Guide 1.97, Revision 3 for the instrument categories defined therein are used as definitions within this study. For example, if Table 1 of this study identifies a variable as being Category 1 then RBS instrumentation and displays used to measure same either presently meet or will meet the regulatory guide criteria for Category 1 unless otherwise determined by the DCRDR Summary Report.

2. Table 1 lists additional instrumentation for monitoring the subject variables which may not meet all the guidance provided by R.G. 1.97, Revision 3. These instruments are listed because it is anticipated that for a large group of events they will be available for use by control room operators in addition to those instruments qualified for use in accordance with R.G. 1.97, Revision 3.

TECHNICAL NOTES

1. The approximate overall height of the RPV measured from the bottom of the vessel to the top of head flange is 842 inches. The following elevation points are provided for reference:

REFERENCE POINT	ELEVATION (inches)
Vessel Bottom	0.0
Top of Active Fuel	358.6
Bottom of Dryer	535.6
Steam Line Nozzle	636.5

2. RBS utilizes a thermal conductivity type device for hydrogen level detection. Continuous air samples for each channel are drawn from the containment or drywell areas at the discretion of main control room operators.

3. The normal level of the suppression pool is at approximately 90 feet above MSL. The depth of the pool is approximately 20 feet.

4. Control rod position is determined by the actuation of magnetic reed switches mounted at approximately three-inch intervals along the control rod length.

TABLE 1 NOTES

5. A digital radiation monitoring system is utilized for monitoring radiation levels throughout the plant. A CRT display is located in the main control room for ready use by plant operators. Class 1E readouts are located on vertical boards for all safety-related instrumentation in addition to the CRT display.

6. FSAR Sections 11.5 and 12.3 identify additional plant instrumentation which the main control room operators may use in diagnosing primary and secondary containment effluent releases.

7. RBS does not provide for on-line monitoring of primary containment air for oxygen levels. The station design does provide for this variable via other means as shown in Note #12.

8. The neutron monitoring system is furnished power via zero time outage motor-generators which are used for suppression of transients of the supply voltage. Class 1E backup power is provided for maintenance and unusual events which might render the system inoperative.

9. The emergency operating procedures direct the plant operators to determine the cause of an automatic scram. Variables identified with this note allow the operator to ascertain this information. The subject variable is annunciated in the main control room. No direct indication of the variable is presented unless otherwise identified by the stipulation of a display located on a benchboard.

10. The implementation of R.G. 1.47 as well as maintenance annunciation (e.g. trouble alarms) are deemed sufficient to ascertain the operational status of the HPCS DG for plant operators.

11. The valve position of all containment isolation valves is monitored on various benchboards in the main control room. Additionally, the SPDS database contains this information.

    The redundancy requirement for Category 1 is met by system design in that each containment penetration has two isolation valves (inboard and outboard). The position indication for each valve does not in itself meet Category 1 requirements for redundancy.

12. Analysis of grab samples obtained from a Post Accident Sampling System (PASS) at RBS is provided on-site by the following methodologies:

TABLE 1 NOTES

PRIMARY COOLANT AND SUMP

. Gross Activity	NaI Detector
. Gamma Spectrum	HPGe Detector
. Boron Content	Plasma Jet Spectrophotometer
. Chloride Content	Ion Gas Chromatagraph
. Dissolved Hydrogen or Total Gas	Ion Gas Chromatagraph
. Dissolved Oxygen	Ion Gas Chromatagraph
. pH	pH Electrode Probe

CONTAINMENT AIR

. Hydrogen Content	Derived by measuring partial
. Oxygen Content	pressures at PASS panel
. Gamma Spectrum	HPGe Detector
Particulates	Particulate Filter
Iodine	Silver Zeolite Filter
Noble Gases	15 cc Gas Sample Vial

13. The limit switches furnished with each MSIV are not individually labelled. The instrument identification numbers shown in Table 1 are those for the MSIV's.

    The subject variable constitutes a special case of the containment isolation valve position variable.

14. Consult Section 12.3 and Table 12.3-1 of the RBS FSAR for a description of plant areas which are monitored for radiation levels in excess of nominal values experienced during plant operation.

    Area radiation monitors are used primarily to determine personnel accessibility into areas containing equipment important to plant safety. Where direct radiation sources are not present the monitors will provide a general indication of containment integrity.

15. Consult the RBS FSAR Section 11.5 and Table 11.5-1 for a description of instrumentation for monitoring airborne radioactivity releases.

16. RBS does not presently monitor the core temperature directly as do PWR's owing to basic design differences between PWR's and BWR's. Further, the state-of-the-art has not made available instrumentation which is capable of reliably measuring core temperatures in a BWR.

Reference 6 has demonstrated the fact that as long as the core of a BWR remains covered with water, core temperatures will not exceed fuel rod limits.

17. RBS emergency operating procedures have identified the need for a containment water level indicator to be used to ascertain the extent of containment flooding which might occur owing to several scenarios. The plant does not presently provide for dedicated indication of this variable in the main control room except for measurement of suppression pool water level.

18. The positions of all key motor-operated valves are provided on the benchboard from which the system is operated.

    All key valve positions necessary for system operation are monitored for the SPDS database.

19. The design of RBS Unit 1 utilizes acoustical monitors for position indication. Additionally, the plant has thermocouples installed in the discharge line to establish safety/relief valve (SRV) actuation. However, the slow cooldown rate of the discharge line piping obviates the use of these instruments as a primary means of detecting SRV position.

    The acoustical monitors detect two-phase as well as single-phase flow for SRV discharges.

20. No dedicated, on-line readout is provided for this instrument channel. However, the data may be accessed through the process computer and displayed via CRT on the principal plant control console 1H13*P680.

21. The state-of-the-art does not provide for reliably measuring this variable as an on-line, Category 1 device. The use of radiation monitors for known effluent pathways and periodic sampling of the primary coolant will suffice for detection of fuel rod failures.

    References 7 and 8 delineate further the RBS Unit 1 position on monitoring of this variable.

22. SRV position, tailpipe thermocouples, and the suppression pool temperature are all monitored at RBS. These parameters will give ample indication of SRV discharge line flow when used in conjunction with RPV pressure indicators.

23. The position of all safety-related damper/valve positions is indicated on benchboard 1H13*P863 which is dedicated to HVAC control.

TABLE 1 NOTES

Selected damper and valve positions are monitored by the SPDS database to insure primary and secondary boundaries for radioactive releases remain intact.

24. The status of the electrical distribution system is monitored on vertical board 1H13*P808 and by the SPDS database to a point of resolution that the SPDS is capable of generating RBS one-line diagrams.

    Other safety-related sources of motive power such as air pressure are monitored and annunciated in the main control room also.

    The following is a partial listing of instruments furnished at RBS Unit 1 for monitoring the subject variable:

Description	Instrument ID
(1) Air Supply	1LSV*PT9A,B
(2) Standby DG Voltage	V-1EGSA07 B07 1E22*VR611
(3) Standby DG Current	A-1EGSA07 B07 1E22*AR607
(4) Standby DG Power	W-1EGSA07 B07 1E22*WR609
(5) Standby DG Reactive Power	VAR-1EGSA07 B07 1E22*VARR608
(6) Standby DG Frequency	F-1EGSA07 B07 1E22*FREQR612
(7) Standby 4.16kV Bus Voltage	V-1EGSA08 B08 1E22*VR610
(8) Standby 4.16kV Incoming Breaker Current	A-1ENSA07 B07 1E22*AR619

TABLE 1 NOTES

Description	Instrument ID
(9) Standby Switchgear 125 VDC Bus Voltage	V-1ENBA03 B03 1E22*VR618

25. The present design of River Bend Station does not provide for direct or indirect readout of the subject variable in the main control room.

26. The instrument readout is a timed, strip chart, multi-pen recorder. Operators ascertain the cooldown rate visually by observing chart slopes. The plant is also provided with a permanent record for later analysis as required.

27. RBS will provide for grab sampling of the suppression pool water inventory. On-site chemistry facilities are equipped to measure the subject variables in a timely fashion commensurate with the needs of MCR operators.

28. The following plant areas are monitored for the subject variable:

    Main Steam Line Pipe Tunnel
    RHR Equipment Areas
    RCIC Equipment Areas
    RWCU Equipment Areas

29. Heatup calculations performed for RBS Unit 1 predict a maximum drywell temperature not to exceed 320 F. Therefore, the existing instrumentation has sufficient range to function as an information source during accident or abnormal conditions.

    The range specified is that of the sending instrument. The actual recording range will be determined at a later time prior to fuel load.

30. RBS EOP's instruct the operator to ascertain this variable by measuring the SLCS tank level drop thus inferring the quantity of sodium pentaborate solution which is injected into the vessel.

31. RBS does not measure SLCS flow directly owing to sensing instrument problems arising from sodium pentaborate contamination of moving parts. Measurement of SLCS pump discharge header pressure is deemed sufficient to ascertain SLCS flow when used in conjunction with other variables such as SLCS tank level.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 1

VARIABLE: Reactor Vessel Water Level

FINDING: The present design of RBS Unit 1 does not provide Category 1 instrumentation over the fuel zone range. Further, the variable and reference leg instrument lines inside the drywell are subject to flashing and boiling which could lead to erroneous water level readings.

TECHNICAL EVALUATION

Reference No. 6 of this study explains the effects of flashing and boiling on water level instrument lines inside the drywell. The NRC Staff has reviewed this reference and concurs with its findings. Inadequate core cooling concerns dictate that the fuel zone range water level instrumentation be Category 1.

REFERENCES: RBS FSAR Section 7.5.1.1.2
Appendix 1A, Item II.F.2
RBS Response to NRC Question 421.014

DESIGN CONSIDERATIONS

River Bend has presently undertaken the following design revisions which shall be complete prior to fuel load:

(1) Upgrade the fuel zone instrumentation to Category 1.

(2) Furnish a high drywell temperature alarm in the main control room.

(3) Reduce the reference leg vertical drop inside the drywell to a minimum.

(4) Relocate restriction orifices as close to the drywell penetration as possible.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

(5) Train operators to recognize possible anomolies in water level readings.

(6) Revise the SPDS database as required to insure that all Category 1 instrument information is monitored, analyzed and displayed.

Consult the DCRDR Summary Report for specific design revisions to RBS Unit 1 and an implementation schedule for same.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 6

VARIABLE: Suppression Pool Temperature

FINDING: The plant design does not provide for a Category 1 display of the bulk pool temperature on either 1H13*P808 or 1H13*P601.

TECHNICAL EVALUATION

The controls for the safety/relief valves are located on 1H13*P601. The operator must base decisions on whether to manually operate on discrete data only available at 1H13*P808. This condition does not appear to be desirable from a human factors viewpoint because (1) the bulk pool temperature must be computed by hand, and (2) the vertical board which contains this information is not located in close proximity to where the information is needed.

REFERENCE: NUREG-0783 "Suppression Pool Temperature Limits for BWR Containments"

DESIGN CONSIDERATIONS

Consult the DCRDR Summary Report for the RBS resolution of the subject finding.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 9

VARIABLE: Condensate Storage Tank (CST) Water Level

FINDING: A direct readout display for this variable is not provided in the main control room except through use of the process computer and SPDS databases and display CRT's.

TECHNICAL EVALUATION

The majority of RBS instrumentation providing this type of information is provided with direct reading displays in the main control room. It is expected that a seismic disturbance would render the process and SPDS computers out of service thus temporarily precluding information from this variable.

DESIGN CONSIDERATIONS

Consult the DCRDR Summary Report for a discussion of the DCRDR review and resolution of this finding.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 10

VARIABLE: SLCS Tank Level

FINDING: The present instrumentation furnished to RBS does not meet the equipment qualification guidelines set forth by R.G. 1.97, Revision 3.

TECHNICAL EVALUATION

The operator will require the subject instrumentation infrequently if ever. However, the information derived from this instrument will allow the operator to ascertain proper system function. The need for this instrument to meet Category 2 criteria is highly dependent upon the resolution of the neutron monitoring system (NMS) finding. If RBS upgrades its NMS to meet Category 1 criteria then this variable need not conform to Category 2 criteria but may remain as purchased without modification insofar as accident monitoring considerations are concerned.

DESIGN CONSIDERATIONS

The DCRDR shall evaluate this finding in light of other control room improvements and make a final determination which will be documented in the DCRDR Summary Report.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 12

VARIABLE: Primary Containment Radiation

FINDING: Radiation level data is almost solely obtained by the digital radiation monitoring system (DRMS) and stored in its database. However, none of this data is presently available for use by the SPDS database.

TECHNICAL EVALUATION

The DRMS is a mini-computer based system with CRT and direct readouts in the main control room (MCR). All safety-related instruments have dedicated as well as CRT readouts in the main control room. The close proximity of the DRMS and SPDS displays in the MCR, TSC, and EOF enhances the operators use of both databases for information retrieval during those events when both might be required. This fact and the difficulty of having the DRMS database communicate with the SPDS database has led RBS to leave both systems functionally isolated insofar as information retrieval is concerned.

This discussion is typical for other variables which are radiation level related.

DESIGN CONSIDERATIONS

RBS deems the existing plant design to be in compliance with the intent of NUREG-0696 and related documents insofar as not having radiation level information in the SPDS database.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 14

VARIABLE: Radiation Level in Circulating Primary Coolant

FINDING: River Bend Station does not presently incorporate in its design any instrumentation or displays to monitor this variable on-line in a real-time mode.

TECHNICAL EVALUATION

The usefulness of the information obtained by monitoring the radioactivity concentration or radiation level in the circulating primary coolant, in terms of helping the operator in his efforts to prevent and mitigate accidents, has not been substantiated. The critical actions that must be taken to prevent and mitigate a gross breach of fuel cladding are (1) shut down the reactor and (2) maintain water level. Monitoring the subject variable will have no influence on either of these actions. The purpose of this monitor falls in the category of (1) information that the barriers to release of radioactive material are being challenged and (2) identification of degraded conditions and their magnitude, so the operator can take actions that are available to mitigate the consequences. Additional operator actions to mitigate the consequences of fuel barriers being challenged, other than those based on R.G. 1.97 Type A and B variables, have not been identified.

Regulatory Guide 1.97, Revision 3 specifies measurement of the radioactivity of the circulating primary coolant as the key variable in monitoring fuel cladding status during isolation of the NSSS. The words "circulating primary coolant" are interpreted to mean coolant, or a representative sample of such coolant, that flows past the core. A basic criterion for a valid measurement of the specified variable is that the coolant being monitored is in active contact with the fuel (i.e. flowing past the failed fuel). Monitoring the active coolant or a sample thereof is the dominant consideration. The RBS post-accident sampling system (PASS) provides a representative sample which can be monitored.

The subject of concern in the RG 1.97, Revision 3 position is assumed to be an isolated NSSS that is shutdown. This assumption is justified as current monitors in the condenser off-gas and main steam lines provide reliable and accurate information on the status of fuel cladding when the plant is not isolated.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

Further, the PASS will provide an accurate status of coolant radioactivity, and hence cladding status, once the PASS is activated. In the interim between NSSS isolation and operation of the PASS, monitoring of the primary containment radiation and containment hydrogen will provide information on the status of the fuel cladding.

DESIGN CONSIDERATIONS

RBS proposes no design changes at the present time based on the above technical evaluation.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 16

VARIABLE: Containment/Drywell Oxygen Concentration

FINDING: The design of RBS does not provide for instrumentation to continuously monitor the containment and drywell for oxygen concentration.

TECHNICAL EVALUATION

The containment atmosphere of RBS will not be inerted. Therefore, the percent volume of oxygen prior to any plant transient will be known. The large volume of the containment air mass insures that the volumetric rate of change of oxygen is sufficiently slow to permit testing of grab samples to determine the amount of oxygen inside the containment. This variable is not considered to be dominant to measuring hydrogen levels and as a consequence it serves no immediate information needs to the plant operators for mitigation of abnormal events.

The oxygen concentration inside the drywell is also a known quantity pursuant to the above. Therefore, the oxygen deflagration overpressure limit is already exceeded during the initial stages of a hydrogen-generating event and the hydrogen concentration becomes the controlling factor to be measured to ascertain the approach to and the exceeding of the hydrogen deflagration overpressure limit.

DESIGN CONSIDERATIONS

No design revisions are contemplated by RBS at the present time.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 17

VARIABLE: Drywell Drain Sump Water Level

FINDING: RBS has furnished Category 2 instrumentation to monitor this variable. However, Regulatory Guide 1.97 specifies the use of Category 1 instruments.

TECHNICAL EVALUATION

The RBS Mark III containment has two drywell drain sumps. One drain is the equipment drain sump which collects identified leakage. The other is the floor drain sump which collects unidentified leakage.

Although the level of the drain sumps can be a direct indication of breach of the reactor coolant system pressure boundary, the indication is not unambiguous, because there is water in those sumps during normal operation. Other RBS instrumentation that indicates leakage in the drywell is:

(1) Drywell pressure

(2) Drywell temperature

(3) Primary containment atmosphere radiation level

(4) Drywell radiation level

While the drywell sump level signal does not automatically initiate safety-related systems, the plant operators will take manual actions based on this variable in accordance with Section 3/4.4.3 of the RBS Technical Specifications. The surveillance requirements of the Technical Specifications are sufficiently stringent to allow the use of a Category 2 device for this application.

Regulatory Guide 1.97, Revision 3 requires instrumentation to function during and after an accident. The drywell sump systems are deliberately isolated at the primary containment penetration upon receipt of a

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

LOCA signal to establish containment integrity. This fact renders the drywell sump level signal irrelevant. Therefore, by design, this instrumentation serves no useful accident monitoring function.

The RBS emergency operating procedures use RPV level and drywell pressure as entry conditions for the level control. A small line break will cause the drywell pressure to increase before a noticeable increase in the sump level. Therefore, the drywell sumps will provide a lagging versus early indication of a leak.

DESIGN CONSIDERATIONS

RBS considers its Category 2 instrumentation to be adequate.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 18

VARIABLE: Neutron Flux

FINDING: Regulatory Guide 1.97, Revision 3 identifies neutron flux as a key variable and classifies it as Category 1. RBS does not furnish the source range (SRM) and intermediate range (IRM) neutron detector drive positioning modules with Class 1E power. Further, while the backup power supply for the neutron monitoring system is Class 1E, the power distribution breaker panels are not.

TECHNICAL EVALUATION

The need to measure neutron flux in an accurate and reliable fashion is necessary for at least one or more accident sequences. The plant design provides for Class 1E or equivalent equipment except as stated above. The large number of detectors in the core, or capable of being inserted into the core, insures that random single failures will not render the system inoperable should it be required to verify shutdown or an approach to criticality. However, common mode failures (i.e. detector drive positioning modules) could render the SRM and IRM systems inoperable for certain design basis events.

DESIGN CONSIDERATIONS

Consult the DCRDR Summary Report for a discussion of this finding and the RBS resolution of same.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 19

VARIABLE: Main Steam Line Radiation

FINDING: The EOP's require the operator to identify the initiating event for a reactor scram. Several variables including the subject variable will produce a scram of the reactor protection system (RPS). The SPDS database does not contain the status information provided by this variable.

TECHNICAL EVALUATION

All of the variables capable of initiating a reactor scram are monitored by the SPDS with the exception of the subject variable and scram discharge volume level (Sequence No. 42). Since the SPDS will be used by other than control room personnel a binary status indication of these variables within the SPDS database would be of use to TSC and EOF personnel.

DESIGN CONSIDERATIONS

Consult the DCRDR Summary Report for a determination in regards to this finding.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 20

VARIABLE: Status of HPCS DG

FINDING: The variable while displayed in the control room is not contained within the SPDS database.

TECHNICAL EVALUATION

This variable was identified via the operator action event trees of Appendix A to allow the operator to diagnose the reason for failure of the HPCS. However, other variables such as the bus supply voltage will allow personnel to make a determination of the failure mode if they are relying upon the SPDS for information.

DESIGN CONSIDERATIONS

RBS believes the SPDS database to be sufficiently complete so as not to require monitoring of this variable. No design revisions are anticipated as a result of this finding.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 33

VARIABLE: Containment Water Level

FINDING: The design of RBS does not provide for main control room instrumentation which covers the range required by this variable.

TECHNICAL EVALUATION

The suppression pool level monitoring instrumentation will be sufficient for most all of the operators information needs in measuring this variable. However, this instrumentation does not measure beyond approximately the 94 ft. elevation. Measurement of this variable will require an upper range of approximately 120 ft. elevation. Consequently, local pressure indicators 1E12*PIR002A,B,C are considered to be adequate for measuring this variable over its entire range. These pressure indicators provide NPSH readings for RHR Pumps A, B, and C. If suction is taken from the suppression pool, static suction head readings will provide an acceptable indication of the containment water level by correlation.

DESIGN CONSIDERATIONS

RBS anticipates no further design revisions to implement this variable. Consult the DCRDR Summary Report for further discussion of this finding.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 35

VARIABLE: Primary Containment Annulus Differential Pressure

FINDING: Direct readout of this variable is not available in the main control room or the SPDS database.

TECHNICAL EVALUATION

The RBS emergency operating procedures provide for depressurizing the containment structure into the annulus region to maintain containment integrity. Therefore, the integrity of the shield wall could be challenged unless the main control room operators are provided with the subject information so the rate of depressurization may be controlled.

DESIGN CONSIDERATIONS

Consult the DCRDR Summary Report for a discussion of this finding and resolution of same pursuant to the DCRDR review.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 37

VARIABLE: Reactor Cooldown Rate

FINDING: RBS has performed calculations to allow for an accelerated RPV cooldown rate of 200°F/hr during accident conditions. The instrumentation, displays, and power supplies for this variable are all non-Class 1E. Therefore, the subject instrumentation cannot be expected to remain operational under accident conditions. Also, the SPDS database does not monitor all of the RPV temperatures available thus precluding any decisions involving reactor cooldown rate based on information from the SPDS.

TECHNICAL EVALUATION

The operator must be provided with accurate information as to the cooldown rate during accident conditions to insure that thermal stresses on the RPV do not create a reactor pressure coolant boundary failure.

DESIGN CONSIDERATIONS

Consult the DCRDR Summary Report for a detailed review and discussion of this finding to include the RBS resolution.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 41

VARIABLE: MSIV Leakage Control System Pressure

FINDING: This variable is identified by R.G. 1.97, Revision 3 but does not appear in the SPDS database pursuant to guidance provided by NUREG-0696.

TECHNICAL EVALUATION

The emergency operating procedures do not make direct use of this variable. Consequently, this data has not been introduced into the SPDS database for this reason.

Personnel performing off-site dose assessments may require this information to insure that MSIV leakage is properly taken into account for dose calculations. This information is available via communications with the MCR operators in the unlikely event it is ever needed.

DESIGN CONSIDERATIONS

There exist no immediate plans for RBS to monitor the subject variable for the SPDS. The DCRDR shall review the subject finding and a final resolution of same will be given in the DCRDR Summary Report.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 52

VARIABLE: Main Steam Line Flow

FINDING: The subject variable is not monitored by the SPDS database.

TECHNICAL EVALUATION

This variable is monitored for diagnostic purposes to identify the initiating event. Also, it is used to indicate the availability of a restored power conversion system. The lack of this data in the SPDS database serves to limit its usefulness by not furnishing SPDS users with a database that is necessary and sufficient.

DESIGN CONSIDERATIONS

The DCRDR shall review the need for this variable in the SPDS database and document its conclusions and recommendations in the DCRDR Summary Report.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 53

VARIABLE: Circulating Water Flow

FINDING: The SPDS database does not contain information from this variable.

The present design of RBS provides for this variable to be displayed via the process computer. The process computer, however, does not display a flow value but rather a pressure value.

TECHNICAL EVALUATION

Consult the discussion for the study findings for main steam line flow (Sequence No. 52).

Human factor principles would seem to dictate that the process computer software be revised to accommodate a flow value algorithm so that a flow value may be displayed for operator use.

DESIGN CONSIDERATIONS

Consult the DCRDR Summary Report for resolution of the subject finding.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 63

VARIABLE: Meteorology

FINDING: The present design of RBS Unit 1 does not display meteorological data in the main control room or furnish same to the SPDS database.

TECHNICAL EVALUATION

The need for this information during the initial stages of an accident event is evident. The lack of design is due to uncertainties in regards to interfacing existing equipment with the main control room.

DESIGN CONSIDERATIONS

Consult the DCRDR Summary Report for the RBS resolution of this finding.

APPENDIX A
ANTICIPATED TRANSIENT EVENT TREE

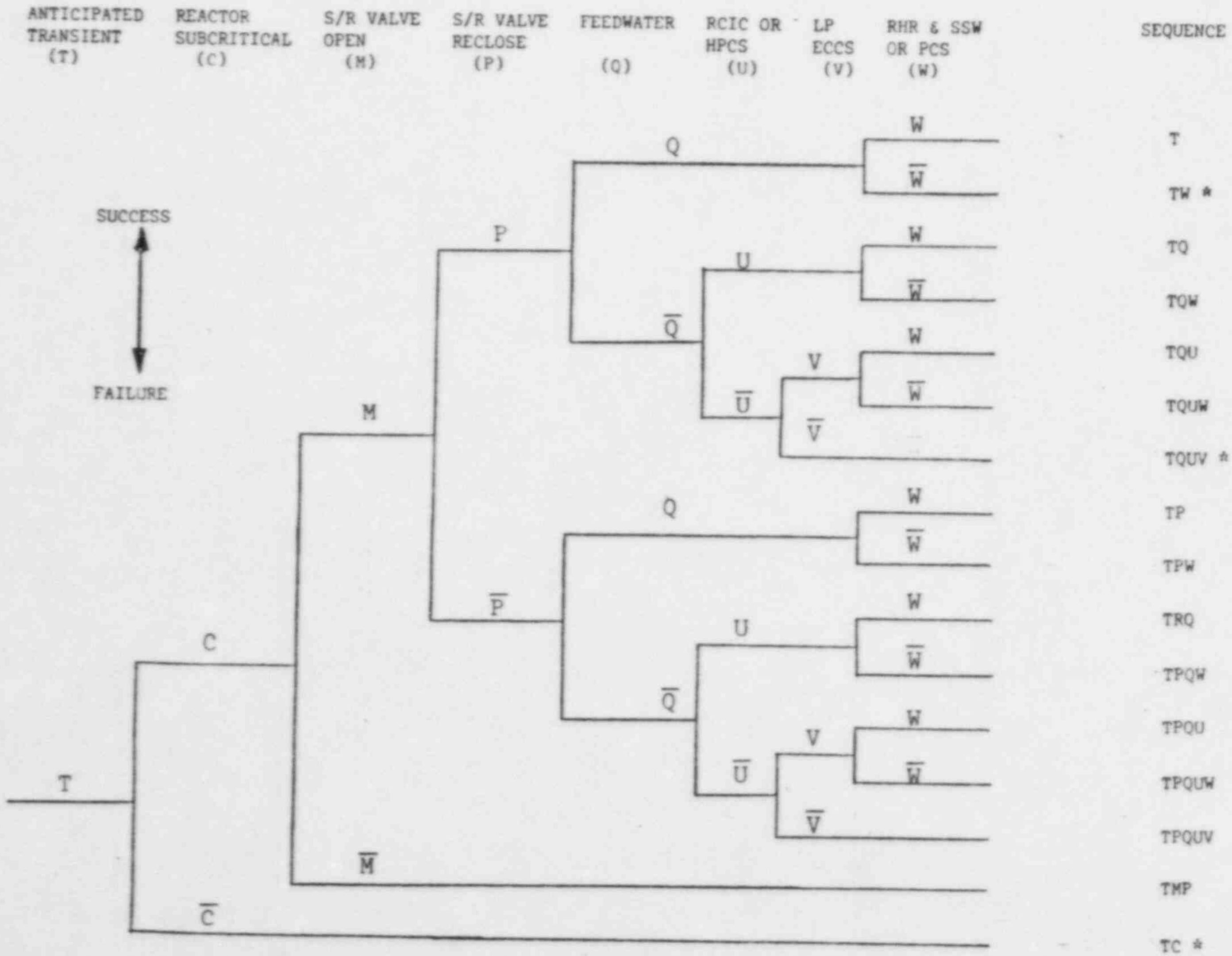


TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 65

VARIABLE: Liquid Radwaste Tank Levels

FINDING: Level indication either direct or indirect for liquid radwaste tanks is not furnished in the main control room or the SPDS database.

TECHNICAL EVALUATION

Monitoring of this variable is directly attributable to specific conditions which occurred during the TMI-2 accident. Several radwaste tanks overflowed as a result of excessive accumulation of water from the containment building. The design of RBS Unit 1 precludes a similar condition from existing because containment isolation valves will not automatically reopen once they are closed by an isolation signal. Operator action is required to reset and reopen the subject valves. Therefore, RBS does not monitor this variable in the main control room. This variable is monitored locally should the need arise for this information.

DESIGN CONSIDERATIONS

RBS envisions no revisions to the plant design but will review the subject finding further as a part of the DCRDR. Consult the DCRDR Summary Report for the RBS resolution of the subject finding.

TABLE 2

ACCIDENT MONITORING INSTRUMENTATION STUDY FINDINGS

SEQUENCE NO: 68

VARIABLE: Room Temperatures for Detection of Leakage from Containment Breach

FINDING: The SPDS database does not monitor this variable.

TECHNICAL EVALUATION

It is not obvious what use SPDS viewers in the TSC and EOF would make of the subject information. The benefit/cost ratio for introducing the subject data into the SPDS database is low. The control room indications appear to address the plant needs.

DESIGN CONSIDERATIONS

RBS does not anticipate any design revisions to monitor this variable for the SPDS. However, final resolution of the finding will be made via the DCRDR Summary Report.

REFERENCES

1. NUREG/CR-2100, "Boiling Water Reactor Status Monitoring During Accident Conditions", EG&G Idaho, April 1981.

2. NUREG/CR-1440, "Light Water Reactor Status Monitoring During Accident Conditions", EG&G Idaho, June 1980.

3. WASH-1400, "Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants", U.S. Nuclear Regulatory Commission, October 1975.

4. Regulatory Guide 1.97, Revision 3, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident", U.S. Nuclear Regulatory Commission, May 1983.

5. NSAC/21, "Fundamental Safety Parameter Set for Boiling Water Reactors", December 1980.

6. SLI-8218, "Inadequate Core Cooling Detection in Boiling Water Reactors", Sol Levy Incorporated, November 1982.

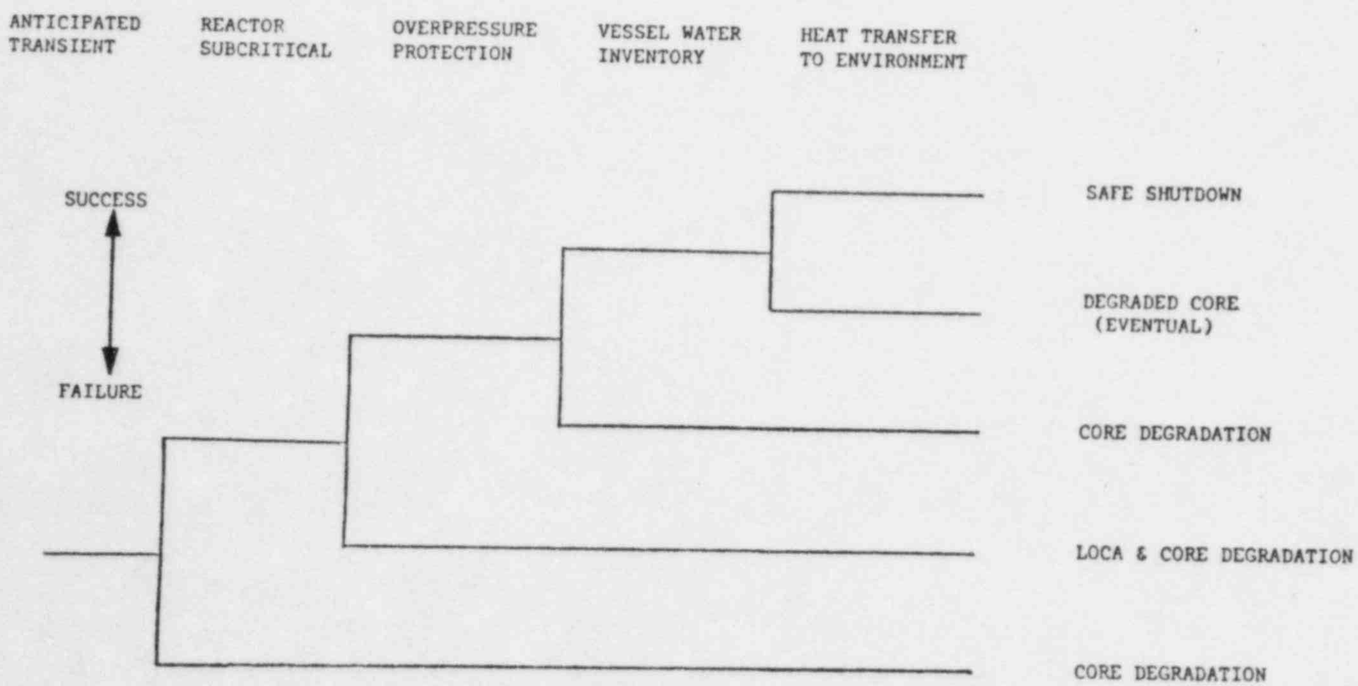
7. "BWR Owners' Group Position on NRC Regulatory Guide 1.97 Revision 2", BWR Owners' Group, July 1982.

8. "Evaluations of Certain Instrumentation Requirements Specified in NRC Regulatory Guide 1.97, Revision 2", BWR Owners' Group, February 1982.

9. "Emergency Procedure Guidelines", BWR Owners' Group, November 1983.

10. "River Bend Station Final Safety Analysis Report", Gulf States Utilities Company, January 1984 (Amendment 11).

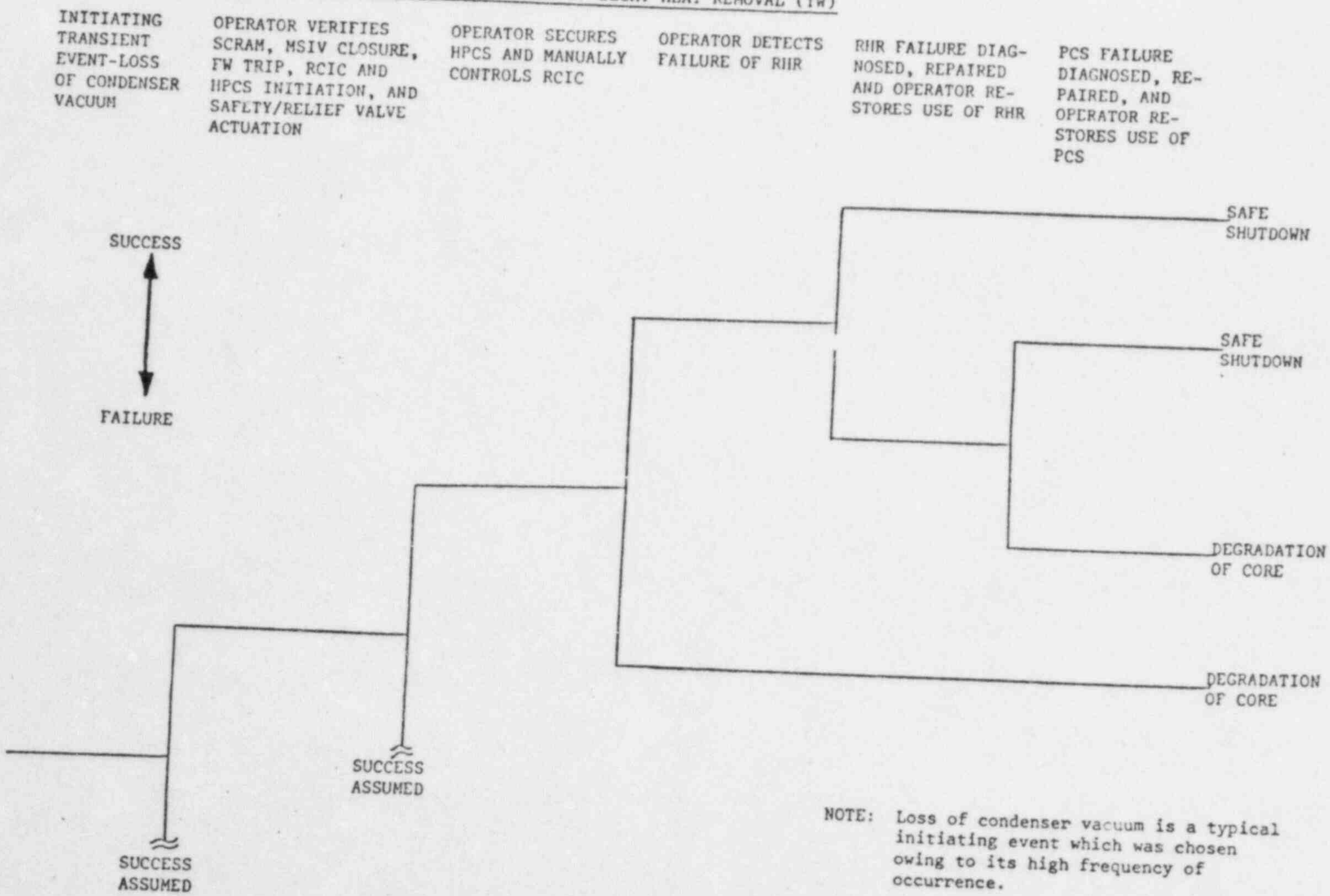
APPENDIX A
TYPICAL BWR FUNCTIONAL EVENT TREE



APPENDIX A

OPERATOR ACTION EVENT TREE

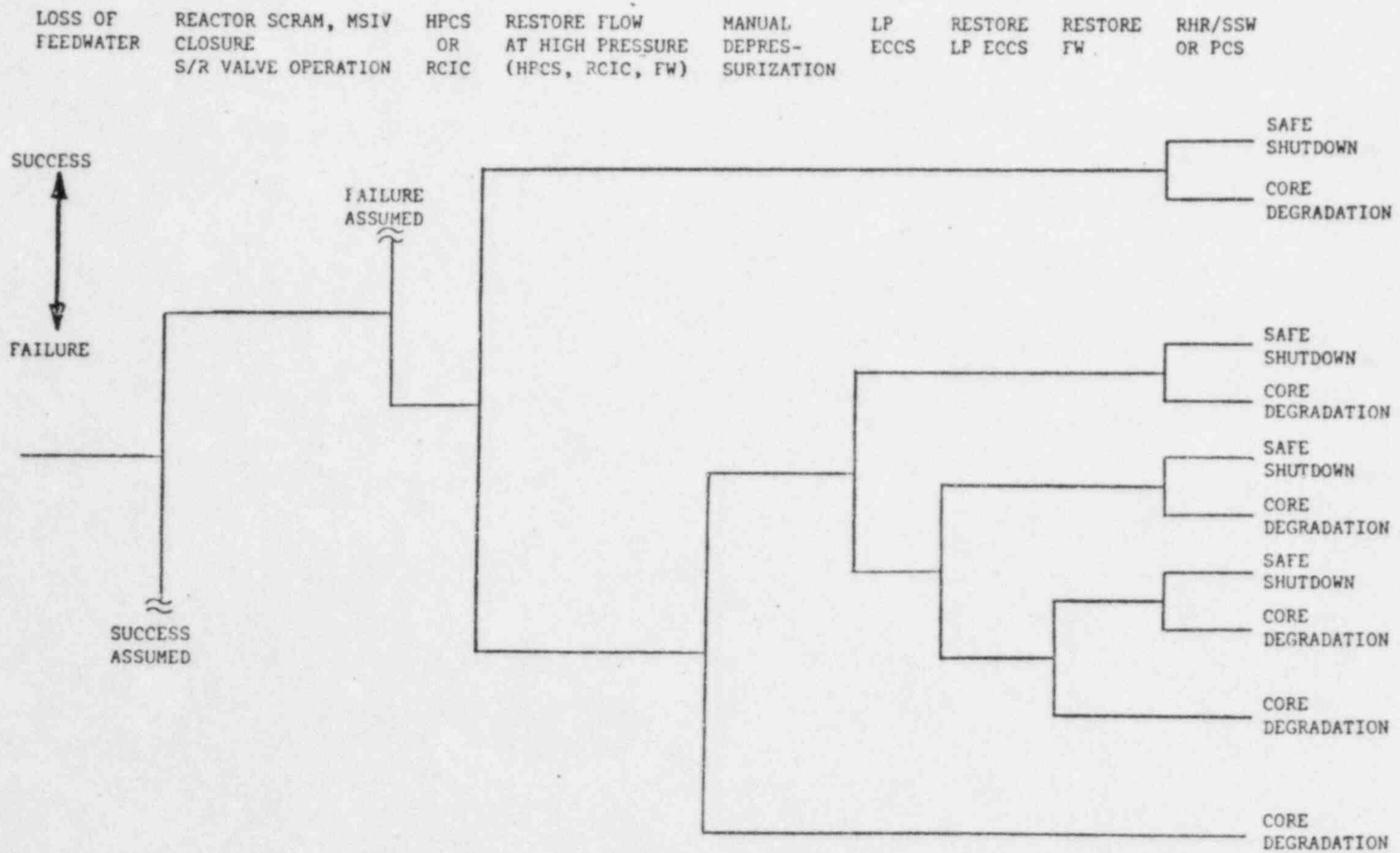
ANTICIPATED TRANSIENT FOLLOWED BY LOSS OF DECAY HEAT REMOVAL (TW)



NOTE: Loss of condenser vacuum is a typical initiating event which was chosen owing to its high frequency of occurrence.

APPENDIX A
OPERATOR ACTION EVENT TREE

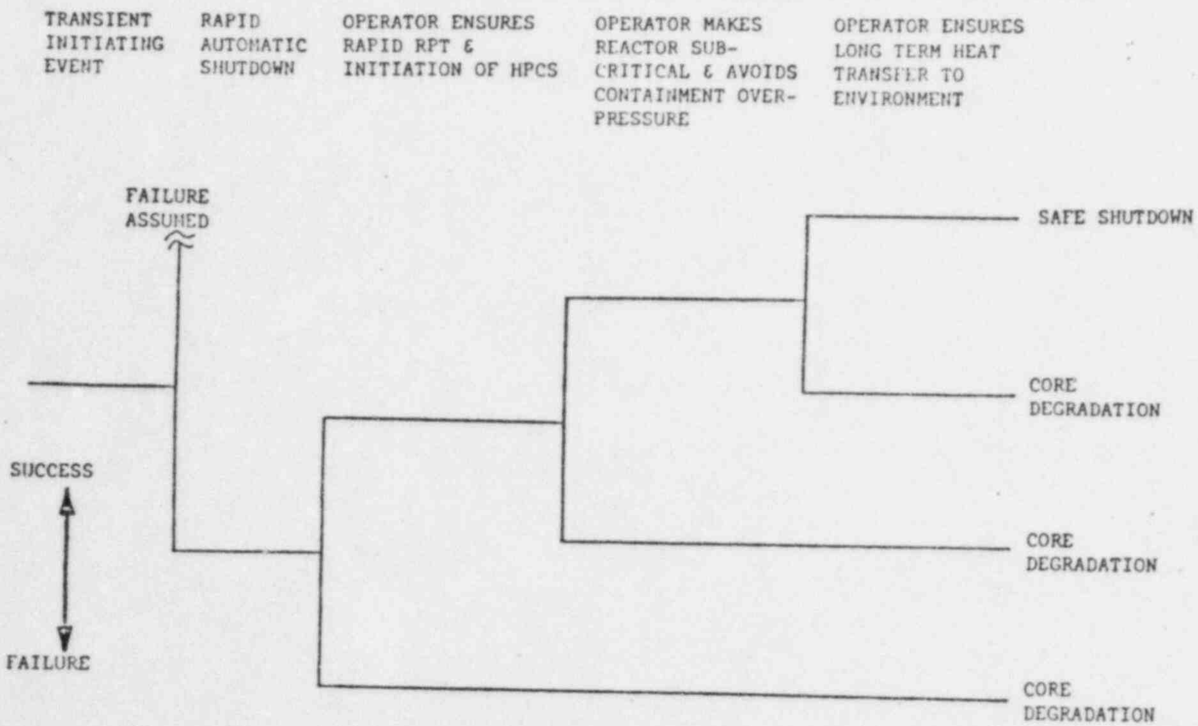
ANTICIPATED TRANSIENT COMBINED WITH FAILURE OF HPCS, RCIC, AND LP ECCS (TQUV)



APPENDIX A

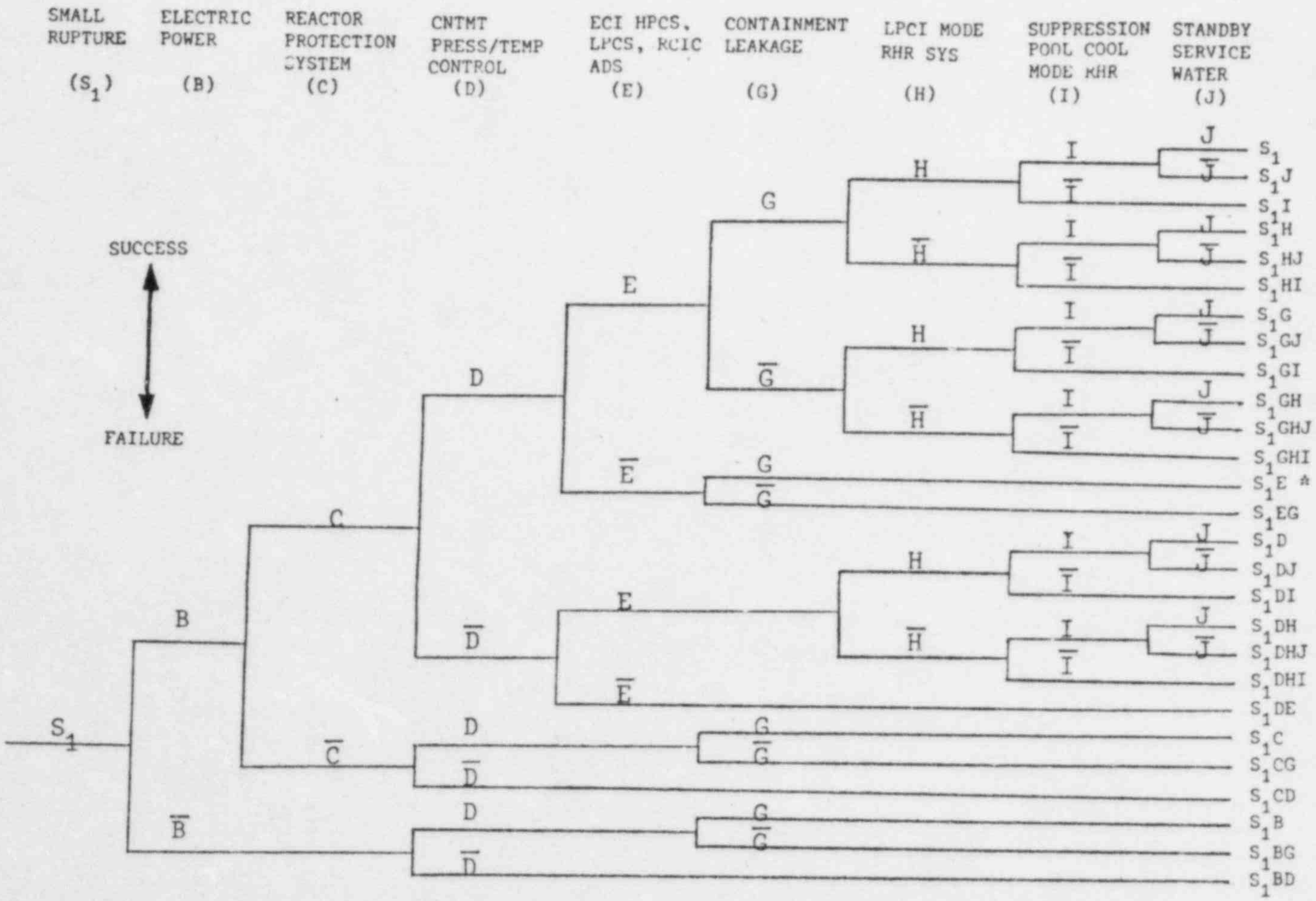
OPERATOR ACTION EVENT TREE

ANTICIPATED TRANSIENT COMBINED WITH FAILURE OF AUTOMATIC SHUTDOWN SYSTEMS (TC)



APPENDIX A

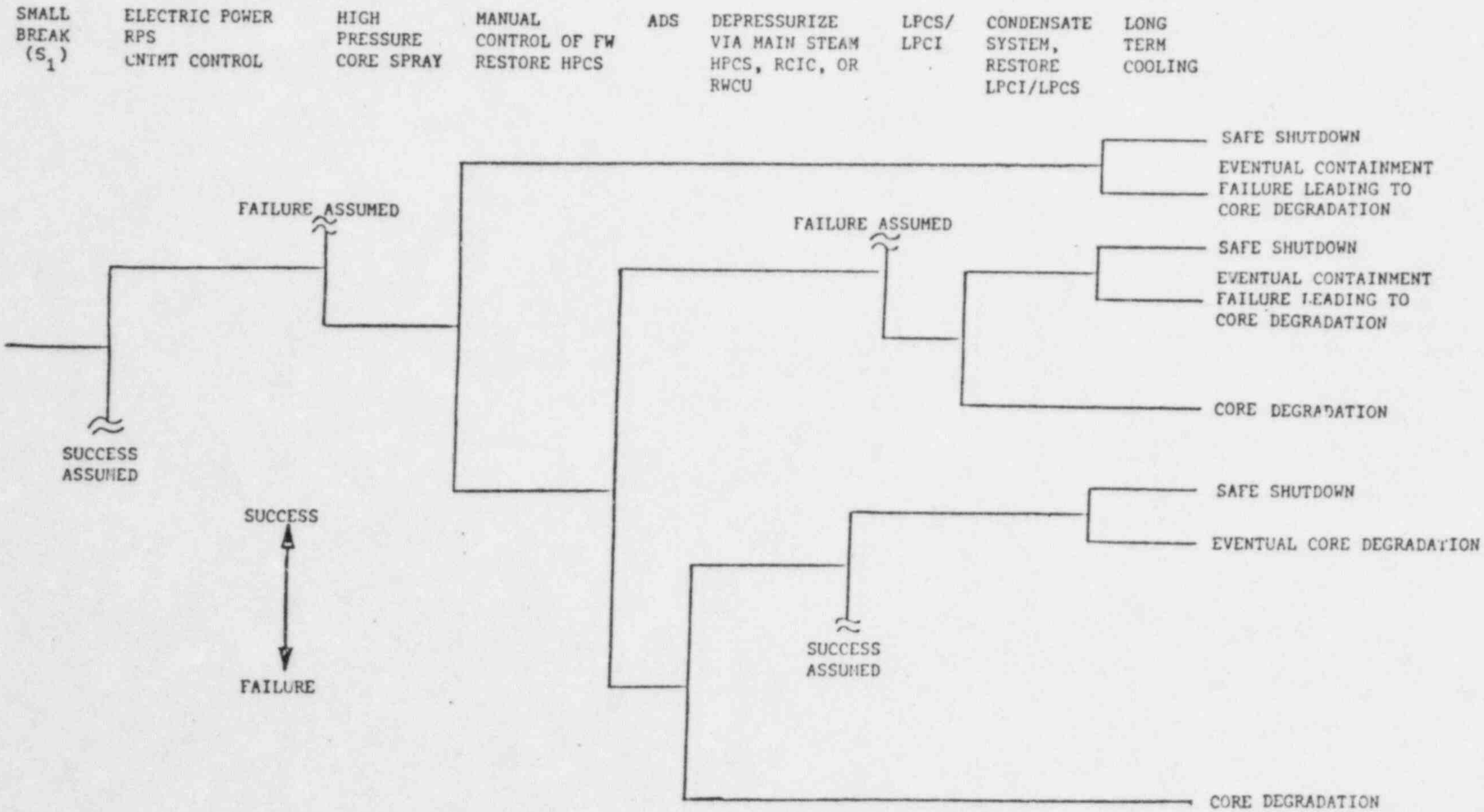
SMALL LOCA EVENT TREE



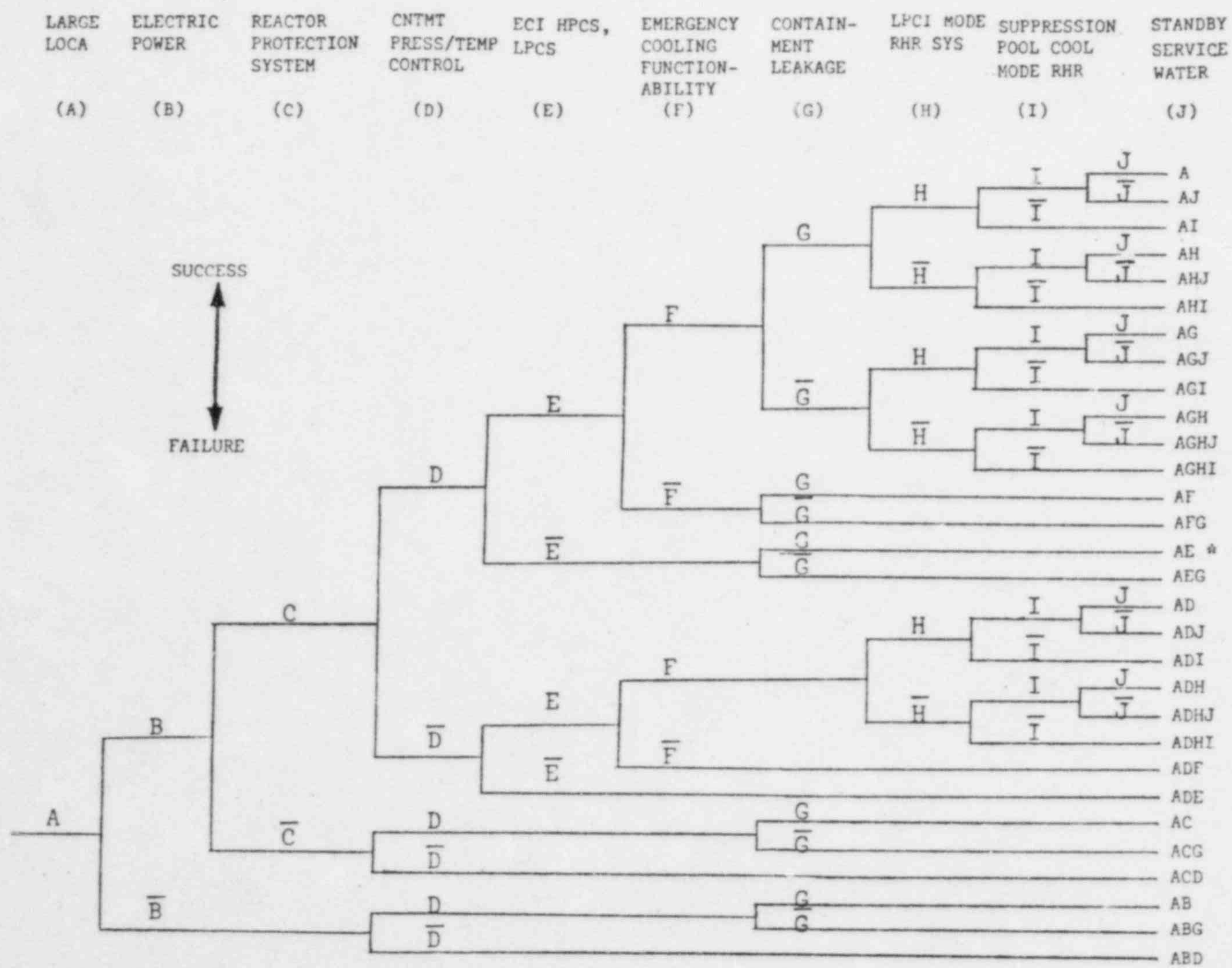
APPENDIX A

OPERATOR ACTION EVENT TREE

SMALL LOCA WITH FAILURE OF ECCS (S_1E)



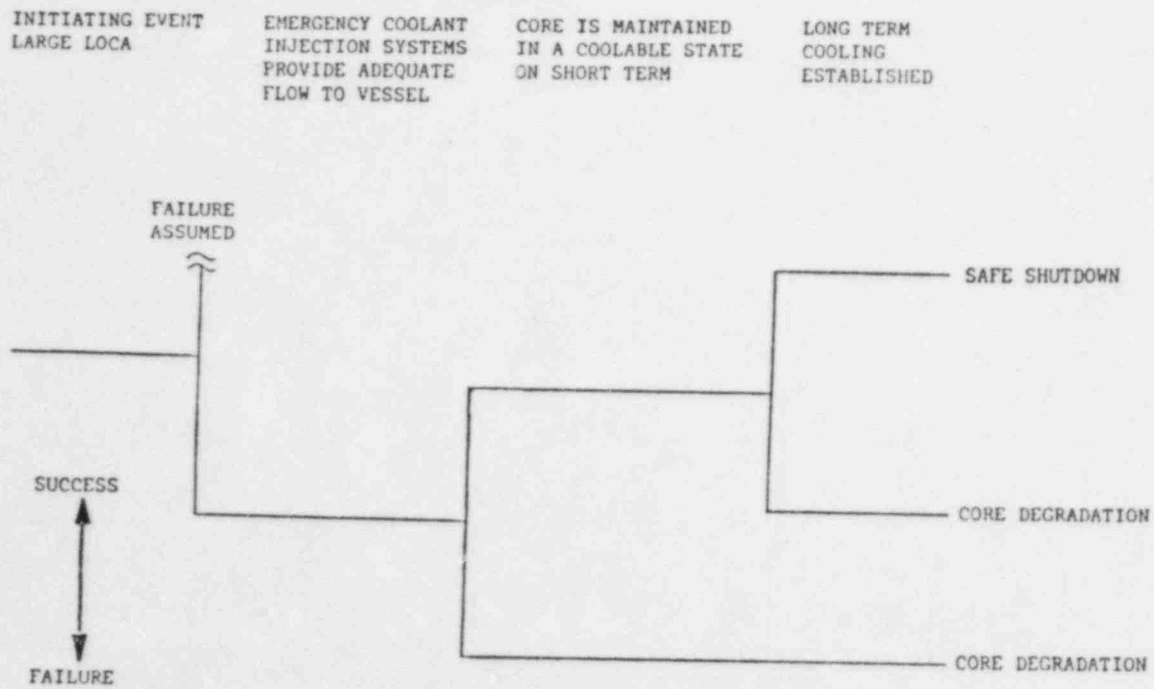
APPENDIX A
LARGE LOCA EVENT TREE



APPENDIX A

OPERATOR ACTION EVENT TREE

LARGE LOCA WITH FAILURE OF ECCS (AE)



APPENDIX A

SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
CONTROL ROD POSITIONS	Verification of scram	Verification of scram	Verification of scram	Verification of scram	Indication of failure of automatic scram and success/failure of manual insertion of rods	
NEUTRON FLUX	Verification of scram	Verification of scram	Verification of scram	Verification of scram	Indication of failure to scram and determination of effect of manual shutdown actions	May be unreliable under severe voiding conditions.
VESSEL WATER LEVEL	Indication of initiating event	Indication of initiating event	Indication of initiating event	Indication of initiating event	Indication of initiating event	
	Indication of HPCS, RCIC, LPCI, LPCS, FW, or Condensate Pump operation	Indication of HPCS, RCIC, LPCI, LPCS, FW, or Condensate Pump operation	Indication of HPCS, RCIC, LPCI, LPCS, FW, or Condensate Pump operation	Indication of LPCI, LPCS operation	Indication of effectiveness of HPCS & RCIC	
REACTOR PRESSURE	Indication of auto responses to initiating event	Indication of auto responses to initiating event	Indication of auto responses to initiating event	Indication of initiating event	Indication of auto responses to initiating event	

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
REACTOR PRESSURE (cont)	Indication of S/R valve operation Guidance during depressurization process Indication of ability to use condensate pumps Indication of restored PCS, RHR Guidance for switchover for shutdown cooling	Indication of S/R valve operation Guidance during depressurization process Indication of ability to use condensate pump Indication of restored PCS, RHR Guidance for switchover for shutdown cooling	Indication of S/R valve operation Guidance during depressurization process Indication of ability to use condensate pumps Indication of restored PCS, RHR Guidance for switchover for shutdown cooling	Guidance for switchover to shutdown cooling	Indication of failure to auto scram Indication of RPT Indication of success/failure of manual shutdown Guidance for switchover to shutdown cooling	
CORE TEMPERATURE	Indication of approach to core damage or exceeding fuel temperature limits	Indication of approach to core damage or exceeding fuel temperature limits	Indication of approach to core damage or exceeding fuel temperature limits	Indication of approach to core damage or exceeding fuel temperature limits	Indication of approach to core damage or exceeding fuel temperature limits	Other parameters such as radiation level and hydrogen concentration could be used to indicate core damage has occurred. River Bend Station monitors reactor water level as an indication of approach to core damage.

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
RECIRCULATION LINE FLOW	-	-	-	-	Indication of auto or manual recirc. pump trip	Not included in Reg. Guide 1.97
PRIMARY CONTAINMENT (DRYWELL) PRESSURE	Indication of effect of RHR containment cooling and maintenance of containment integrity	Indication of effect of RHR containment cooling and maintenance of containment integrity	Indication of initiating event	Indication of initiating event	Indication of effect of RHR containment cooling and maintenance of containment integrity	Containment Temperature and Humidity can also be used to indicate LOCA.
PRIMARY CONTAINMENT RADIATION LEVEL	Indication of core damage	Indication of core damage	Indication of core damage	Indication of core damage	Indication of core damage	Provides a backup indication of a LOCA inside containment.
SUPPRESSION POOL TEMPERATURE	Indication of system responses to initiating event Guidance in depressurization process Indication of RHR failure	Indication of system responses to initiating event Guidance in depressurization process Indication of RHR failure	Guidance in depressurization process Indication of RHR pool cooling effectiveness	Indication of effectiveness of RHR cooling	Indication of auto responses to initiating event Indication of failure to scram Indication of effectiveness of RHR pool cooling	

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
SUPPRESSION POOL LEVEL	Indication of auto responses to initiating event Guidance for switchover of HPCS & RCIC from condensate storage tank	Indication of auto responses to initiating event Guidance for switchover of HPCS & RCIC from condensate storage tank	Indication of auto responses to initiating event Guidance for switchover of HPCS & RCIC from condensate storage tank	-	Indication of auto responses to initiating event Guidance for switchover of HPCS & RCIC from condensate storage tank	
S/R VALVE POSITION	Indication of auto responses to initiating event Guidance in depressurization process	Indication of auto responses to initiating event Guidance in depressurization process	Indication of ADS failure Guidance in depressurization process	-	Indication of auto response to initiator Indication of failure to scram	
SRV DISCHARGE LINE FLOW	Indication of auto responses to initiating event Guidance in depressurization process	Indication of auto responses to initiating event Guidance in depressurization process	Indication of ADS failure Guidance in depressurization process	-	Indication of auto response to initiator Indication of failure to scram	SRV position, tailpipe thermocouples, and the suppression pool temperature are all monitored at River Bend Station. These parameters will give ample indication of the SRV discharge line flow.

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
MAIN STEAM LINE FLOW	Indication of auto response to initiating event Indication of availability of restored PCS	Indication of initiating event Indication of depressurization through main steam line to condenser	Indication of initiating event Indication of availability of FW Guidance in depressurization through PCS	Indication of initiating event	Indication of initiating event	Not included in Reg. Guide 1.97.
POSITION OF CONTAINMENT ISOLATION VALVES	-	Guidance for depressurization through auxiliary systems	Indication of auto response to initiating event	Indication of auto response to initiating event	-	
TURBINE BYPASS VALVES POSITION	Indication of initiating event Indication of availability of restored PCS	Indication of availability of PCS Indication of depressurization to main condenser	Indication of availability of PCS Indication of depressurization to main condenser	-	-	Not included in Reg. Guide 1.97.
CONDENSER HOTWELL LEVEL	Indication of availability of repaired PCS	Indication of availability of FW for makeup	Indication of availability of condensate pumps for makeup	-	-	Not included in Reg. Guide 1.97.

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
FEEDWATER FLOW OR PUMP DISCHARGE PRESSURE	Indication of auto response to initiating event Indication of PCS restoration	Indication of initiating event Indication of FW makeup	Indication of FW availability for makeup after initiating event	Indication of auto response to initiating event	Indication of initiating event	
FEEDWATER CONTROLLER POSITION	Indication of auto response to initiating event Indication of PCS restoration	Indication of initiating event Indication of FW makeup	Indication of FW availability for makeup after initiating event	Indication of auto response to initiating event	Indication of initiating event	Not included in Reg. Guide 1.97.
POWER AVAILABLE TO FEEDWATER PUMPS	Indication of auto response to initiating event Indication of PCS restoration	Indication of initiating event Indication of FW makeup	Indication of FW availability for makeup after initiating event	Indication of auto response to initiating event	Indication of initiating event	Not included in Reg. Guide 1.97.
MSIV's POSITION	Indication of auto response to initiating event Indication of availability of restored PCS	Indication of auto response to initiating event Indication of ability to depressurize through condenser	Indication of initiating event Indication of FW availability	Indication of initiating event	Indication of initiating event	Not included in Reg. Guide 1.97.

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
CONDENSER PRESSURE	Indication of initiating event Indication of availability of repaired PCS	-	Guidance in establishing PCS as heat sink	-	-	Not included in Reg. Guide 1.97.
CONDENSATE PUMP DISCHARGE PRESSURE	Indication of availability of condensate pumps for makeup	Indication of availability of condensate pumps for makeup	Indication of availability of condensate pumps for makeup	-	-	Not included in Reg. Guide 1.97.
CONDENSATE STORAGE TANK LEVEL	Indication of available water supply for HPCS and RCIC Guidance in switchover to suppression pool suction for RCIC, HPCS	Indication of available water supply for HPCS, RCIC, and condenser hotwell for FW makeup Guidance in switchover to suppression pool suction for RCIC and HPCS	Indication of available water supply for HPCS, RCIC, and condenser hotwell for FW makeup Guidance in switchover to suppression pool suction for RCIC and HPCS	-	Indication of available water supply for HPCS and RCIC Guidance in switchover to suppression pool suction for RCIC, HPCS	

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
STEAM JET AIR EJECTOR LINE FLOW	Indication and diagnosis of initiating event Indication of availability of repaired PCS	Indication and diagnosis of initiating event Indication of availability of repaired PCS	-	-	-	Not included in Reg. Guide 1.97.
CIRCULATING WATER SYSTEM FLOW OR PUMP DISCHARGE PRESSURE	Diagnosis of initiating event Determination of availability of repaired PCS	Indication of availability of condenser as heat sink	Indication of availability of condenser as heat sink	-	Indication of availability of condenser as heat sink	Not included in Reg. Guide 1.97.
HPCS FLOW OR PUMP DISCHARGE PRESSURE	Indication of availability of system to maintain level	Indication of availability of system to maintain level	Indication of availability of system to maintain level	-	Indication of availability of system to maintain level	
HPCS KEY VALVE POSITIONS	Indication of safety system status or diagnosis of system failure	Indication of safety system status or diagnosis of system failure	Indication of safety system status or diagnosis of system failure	-	Indication of safety system status or diagnosis of system failure	Not included in Reg. Guide 1.97.

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BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
HPCS DIESEL OPERATIONAL STATUS	Diagnosis of system failure or guidance in system operation	Diagnosis of system failure or guidance in system operation	Diagnosis of system failure or guidance in system operation	-	Diagnosis of system failure or guidance in system operation	Not included in Reg. Guide 1.97.
RCIC FLOW OR PUMP DISCHARGE PRESSURE	Indication of availability of system to maintain level	Indication of availability of system to maintain level	Indication of availability of system to maintain level	-	Indication of availability of system to maintain level	
RCIC KEY VALVE POSITIONS	Indication of safety system status or diagnosis of system failure	Indication of safety system status or diagnosis of system failure	Indication of safety system status or diagnosis of system failure	-	Indication of safety system status or diagnosis of system failure	Not included in Reg. Guide 1.97.
STEAM FLOW TO RCIC TURBINE	Diagnosis of system failure or guidance in system operation	Diagnosis of system failure or guidance in system operation	Diagnosis of system failure or guidance in system operation	-	Diagnosis of system failure or guidance in system operation	Not included in Reg. Guide 1.97.
RHR FLOW OR PUMP DISCHARGE PRESSURE	Indication of system availability to maintain level	Indication of system availability to maintain level	Indication of system availability to maintain level	Indication of system availability to maintain level	-	

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
RHR KEY VALVE POSITIONS	Indication of system availability to maintain level Diagnosis of system failure Guidance in system reconfiguration	Indication of system availability to maintain level Diagnosis of system failure Guidance in system reconfiguration	Indication of system availability to maintain level Diagnosis of system failure Guidance in system reconfiguration	Indication of system availability to maintain level Diagnosis of system failure Guidance in system reconfiguration	-	Not included in Reg. Guide 1.97.
LPCS FLOW OR PUMP DISCHARGE PRESSURE	Indication of system availability to maintain level	Indication of system availability to maintain level	Indication of system availability to maintain level	Indication of system availability to maintain level	-	
LPCS KEY VALVE POSITIONS	Indication of system availability to maintain level Diagnosis of system failure	Indication of system availability to maintain level Diagnosis of system failure	Indication of system availability to maintain level Diagnosis of system failure	Indication of system ability to maintain level Diagnosis of system failure	-	Not included in Reg. Guide 1.97.

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SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
SSW FLOW OR PUMP DISCHARGE PRESSURE	Indication of system availability for heat removal through RHR heat exchangers	Indication of system availability for heat removal through RHR heat exchangers	Indication of system availability for heat removal through RHR heat exchangers	Indication of system availability for heat removal through RHR heat exchangers	Indication of system availability for heat removal through RHR heat exchangers	Not included in Reg. Guide 1.97.
SSW KEY VALVE POSITIONS	Indication of system status and diagnosis of RHR failure	Indication of system status and diagnosis of RHR failure	Indication of system status and diagnosis of RHR failure	Indication of system status and diagnosis of RHR failure	Indication of system status and diagnosis of RHR failure	Not included in Reg. Guide 1.97.
RHR HEAT EXCHANGERS INLET AND OUTLET TEMPERATURES	Indication of effectiveness of RHR cooling and diagnosis of failure	Indication of effectiveness of RHR cooling and diagnosis of failure	Indication of effectiveness of RHR cooling and diagnosis of failure	Indication of effectiveness of RHR cooling and diagnosis of failure	Indication of effectiveness of RHR cooling and diagnosis of failure	
ECCS PUMP ROOM TEMPERATURE	Indication of system performance and diagnosis of ECCS pump failure	Indication of system performance and diagnosis of ECCS pump failure	Indication of system performance and diagnosis of ECCS pump failure	Indication of system performance and diagnosis of ECCS pump failure	Indication of system performance and diagnosis of ECCS pump failure	
SLCS FLOW OR PUMP DISCHARGE PRESSURE	-	-	-	-	Indication of accomplishment of system function.	
SLCS EXPLOSIVE VALVE POSITION	-	-	-	-	Indication of system status	Not included in Reg. Guide 1.97.

APPENDIX A

SUMMARY OF VARIABLES IDENTIFIED IN SEQUENCE EVALUATIONS

BWR Measured Variable	Major Purpose for Indicated Accident Sequence					COMMENTS
	TW	TQUV	S_1E	AE	TC	
SLCS TANK LEVEL	-	-	-	-	Indication of SLCS availability and operation	
RPV BORON CONCENTRATION	-	-	-	-	Indication of effectiveness of SLCS	Could be useful backup under accident conditions which make neutron flux monitors less reliable
HYDROGEN CONCENTRATION	Indication of fuel damage	Indication of fuel damage	Indication of fuel damage	Indication of fuel damage	Indication of fuel damage	
CONTAINMENT EFFLUENT RADIOACTIVITY	Indication of primary containment failure or leakage	Indication of primary containment failure or leakage	Indication of primary containment failure or leakage	Indication of primary containment failure or leakage	Indication of primary containment failure or leakage	
PRIMARY CONTAINMENT TEMPERATURE	-	Indication of cause of initiating event	Indication of initiating event	-	-	Not included in Reg. Guide 1.97.

APPENDIX B

EMERGENCY OPERATING PROCEDURE VARIABLE LIST

Variable Name	Comments and Notes
Reactor vessel level	Note 1
Reactor vessel pressure	Note 1
Drywell pressure	Notes 1 and 2
MSIV isolation signal	Note 1
SCRAM initiating signal when reactor greater than 3% power:	Note 1
Neutron flux (APRMS and IRMS)	
Main steam line radiation	
MSIV closure	
Turbine stop valve closure	
Turbine control valve fast closure	
SCRAM discharge volume level	
Loss of condenser vacuum	
Suppression pool temperature	Note 2
Drywell temperature	Note 2
Containment temperature	Note 2
Suppression pool level	Note 2
Containment/drywell H2 concentration	Notes 2 and 5
Annulus differential pressure	Note 3
Room temperatures in safety related equipment areas	Note 3
HVAC HX ΔT in safety related areas	Note 3
Area radiation levels	Note 3
Floor drain sump levels	Note 3
Containment water level	Note 3
Identified offsite radioactivity release rates	Note 4
RHR pump flow	Note 5
LPCS pump flow	Note 5
Condensate storage tank water level	Note 5
RCIC turbine speed	Note 5
Reactor cooldown rate	Note 5
SLC tank level	Note 5
SRV position	Note 5
Control rod position	Note 5
Cumulative boron injected	Notes 5 and 6
Suppression pool H2 and O2 concentrations	Note 5
Containment/Drywell pressure	Note 5
Neutron flux	Note 1

Notes for Appendix B

Note 1 - Variable is monitored for reactor pressure vessel control.

Note 2 - Variable is monitored for primary containment control.

Note 3 - Variable is monitored for secondary containment control.

Note 4 - Variable is monitored for radioactivity release control.

Note 5 - Variable is listed in the EOP procedures and has not been required for monitoring for control of any of the functions listed in Notes 1 through 4.

Note 6 - Derived from SLC tank level only.

APPENDIX C

This study utilizes the content of USNRC Regulatory Guide 1.97, Revision 3 for the purposes of this study. The following Type A variables which are specific to River Bend Station and not defined within the guide are presented below for information.

VARIABLE

(1) Reactor Coolant System (RCS) Pressure

(2) Containment/Drywell Hydrogen Concentration

(3) Suppression Pool Water Temperature

APPENDIX D

VARIABLE CATEGORY ANALYSIS

INTRODUCTION

The purpose of this analysis is to categorize the variables defined in Appendix A and B. The guidelines depicted in R.G. 1.97, Rev. 3 and plant specific information obtained on systems and components were used to determine these categories. The variables categorized in this analysis are selected from a wide range of significant accident event sequences.

Tables D-1 and D-2 of this appendix show the instrumentation categories for the RBS design in comparison with the regulatory guide categories. A note of explanation follows when RBS categories are less stringent as compared with regulatory categories or when regulatory categories are not available.

METHODOLOGY

The methodology used in the analysis to categorize additional variables is in accordance with the regulatory position of R.G. 1.97, Rev. 3. The analysis was carried out in two steps. The first step was to determine the variable type. Based on the variable type, the second step to determine the instrumentation category was performed. Tables 1 and 2 of this appendix show the outcome of this analysis with explanatory notes as applicable.

Variables Type Analysis

This part of the analysis is based on defining the variables types. The five variable types are stated for reference as follows:

a) Type A - variables that provide primary information needed to permit the control room operating personnel to take the specified manually controlled actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for design basis accident events.

b) Type B - variables that provide information to indicate whether plant safety functions are being accomplished.

c) Type C - variables that provide information to indicate the potential for being breached or the actual breach of the barriers to fission product release.

APPENDIX D

VARIABLE CATEGORY ANALYSIS

d) Type D - variables that provide information to indicate the operation of individual safety systems and other systems important to safety.

e) Type E - variables to be monitored as required for use in determining the magnitude of the release of radioactive materials and for continuously assessing such releases.

Knowing the plant specific purpose of each variable, the type is selected pursuant to the above definitions.

Instrumentation Category Analysis

The basis of this analysis is to determine whether the variable is a key variable or a non-key variable. A key variable is defined as "a single or minimum number of variables that most directly indicate the accomplishment of safety function or operation of a safety system or radioactive material release". Example of non-key variables are backup, diverse backup and diagnostic variables. In order to proceed further with this analysis it is necessary to define the three following categories of instrumentation as stated in R.G. 1.97, Rev. 3.

a) Category 1 - provides the most stringent requirements and is intended for key variables.

b) Category 2 - provides less stringent requirements and generally applies to instrumentation designated for indicating system operating status.

c) Category 3 - provides requirements that will ensure that high quality off-the-shelf instrumentation is obtained and applies to backup or diagnostic instrumentation.

Based on the above definitions the relationship between variables types and the instrumentation categories can be summarized as follows:

Category 1 - key variable types A, B, or C

Category 2 - key variable types D or E

Category 3 - backup or diagnostic variable types B, C, D, or E

(Note: Type A variables cannot be backup or diagnostic.)

APPENDIX D

TABLE D-1

VARIABLE CATEGORY ANALYSIS

SOURCE: Accident Event Sequences (Tree)

VARIABLES	MOST STRINGENT R.G. 1.97 REV. 3 CATEGORY	RBS UNIT 1 CATEGORY DETERMINATION	NOTES
Control Rod Position	3	3	
Neutron Flux	1	1	1
Reactor Vessel Water Level	1	1	
Reactor Vessel Pressure	1	1	
Core Temperature	Not Noted		2
Recirculation Line Flow	Not Noted	3	3
Primary Containment Pressure	1	1	
Drywell Pressure	1	1	
Primary Containment Radiation	1	1	
Suppression Pool Temperature	2	1	
Suppression Pool Level	2	1	
SRV Position	2	2	4
SRV Discharge Line Flow	Not Noted		
Feedwater Flow	3	3	
Feedwater Controller Position	Not Noted	3	5
MSIV Positions	Not Noted	1	14
Main Steam Line Flow	Not Noted	3	5
Containment Isolation Valve Positions	1	1	
Turbine Bypass Valve Position	Not Noted	3	6
Condenser Hotwell Water Level	Not Noted	3	7
Condenser Pressure	Not Noted	3	8
Condensate Pump Discharge Pressure	Not Noted	3	7
Condensate Storage Tank Level	3	3	
Air Ejector Line Flow	Not Noted	3	9
Circulating Water Flow	Not Noted	3	9
HPCS Flow	2	2	
HPCS Key Valve Positions	Not Noted	3	10
RCIC Flow	2	2	
RCIC Key Valve Positions	Not Noted	3	10
Steam Flow to RCIC Turbine	Not Noted	3	10
LPCS Flow	2	2	

TABLE D-1 (Continued)

VARIABLES	MOST STRINGENT R.G. 1.97 REV. 3 CATEGORY	RBS UNIT 1 CATEGORY DETERMINATION	NOTES
LPCS Key Valve Positions	Not Noted	3	11
Containment/Drywell Hydrogen Concentration	1	1	
SSW Key Valve Positions	Not Noted	3	12
RHR HX Inlet/Outlet Temperatures	2	2	
SSW Flow Discharge Pressure/Flow	2	2	
SLCS Tank Level	2	2	13
SLCS Discharge Pressure	2	2	
RPV Boron Concentration (grab)	3	3	
RHR Key Valve Positions	Not Noted	3	10
Status of HPCS DG	Not Noted	3	
Containment Effluent Radioactivity	2	2	
Room Temperatures for Detection of Leakage from Containment Breach	Not Noted	3	15
Containment Atmosphere Temperature	3	3	

NOTES:

1. Though diverse backup variables are available following loss of this key variable, a Category 1 classification of this instrumentation is justified because no other instrumentation directly measures the core neutron population.

2. The use and category classification of this variable is under consideration per RG 1.97, Rev. 3. An analysis (Reference 6) with thermocouples located at the top of the core shows that for conditions typical of a small LOCA there is a delay of at least 10 minutes between the start of core uncovery and the time when the thermocouples read 40°F above saturation. Also, the operation of relief valves during this event will interfere with thermocouple operation and render them useless. Hence, River Bend Station Unit 1 does not use this instrumentation.

3. No category classification is given to recirculation line flow by R.G. 1.97, Rev. 3. This variable will be classified as Category 3 because it is a diverse backup variable to the accomplishment of the safety function recirculation pump trip (RPT). Reactor water level will begin to drop within seconds

TABLE D-1 (Continued)

following a loss of feedwater in conjunction with a failure to scram. The operator must verify a rapid RPT followed by initiation of RCIC and HPCS. An unsuccessful or delayed RPT might lead to a degraded core if no immediate operator action is taken.

4. The SRV position indication instrumentation (acoustic monitors) are fully qualified, continuously displayed, and have Class 1E power as per Category 2.

5. These variables are not included in R.G. 1.97, Rev. 3. They are classified as Category 3 and are used as diverse backup variables in indication of response to initiating event as well plant restoration following an event, where required, in all major sequences.

6. Turbine Bypass Valve Position indication instrumentation is classified as Category 3. For example, the operator will obtain backup indication of availability of the power conversion system following loss of condenser vacuum or feedwater.

7. These are backup variables and they will provide backup indication of availability of the power conversion system, feedwater, or condensate pumps for makeup. These instruments are classified as Category 3.

8. This variable will be used by the operator as an indication of the initiating event and as backup indication of availability of the power conversion system. The condenser pressure indicating instrument is classified as Category 3.

9. The operator will use these diagnostic variables for the diagnosis of the initiating event or determination of the availability of the power conversion system or condenser as a heat sink. The instruments are classified as Category 3.

10. The operator will use these variables as backup information to RCIC/HPCS/RHR flow for indication of RCIC, HPCS and RHR systems status or diagnosis of failure for all events other than AE sequence. Therefore, the Category 3 classification of this instrumentation is justified.

11. LPCS key valve positions will provide the operator with backup or diagnostic information to LPCS system availability or diagnosis of failure. The instrumentation is classified as Category 3.

TABLE D-1 (Continued)

12. This backup variable will indicate the ESF system status or diagnose failure and is classified as Category 3 instrumentation.

13. The operator will use the SLCS storage tank level variable in conjunction with SLCS pump discharge pressure indication for an indication of SLCS flow. Hence, a Category 2 classification is given to the SLCS storage tank level instrumentation.

14. This is a key variable for ascertaining the containment isolation function is performed and is classified as Category 1 instrumentation.

15. Room temperature for detection of leakage from containment breach variables are backup variables to the key variable of containment radiation and the instrumentation is classified as Category 3.

APPENDIX D

TABLE D-2

VARIABLE CATEGORY ANALYSIS

SOURCE: Emergency Operating Procedures

VARIABLES	MOST STRINGENT R.G. 1.97 REV. 3 CATEGORY	RBS UNIT 1 CATEGORY DETERMINATION	NOTES
Reactor Vessel Water Level	1	1	
Reactor Vessel Pressure	1	1	
Drywell Pressure	1	1	
MSIV Positions	Not Noted	1	1
Neutron Flux	1	1	2
Suppression Pool Temperature	2	1	
Drywell Atmosphere Temperature	2	1	
Containment Atmosphere Temperature	Not Noted	3	3
Suppression Pool Level	2	1	
Containment/Drywell Hydrogen Concentration	1	1	
Primary Containment Pressure	1	1	
Area Radiation	3	3	
Drywell Equipment and Floor Drain Sump Water Level	1	2	4
RHR Flow	2	2	
LPCS Flow	2	2	
Condensate Storage Tank Level	3	3	
RCIC Turbine Speed	Not Noted	3	5
Reactor Cooldown Rate	Not Noted	3	6
SLCS Tank Level	2	2	7
SRV Position	2	2	8
Control Rod Position	3	3	
Cumulative Boron Injected	3	3	
Containment/Drywell Oxygen Concentration			
Turbine Stop Valve Positions	Not Noted	3	9
Turbine Control Valve Positions	Not Noted	3	9
Scram Discharge Volume Level	Not Noted	3	10
Liquid Effluent Radioactivity	Not Noted	3	11
Primary Containment Radiation	1	1	
Containment Effluent Radioactivity	2	2	
Main Steam Line Radiation	Not Noted	3	12
Airborne Radioactivity Releases	2	2	13

TABLE D-2 (Continued)

VARIABLES	MOST STRINGENT R.G. 1.97 REV. 3 CATEGORY	RBS UNIT 1 CATEGORY DETERMINATION	NOTES
Suppression Pool Hydrogen/ Oxygen Concentration	Not Noted	3	14
Containment Water Level	Not Noted	3	15
Condenser Pressure	Not Noted	3	16
Room Temperatures for Detection of Leakage From Containment Breach	Not Noted	3	17
Turbine Bypass Valve Position	3	3	

NOTES:

1. See Note 14 of Table D-1.

2. See Note 1 of Table D-1.

3. Primary containment temperature can be used by the operator as a diverse backup variable to the key variable of drywell temperature or primary containment radiation level. The instrumentation is classified as Category 3.

4. This variable will be used as a backup or diagnostic variable to the key variables like drywell pressure, temperature, or radiation level in the event of RCS pressure boundary breach/leakage. Therefore, the drywell drain sump level is classified as Category 2 against the R.G. 1.97, Rev. 3 recommendation of Category 1. Moreover, this instrumentation serves no useful accident monitoring function other than providing indication and alarm.

5. RCIC turbine speed is a diverse backup and diagnostic variable to RCIC system operation and the instrumentation is classified as Category 3.

6. Reactor cooldown rate is a diagnostic variable for the protection of reactor pressure vessel and is controlled by administrative procedure. A Category 3 classification is given to this instrumentation.

7. See Note 13 of Table D-1.

TABLE D-2 (Continued)

8. See Note 4 of Table D-1.

9. These are diagnostic variables indicating the status of key valves for power conversion system operation and are classified as Category 3 instrumentation.

10. The scram discharge volume level will provide the operator with backup information as to the scram initiating event and is classified as Category 3.

11. This variable provides diagnostic information on equipment performance and is classified as Category 3 instrumentation.

12. Main steam line radiation is not considered a key variable insofar as the scope of this report is concerned. The reason being that the usefulness of information by monitoring this variable, in terms of helping the operator in his efforts to prevent and mitigate accidents, has not been substantiated. Hence, this instrumentation is classified as Category 3.

13. Airborne radioactivity release is a key variable and classified as Category 2 by R.G. 1.97, Rev. 3. RBS concurs with this regulatory position.

14. This variable is a backup to the key variable of containment/drywell hydrogen concentration and the variable is classified as Category 3.

15. This variable can be used for diagnostic information in the event post-accident containment flooding is required. The instrumentation to be used is classified as Category 3.

16. See Note 8 of Table D-1.

17. See Note 15 of Table D-1.