TEXAS UTILITIES SERVICES INC.
2001 BRYAN TOWER · DALLAS, TEXAS 75201

TXX-2912 November 16, 1978

Mr. Ron Naventi
Licensing Project Manager
Light Water Reactors Branch No. 4
Division of Project Management
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

COMANCHE PEAK STEAM ELECTRIC STATION
TRANSMITTAL OF MATERIAL REQUESTED
BY QUESTION 032.1
FILE NO. 10010

Dear Mr. Naventi:

Please find enclosed three (3) copies of our response to question 032.1 concerning staff positions and questions transmitted to all applicants with RESAR-3 plants.

Sincerely,

C. K. Feist

C. K. Feist

CKF:skf
Enclosure
cc: N. S. Reynolds, Esq. w/o enclosures
S. C. Relyea, Esq. w/o enclosures
H. C. Schmidt w/o enclosures
H. R. Rock w/enclosures
G. L. Hohmann w/enclosures
J. T. Merritt w/enclosures
J. C. Kuykendall w/enclosures

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032.0 INSTRUMENTATION AND CONTROL SYSTEMS BRANCH

Q032.1 Provide a listing of the sections of the FSAR which include the responses to the staff positions and questions transmitted to all applicants with RESAR-3 plants. This transmittal was dated November 17, 1977.

R032.1 The set of RESAR-3 questions and responses follows. Note that all references to Sections and Questions in the Responses are to the CPSES/FSAR.

RESAR-3 (Q31.1) Section 3.9.1.2 of RESAR-3 states that dynamic testing procedures concerning Westinghouse supplied safety-related mechanical equipment will be provided in the applicant's FSAR. It is our position that as a minimum you commit to conduct a seismic qualification program to conform to the criteria as contained in Attachment A. State your intent to employ the criteria as contained in Attachment A for all Westinghouse Category I mechanical equipment in order to confirm the functional operability of such equipment during and after a seismic event up to and including the SSE.

Response See Subsection 3.9N.2.2

RESAR-3 (Q31.2) Section 3.9.2.4.1 of RESAR-3 states that the pump motor and vital auxiliary electrical equipment will be qualified by meeting the requirements of IEEE Standard 344-1971. Since the standard has undergone a major revision, state your intent to meet the requirements of the 1975 version of IEEE Standard 344. IEEE Standard 344-1975 includes requirements which are applicable to all plants with C.P. applications docketed after October 1972.

Response See Question 112.9 and Subsection 3.9N.3.2

RESAR-3 (Q31.3) The Seismic qualification criteria for electrical equipment as stated in Section 3.10 of the proposed Amendment 6 to RESAR-3 is not completely acceptable because it is only applicable to certain specific conditions when single frequency input to an individual axis is justifiable. A broader criterion to account for overall considerations should be provided. The major concern is the possible directional coupling and the concurrent multi-mode response. An acceptable response is to conduct a seismic qualification program as recommended by the 1975 version of IEEE-344 standard. State your intent to use this recommended criteria.

Response See Section 3.10N

RESAR-3 (Q31.4) The lists of safety-related equipment and components provided in Section 3.11.1 of RESAR-3 are not complete. Identify all individual components and complete the lists.

Response See Section 3.11N

RESAR-3 (Q31.5) Section 3.11.2 of RESAR-3 does not give a complete and acceptable description of the qualification tests and analyses for each type of safety-related equipment and component. Provide this information for each item.

Response See Section 3.11N

RESAR-3 (Q31.6) RESAR-3 Section 7.1.2.5. Describe how your design complies with IEEE Standard 323-1971, or IEEE Standard 323-1974, for all applications for which the construction permit safety evaluation report was issued July 1, 1974 or later.

Identify and justify all exceptions.

Response See Section 3.11N

RESAR-3 (Q31.7) In accordance with the implementation dates (noted in parentheses) and as they apply to your application, describe the extent to which the recommendations of the following regulatory guides will be met. Identify and justify any exception.

Regulatory Guide 1.22 (Safety Guide 22), "Periodic Testing of Protection System Actuation Functions" (Guide dated 2/17/72)

Regulatory Guide 1.29, "Seismic Design Classification;" (Revision 1 dated August 1973)

Regulatory Guide 1.30 (Saftey Guide 30), "Quality Assurance Requirements for the Installation, Inspection, and Testing of Instrumentation and Electric Equipment;" (Guide dated August 11, 1972)

Regulatory Guide 1.40, "Qualification Tests of Continuous-Duty Motors Installed Inside the Containment of Water-Cooled Nuclear Power Plants;" (Guide dated 3/16/73)

Regulatory Guide 1.47, "Bypassed and Inoperable State Indication for Nuclear Power Plant Safety Systems;" (Guide dated May 1973)

Regulatory Guide 1.53, "Application of the Single-Failure Criterion to Nuclear Power Plant Protection System;" (Guide dated June 1973)

Regulatory Guide 1.62, "Manual Initiation of Protection Action;" (Guide dated October 1973)

Regulatory Guide 1.63, "Electric Penetration Assemblies in Containment Structures for Water-Cooled Nuclear Power Plants;" (Guide dated October 1973)

Regulatory Guide 1.68, "Preoperational and Initial Startup Test Programs for Water-Cooled Power Reactors;" (Guide dated November 1973)

Regulatory Guide 1.73, "Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants;" (Guide dated January 1974)

Regulatory Guide 1.75, "Physical Independence of Electric Systems." The physical indentification of safety-related equipment should also be addressed in this section; (Guide dated February 1974)

Regulatory Guide 1.80, "Preoperational Testing of Instrument Air System;" (Guide dated June 1974) and

Regulatory Guide 1.89, "Qualification of Class IE Equipment for Nuclear Power Plants." (Applicable to all plants with an SER issued after July 1, 1974).

Response

Regulatory Guide	FSAR Section
1.22	Appendix 1A(N)
1.29	Appendix 1A(N) & 1A(B)
1.30	Appendix 1A(N) & 1A(B)
1.40	Appendix 1A(B)
1.47	Appendix 1A(B)
1.53	Appendix 1A(N)
1.62	Appendix 1A(N)
1.63	Appendix 1A(B)
1.68	Appendix 1A(B)
1.73	Appendix 1A(B) & 1A(N)
1.75	Appendix 1A(N) & 1A(B)
1.80	Appendix 1A(B)
1.89	Appendix 1A(N) & 1A(B)

RESAR-3 (Q31.8.1) Provide a discussion and the results of an analysis showing how your design of the test and calibration features of the safety systems meets the requirements of Section 4.10 of IEEE Standard 279-1971.

Response See Subsections 7.1.2.5, 7.1.2.11 and Figure 7.3-1, 7.3-3.

RESAR-3 (Q31.8.2) Based on Figure 7.2-1, Sheet 7 of 17, of RESAR-3, we have concluded that the proposed design for the steamline differential pressure circuits does not conform to the requirements of IEEE Standard 279-1971. Specifically, during operation with a loop isolated, the logic for the operable steamlines is effectively changed to 2-out-of-2 which does not meet the single failure criterion. Our position is that in order to comply with IEEE Standard 279-1971, the desing should incorporate positive means of assuring that these circuits continue to meet the single failure criterion during operation with a coolant loop isolated. Discuss your intent to comply with this position and describe the necessary design changes, or justify any exceptions by discussing your reasons for concluding that such exceptions are in accordance with the requirements of IEEE Standard 279-1971. In addition as committed on Page 7.2-30 of RESAR-3, provide the results of an analysis that will determine whether automatic tripping of the steamline differential pressure bistables is required for N-1 loops operating.

<u>Response</u> Steamline break protection sensors and logic are being changed. The revised design commitment will be provided in the last quarter of 1978.

RESAR-3 (Q31.9) RESAR-3 Section 7.2.1.1.2(1)(d) and Figure 7.2-1 Sheet 3 address a power range high neutron flux rate "Positive" trip. This trip is used as protection against a rod ejection accident. The referenced Westinghouse Topical Report WCAP-7380-L (pages 2-8 and 3-12) provides a diagram and a description for the "Negative" flux rate trip but does not provide for the "Positive" flux rate trip. Provide a description and diagram covering "Positive" flux rate trip.

<u>Response</u> WCAP-7380-L is no longer referenced. It is replaced with WCAP-8255 as listed in the references for FSAR Subsection 7.2. WCAP-8255 discussed both the positive and negative rate trips and provides diagrams for both.

RESAR-3 (Q31.10) The reactor trip system contains logic circuits that can initiate trips for the purpose of anticipating the approach to a limiting condition for operation. Sepcifically, these reactor trips are:

(1) Generation of a reactor trip by tripping the main coolant pump breakers,

(2) Generation of a reactor trip by tripping the turbine,

(3) Generation of reactor trip by underfrequency conditions on reacotr coolant pump bus, and

(4) Generation of reactor trip by undervoltage conditions on reactor coolant pump bus.

Our position requires that all inputs to the reactor trip system be designed to meet IEEE Standard 279-1971, with an exception for anticipatory trips (trips not required for safety actions in the accident analysis - Chapter 15). The exception is that sensors for anticipatory trips are not required to be located in a qualified seismic Category I structure. Discuss your intent to comply with this position or justify any exceptions you may have in this regard. Your response should include a discussion of the testability of these circuits while the reactor is at power.

Response (1) The design is changed. The reactor trips by main coolant pump breaker opening is one condition of the undervoltage trip. See Subsection 7.2.1.1.2(4b).

(2) See Subsection 7.2.1.1.2(6)

(3) See Subsection 7.2.1.1.2(4c)

(4) See Subsection 7.2.1.1.2(4b)

For a discussion of testability of these circuits while the reactor is at power, refer to Section 7.1.2.5.

RESAR-3 (Q31.11) Testing of the reactor trip system and the engineered safety feature actuation system to verify that the "system" response times are equal to or less than the values assumed in the accident analysis is discussed on Pages 7.1-19, 7.2-24, and 7.3-13 or RESAR-3. In addition to the proposed response time testing during preoperational start-up testing and following the replacement of a component that affects response time, our position requires that these systems be designed to permit periodic verification that the response times are within the values assumed in the accident analysis. Discuss your intent to comply with this position or justify any exceptions. It is stated in RESAR-3 on Pages 7.3-26 that the response time specified in Paragraph 4.1 of IEEE Standard 338-1971 is not checked periodically as is the set point accuracy. Provide justification for the exception to this requirement.

Response See Subsection 7.1.2.11

RESAR-3 (Q31.12) With regard to the motor operated accumulator isolation values, we require that the proposed design include the following features in order to conform to the requirements of IEEE Standard 279-1971:

(1) Automatic opening of the accumulator valves when either (a) the primary coolant system pressure exceeds a preselected value (to be specified in the Technical Specifications) or (b) a safety injection signal has been initiated. Both signals shall be provided to the values.

(2) Visual indication in the control room of the open or closed status of the valve, actuated by sensors on the valve.

(3) An audible alarm, independent of Item (2), that is actuated by a sensor on the valve when the valve is not in the fully open position.

(4) Utilization of a safety injection signal to automatically remove (override) any bypass feature that may be provided to allow an isolation valve to be closed for short periods of time when the reactor coolant system is at pressure (in accordance with the provisions of the proposed Technical Specifications). Discuss your intent to comply with these requirements or justify any exceptions to these requirements.

Response See Subsection 7.6.4

RESAR-3 (Q31.13) Based on the information provided in Secton 7.3 of RESAR-3, we conclude that the proposed design for manual initiation of steamline isolation does not conform with the requirements of Section 4.17 of IEEE Standard 279-1971. In addition, there is not sufficient information on the design provision for manual initiation of containment isolation and containment depressurization to determine whether these functions are desinged in accordance with Section 4.17 of IEEE Standard 279-1971. Our position is that a design which meets the following is an acceptable means of meeting the requirements of Section 4.17 of IEEE Standard 279-1971:

(1) Means should be provided for manual initiation of each protective action (e.g., reactor trip, containment isolation) at the system level,

regardless of whether or not means are also provided to initiate the protective action at the component or channel level (e.g., individual control rod, individual isolation valve).

(2) Manual initiation of a protective action at the system level should perform all actions performed by automatic initiation such as starting auxiliary or supporting system, sending signals to appropriate valves to assure their correct position, and providing the required action-sequencing functions and interlocks.

(3) The switches for manual initiation of protective actions at the system level should be located in the control room and be easily accessible to the operator so that action can be taken in an expeditious manner.

(4) The amount of equipment common to both manual and automatic initiation should be kept to a minimum. It is preferable to limit such common equipment to the final actuation devices and the actuated equipment. However, action-sequencing functions and interlocks (of Position 2) associated with the final actuation devices and actual equipment may be common providing individual manual initiation at the component or channel level is provided in the control room. No single failure within the manual, automatic, or common portions of the protection system should prevent initation of protective action by manual or automatic means.

(5) Manual initiation of protective actions should depend on the operation of a minimum of equipment consistent

with 1, 2, 3, and 4 above.

(6) Manual initiation of protective action at the system level should be so designed that once initiated, it will go to completion as required in Section 4.16 of IEEE Standard 279-1971.

Discuss your intent to comply with this position or justify any exceptions by discussing your reasons for concluding that such exceptions are in accordance with the requirements of IEEE Standard 279-1971.

Response See Subsection 7.3.2.2.7

RESAR-3 (Q31.14) General Design Criterion 37 requires, in part, that the emergency core cooling system by designed to permit testing the operability of the system as a whole. On Page 7.3-26 of RESAR-3, it is stated that the safety injection and residual heat removal pumps are made inoperable during the system tests. Our position is that in order to comply with the requirements of Criterion 37, these pumps must be included in the system test. Discuss your intent to comply with this position or justify any exception.

Response See Subsection 6.3.4 and Appendix 1A(B)

RESAR-3 (Q21.15) Section 6.3.5.1 of RESAR-3 states that only "one temperature detector which provides heater control for the immersion heater, control room alarm and control room indication" is provided for the boron injection surge tank. Provide the results of an analysis which addresses the effect of a single failure in this system. This analysis should include possible boron dilution during recirculation. Also, it is our position that the monitoring system for the boron injection system meet IEEE Standard 279-1971. Discuss your intent to comply with this position or justify any exceptions you may have in this regard.

Response See revised Subsection 6.3.2.2.3

RESAR-3 (Q31.16) The description of the Emergency Safety Feature systems provided in Section 7.3.1 of RESAR-3 is incomplete in that it does not provide all of the information requested in Section 7.3.1 of the Standard Format for those safety related systems, interfaces and components supplied by the applicant which match with the RESAR-3 scope systems. Provide all of the descriptive and design basis information requested in the Standard Format for these systems. In addition, provide the results of an analysis, as requested in Section 7.3.2 of the Standard Format, to demonstrate how the requirements of the General Design Criteria and IEEE Standard 279-1971 are satisfied and the extent to which the recommendations of applicable Regulatory Guide are satisfied. Identify and justify each exception.

Response See the response to Q032.17

RESAR-3 (Q31.17) Provide analyses showing that no adverse effects will occur or a discussion of such adverse effects that could occur as a result of power interruption to the Engineered Safety Features Actuation System at any time following the onset of a LOCA or other accident conditions.

Response See Question 032.21

RESAR-3 General Design Criterion 25 requires that the protection

(Q31.18) system be designed to assure that specified acceptable fuel design limits are not exceeded from an accidental withdrawal of a single rod control cluster assembly (not ejection). In the accident analysis, presented in Section 15.3-6 of RESAR, it is stated that "no single electrical or mechanical failure in the rod control system could cause th accidental withdrawal of a single rod control cluster assembly." However, Chapter 7.0 does not describe how the design prevents such an occurrence. Provide a detailed description of the control circuitry and discuss how the design meets the requirements of Criterion 25.

Response See Question 032.29

RESAR-3 (Q31.19) Provide a discussion which supplements those in Section 7.4, 7.5, and 7.6 of RESAR-3 and which addresses the Standard Format information requirements for the safe shutdown systems, the safety-related display instrumentation and other safety systems and equipment outside the RESAR-3 scope which are assumed in the RESAR-3 and the PSAR Chapter 15 accident analyses.

Response See Question 032.22

RESAR-3 (Q31.20) In addition to the design features discussed in Section 7.6.2 of RESAR-3, it is our position that the design of the RHR isolation valves satisfy the following:

(1) The interlocks shall utilize diverse equipment, and

(2) The interlocks shall be designed in accordance with the intent of IEEE Standard 279-1971.

The information presented in Section 7.6.2 of RESAR-3 does not address the requirement for diverse equipment and describes a degree of testability that conflicts with the requirements of IEEE Standard 1971. In addition it is stated that the position indications for the RHR valves differ from those for the accumulator isolation valves but these differences are not identified. Discuss your intent to comply with the requirements that the design shall utilize diverse equipment and shall include complete on-line test capability without opening the isolation valves, or justify any exceptions. In addition identify the differences in the position indications provided for the RHR valves compared to the accumualtor valves and discuss the reasons for the differences.

<u>Response</u> See Question 032.27

RESAR-3 (5.1) Provide the list of transients that were analyzed in determining the maximum steam system pressure transient for sizing the steam generator safety valves.

<u>Response</u> See Subsection 5.2.2.2

RESAR-3 (5.2) In reference to Section 5.3.4, provide Reactor Coolant System Temperature - Precent Power Map for plant <u>with</u> loop stop valves if different from Figure 5.3.1.

<u>Response</u> See Figure 4.4-21 which corresponds to RESAR-3 Figure 5.3-1: CPSES does not have loop stop valves.

RESAR-3 (5.2.2) Provide a discussion of the consequences of inadvertent overpressurization resulting from a malfunction or operator error when the reactor coolant system is watersolid during startup or shutdown. The discussion should include consideration of the pressure-temperature operating limitations on the reactor vessel to protect against brittle fracture. In addition, discuss any design provisions that will be incorporated into the facility design to prevent overpressurization incidents that would exceed allowable pressures in this particular plant condition.

<u>Response</u> See Question 212.5

RESAR-3 (5.2.7 & 6.3) Discuss the ability to assure that the operational capability of the valves that are required to function in the short and long term LOCA modes of ECCS operation are not impaired by potential crystallization of boric acid solutions on the valve stem due to leakage. Appropriate methods may include the ability to detect individual valve stem leakoff or periodic operational testing of the valves.

<u>Response</u> See revised Subsection 6.3.2.2.12

RESAR-3 (5.3) Justify the fouling factor resistance specified in Section 5.5.2.3.1. Correct the difference between Section 5.5.2.3.1 and Table 5.5-3 with regard to the fouling factor.

<u>Response</u> The fouling factor is discussed in Subsection 5.4.2.5.1 and is consistent with the value reported in Table 5.4-3.

RESAR-3 (5.4) Provide pressurizeer relief and safety valve capacities when discharging water liquid.

<u>Response</u> Liquid flow rates assumed in analysis are based on the homogeneous equilibrium saturated flow model which gives the most conservative relief rate. Accident analysis demonstrate that water relief through the pressurizer

valves occurs only during the feedline rupture event and the peak liquid relief rate is approximately 1 $ft.^3/sec$ at 2575 psia (see Subsection 15.2.8), compared with the homogeneous equilibrium model relief capacity of 15.3 $ft.^3/sec$ at 2575 psia.

RESAR-3 (6.1) Item 6.3.11 of the "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants" Revision 1, (October 1972) indicates the need to distinguish between true redundancy incorporated in a system and multiple components. To complement the SAR discussions in this regard, provide a summary of a systematic core cooling functional analysis of components required over the complete range of coolant pipe break inside the containment. The summary should be shown in the form of simple block diagrams beginning with the event (pipe break), branching out to the various possible sequences for the different size breaks, continuing through initial core cooling and ending with extended to long-term core cooling. When complete, the diagram should clearly identify each safety system required to function to cool the core for all coolant pipe breaks inside the containment during any plant operating state. The attached Figure 6-1 is provided as a guide.

<u>Response</u> System reliabiltiy of the ECCS, including a discussion of redundancy and compliance with the single failure criteria is provided in Section 6.3.2.5. Functioning of the various ECCS components for various accidents including large and small LOCAs are discussed in Subsection 6.3.3. The actual LOCA analyses are discussed in Subsection 6.2 and 15.6.5. Additional information is provided in the response to RESAR-3 (Q15.0.1).

RESAR-3 (6.2) For each engineered safety feature identified in Question 6.1, list the auxiliaries required for its operation.

Response The supporting auxiliaries which are required to function and support the ECCS are the safeguards electrical busses, the component cooling water system, and the engineered safety features ventilation systems. The safeguards electrical busses are required to provide electrical power to the ECCS pumps and motor operated valves. The component cooling water system is required to provide cooling to the ECCS pumps and the RHR heat exchanger (during recirculation only). The engineered safety features ventilation system is required to provide cooling for the ECCS pump motors. Addition information is provided in the response to RESAR-3 (Q15.0.1).

RESAR-3 (15.0.1) For each transient and accident analyzed in Chapter 15, provide the following information:

(1) The step-by-step sequence of events from event initiation to the final stabilized condition. This listing should identify each significant occurrence on a time scale, including for example: flux monitor trip, insertion of control rods begin, primary coolant pressure reaches safety valve set point, safety valves open, safety valves close, containment isolation signal initiated, containment isolated, etc. All required operator actions should also be identified.

(2) The extent to which normally operating plant instrumentation and controls are assumed to function.

(3) The extent to which plant and reactor protection

systems are required to function.

(4) The credit taken for the functioning of normally operating plant systems.

(5) The operation of engineered safety systems that is required.

Response These diagrams are given in Figures Q032.1-1 to Q032.1-24.

RESAR-3 (15.0.2) Section 15.2.4 of RESAR-3 UNCONTROLLED BORON DILUTION, analyses the effects of a dilution at power. The analysis discusses the causes of the incident, and the automatic actions of the Reactor Protection System and the manual actions prompted by alarms and instrumentation that would mitigate the consequences of the accident.

However, there is a possible situation, involving the loss of offsite power, where a dilution incident may not be as readily apparent as that described in Section 15.2.4 and where no automatic Reactor Protection System action is available.

In order to assess the potential severity of a dilution accident after a loss of offsite power, provide the results of an analysis that assumes the anticipated equipment configurations in normal use prior to the event that result in the most severe consequences. The analysis should include a dilution operation in progress with the Chemical and Volume Control System mode selector switch being in the DILUTE position (or A:TERNATE DILUTE mode). The loss of offsite power is then assumed to occur with the minimum shutdown reactivity insertion due to control rods. Both diesel generators start and sequence the loss of offsite power loads.

The concerns are that the charging pumps again automatically start running after being loaded to the diesel generators and from electrical schematics of control circutis for the reactor makeup water pumps, that the reactor makeup water pumps would also again automatically start with the mode selector switch in DILUTE. Therefore, a dilution of the Reactor Coolant System is again in progress which could potentially result in a return to critical.

If the reactor makeup water batch integrator is assumed to malfunction by not automatically cutting off flow at the pre-selected value, provide the time available for manual action before the total shutdown margin is lost due to this dilution. If operator action is to be prompted by alarms, describe the features that will alert the operator to this specific action at a time when alarms from many plant systems are occurring simultanelously.

Response This question will be answered with the responses to round one questions.

ABBREVIATIONS USED:

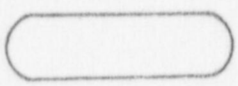
AFWS - AUXILIARY FEEDWATER SYSTEM
CVCS - CHEMICAL AND VOLUME CONTROL SYSTEM
ESFAS - ENGINEERED SAFETY FEATURES ACTUATION SYSTEM
FW - FEEDWATER
RTS - REACTOR TRIP SYSTEM
SIS - SAFETY INJECTION SYSTEM
SI - SAFETY INJECTION
RT - REACTOR TRIP
CS - CONTAINMENT SPRAY
ECCS - EMERGENCY CORE COOLING SYSTEM
HL - HOT LEG
CL - COLD LEG
CCWS - COMPONENT COOLING WATER SYSTEM
RCS - REACTOR COOLANT SYSTEM
SWS - SERVICE WATER SYSTEM
HPI - HIGH PRESSURE INJECTION
LPI - LOW PRESSURE INJECTION
CI - CONTAINMENT ISOLATION
SG - STEAM GENERATOR

NOTES:

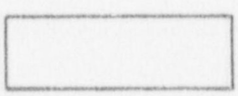
1. FOR TRIP INITIATION AND SAFETY SYSTEM ACTUATION, MULTIPLE SIGNALS ARE SHOWN BUT ONLY A SINGLE SIGNAL IS REQUIRED. THE OTHER SIGNALS ARE BACKUPS.

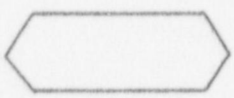
2. NO TIMING SEQUENCE IS IMPLIED BY POSITION OF VARIOUS BRANCHES. REFER TO EVENT TIMING SEQUENCES PRESENTED IN TABULAR FORM IN PERTINENT ACCIDENT ANALYSIS SECTION OF CHAPTER 15.0 OF THE FSAR.

DIAGRAM SYMBOLS:


- EVENT TITLE


- BRANCH POINT FOR DIFFERENT PLANT CONDITIONS


- SAFETY SYSTEM


- SAFETY ACTION

- SYSTEM REQUIRED TO MEET SINGLE-FAILURE CRITERIA

- MANUAL ACTION REQUIRED DURING SYSTEM OPERATION

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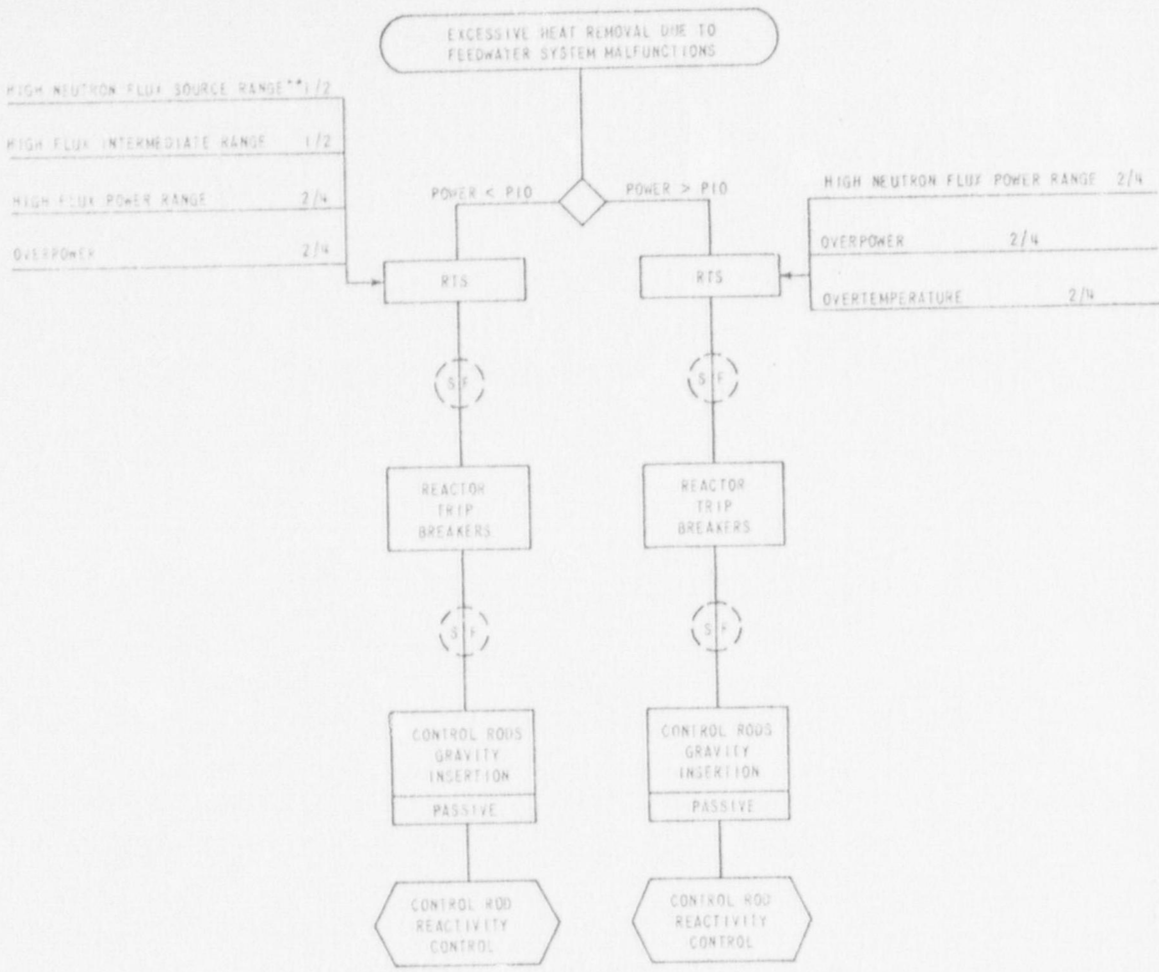
UNITS 1 and 2

ABBREVIATIONS

FIGURE Q032.1-0



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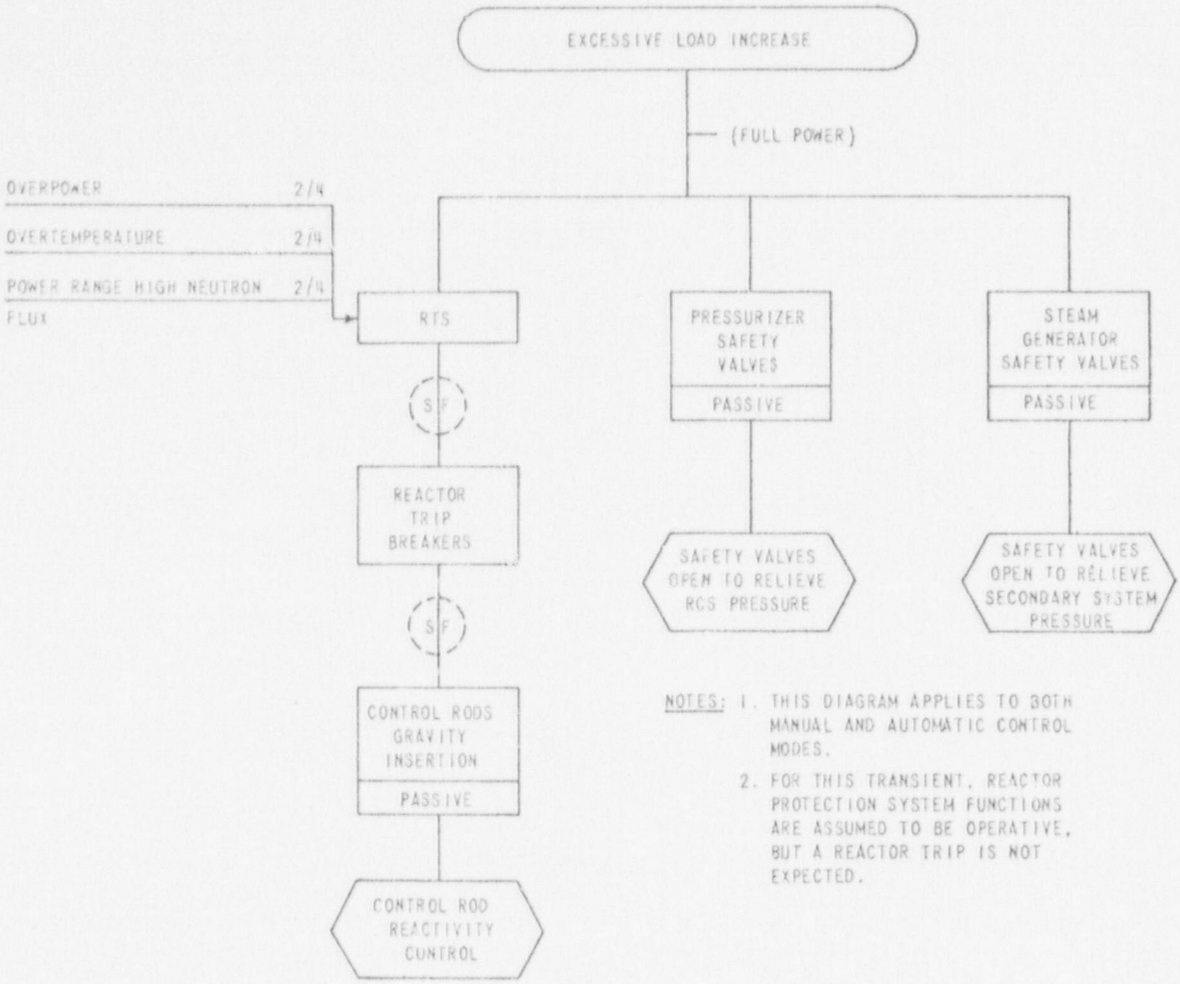
UNITS 1 and 2

EXCESSIVE HEAT REMOVAL DUE TO FEEDWATER SYSTEMS MALFUNCTION

FIGURE Q032.1-1



NOTES: 1. THIS DIAGRAM APPLIES TO BOTH MANUAL AND AUTOMATIC CONTROL MODES.

2. FOR THIS TRANSIENT, REACTOR PROTECTION SYSTEM FUNCTIONS ARE ASSUMED TO BE OPERATIVE, BUT A REACTOR TRIP IS NOT EXPECTED.

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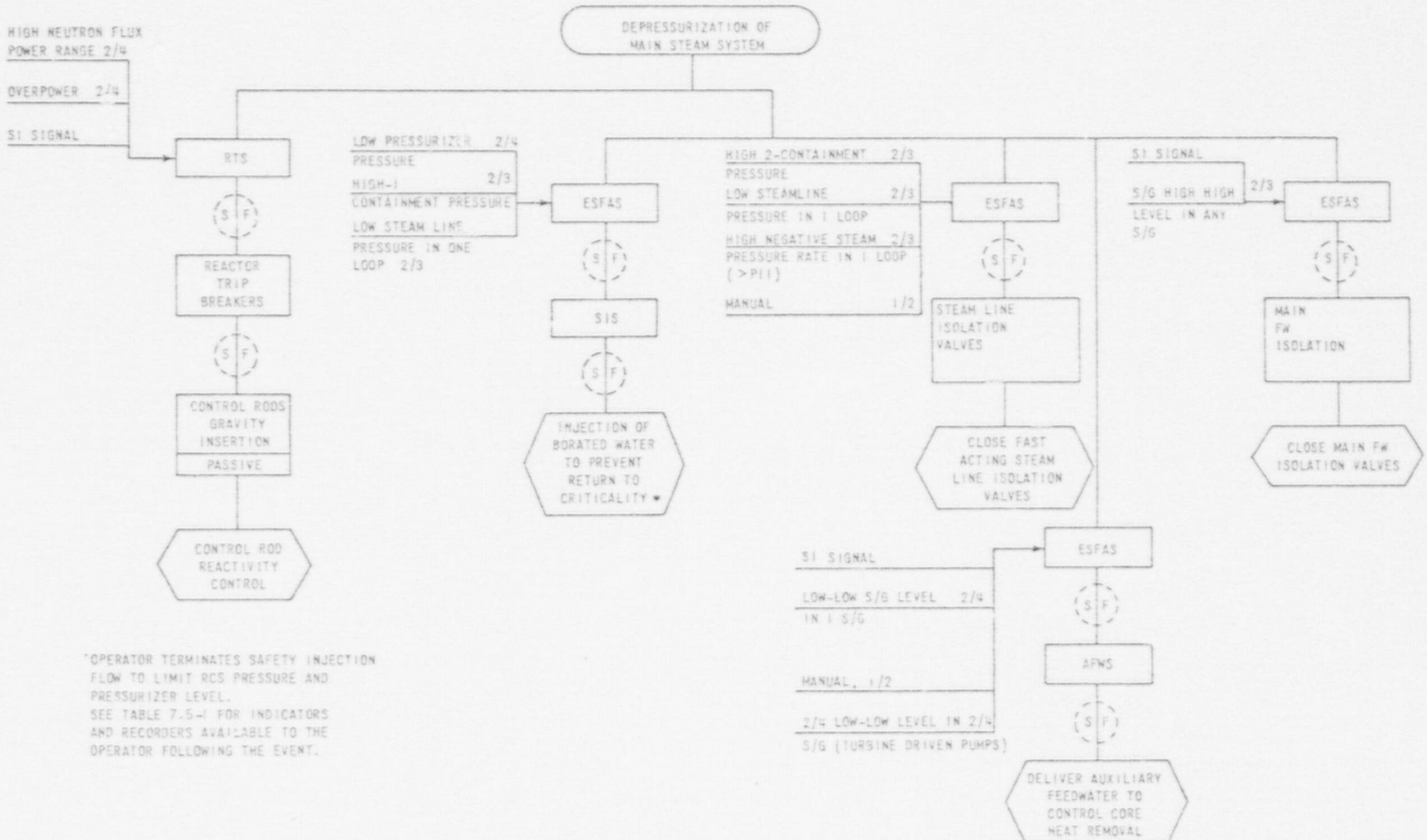
UNITS 1 and 2

EXCESSIVE LOAD INCREASE

FIGURE Q032.1-2



*OPERATOR TERMINATES SAFETY INJECTION FLOW TO LIMIT RCS PRESSURE AND PRESSURIZER LEVEL.
SEE TABLE 7.5-1 FOR INDICATORS AND RECORDERS AVAILABLE TO THE OPERATOR FOLLOWING THE EVENT.

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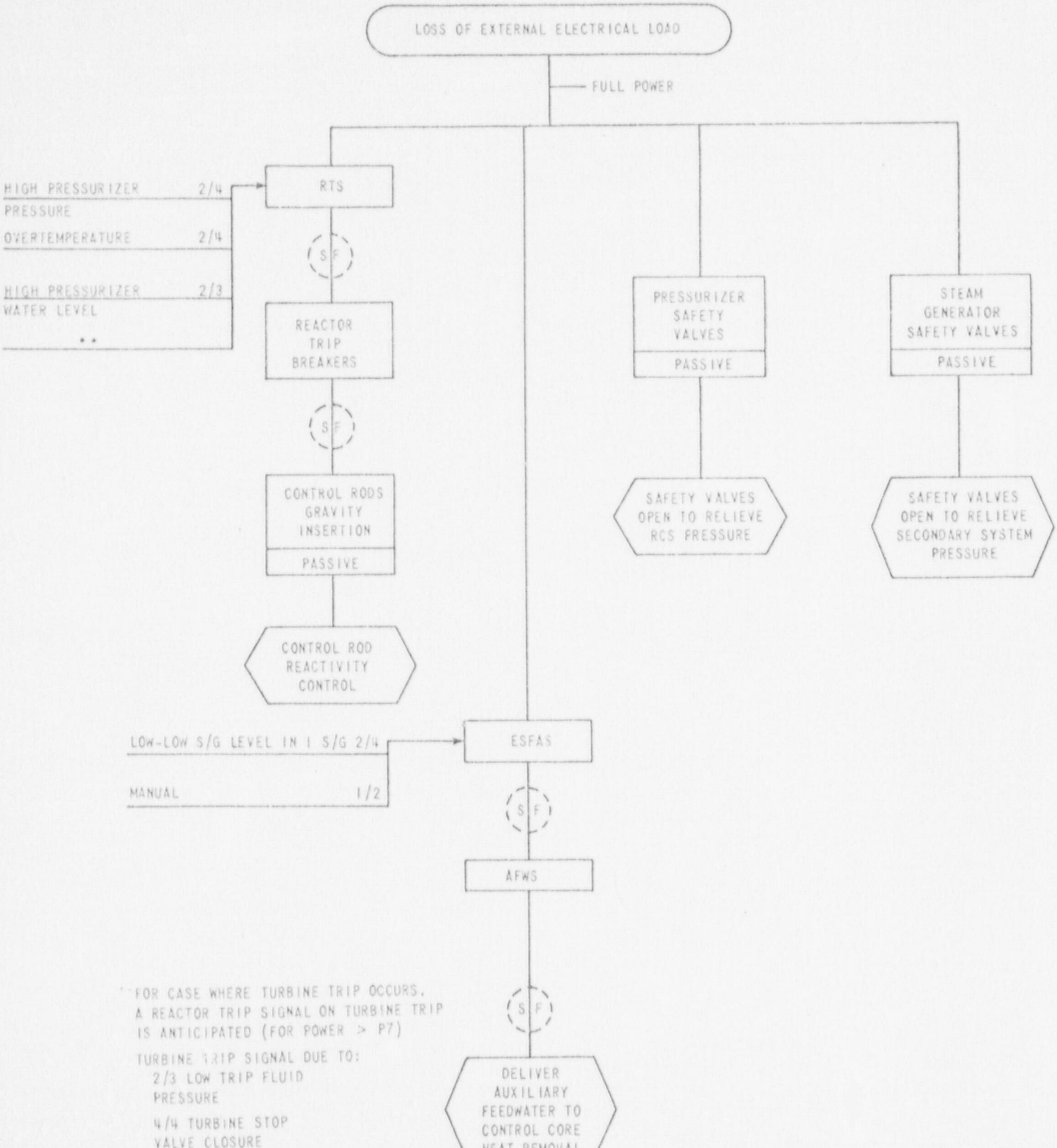
UNITS 1 and 2

DEPRESSURIZATION OF MAIN STEAM SYSTEM

FIGURE Q032.1-3



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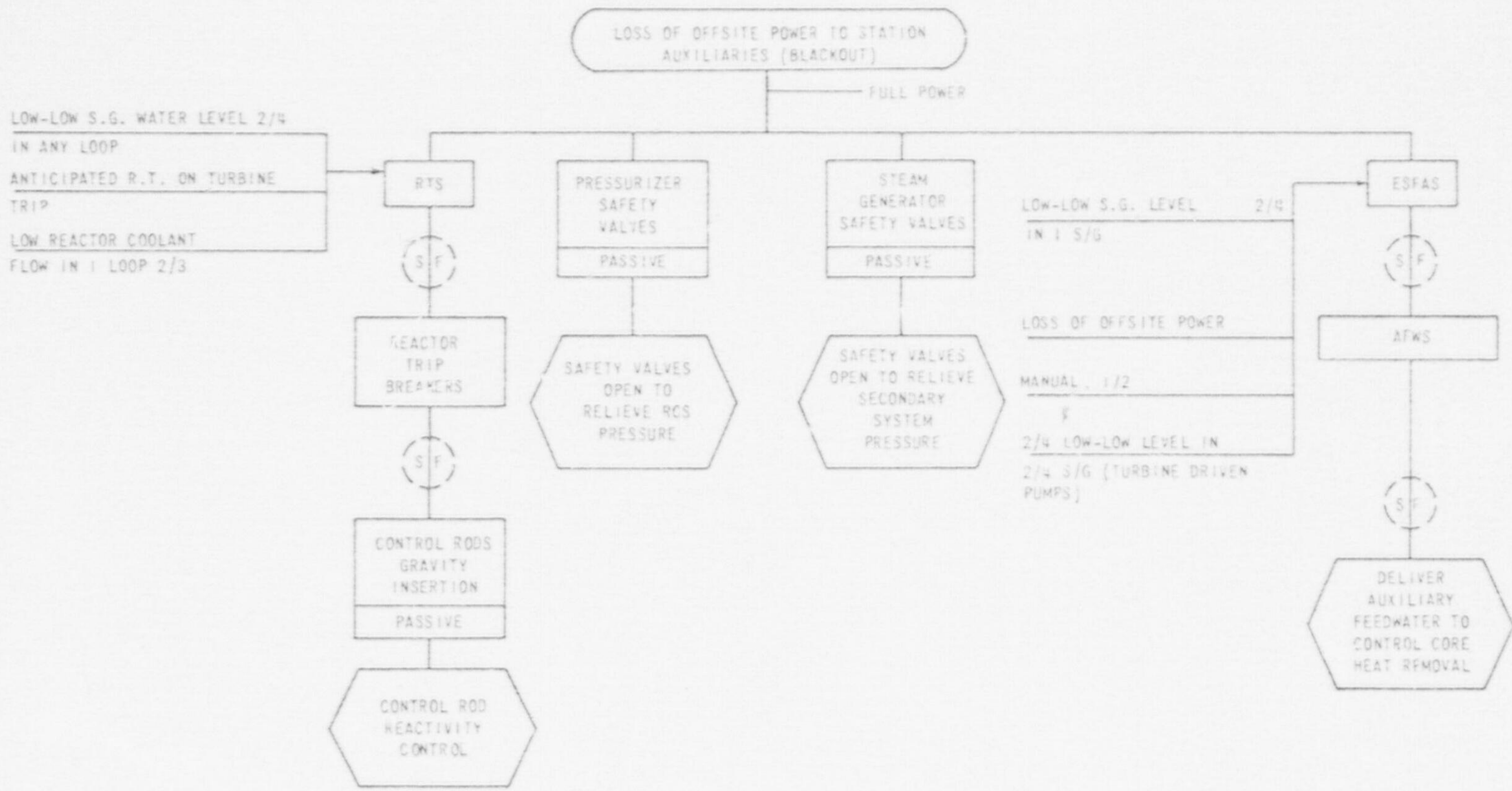
UNITS 1 and 2

LOSS OF EXTERNAL LOAD

FIGURE Q032.1-4



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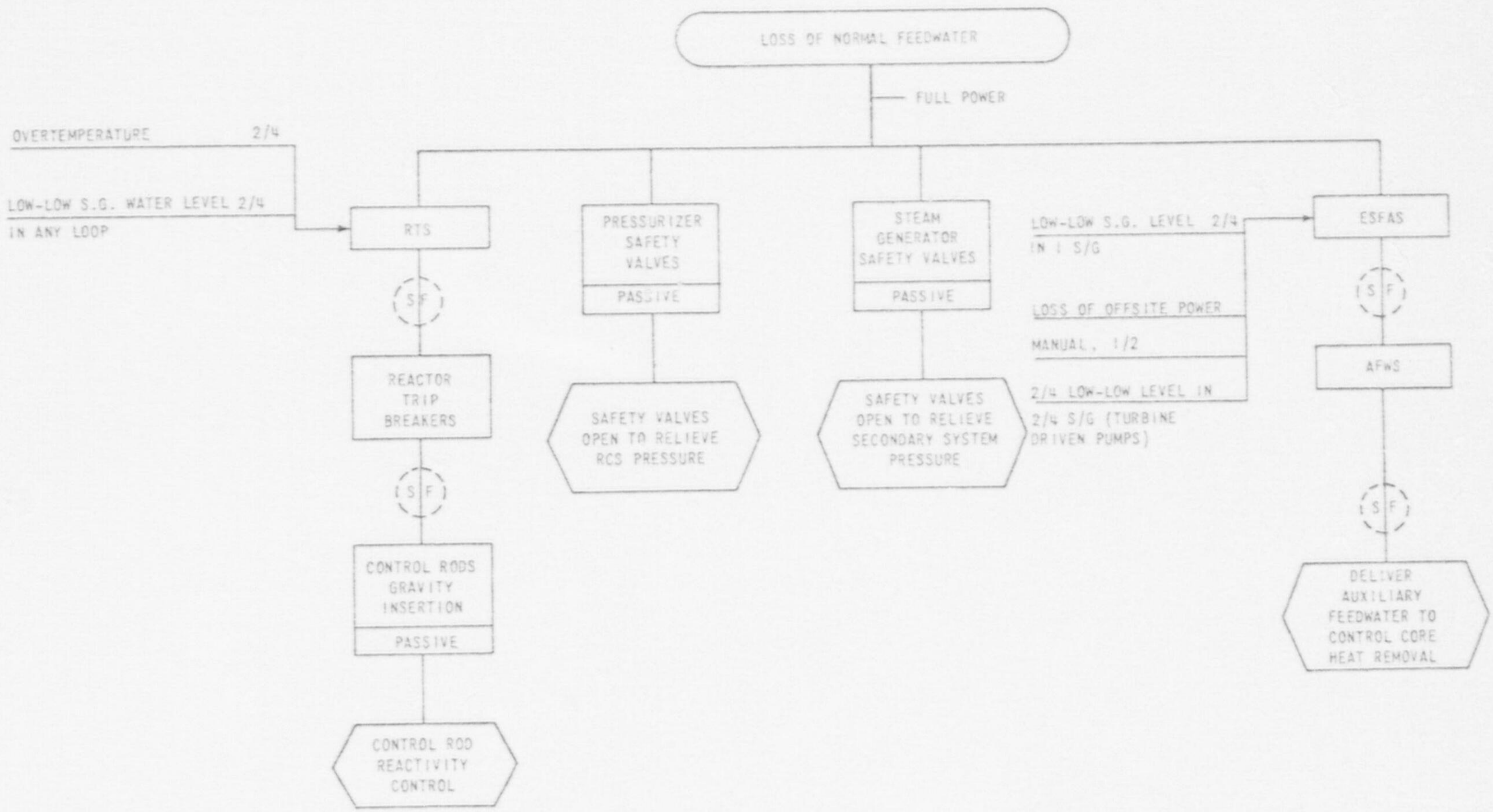
UNITS 1 and 2

LOSS OF OFFSITE POWER TO STATION AUXILIARIES (BLACKOUT)

FIGURE Q032.1-5



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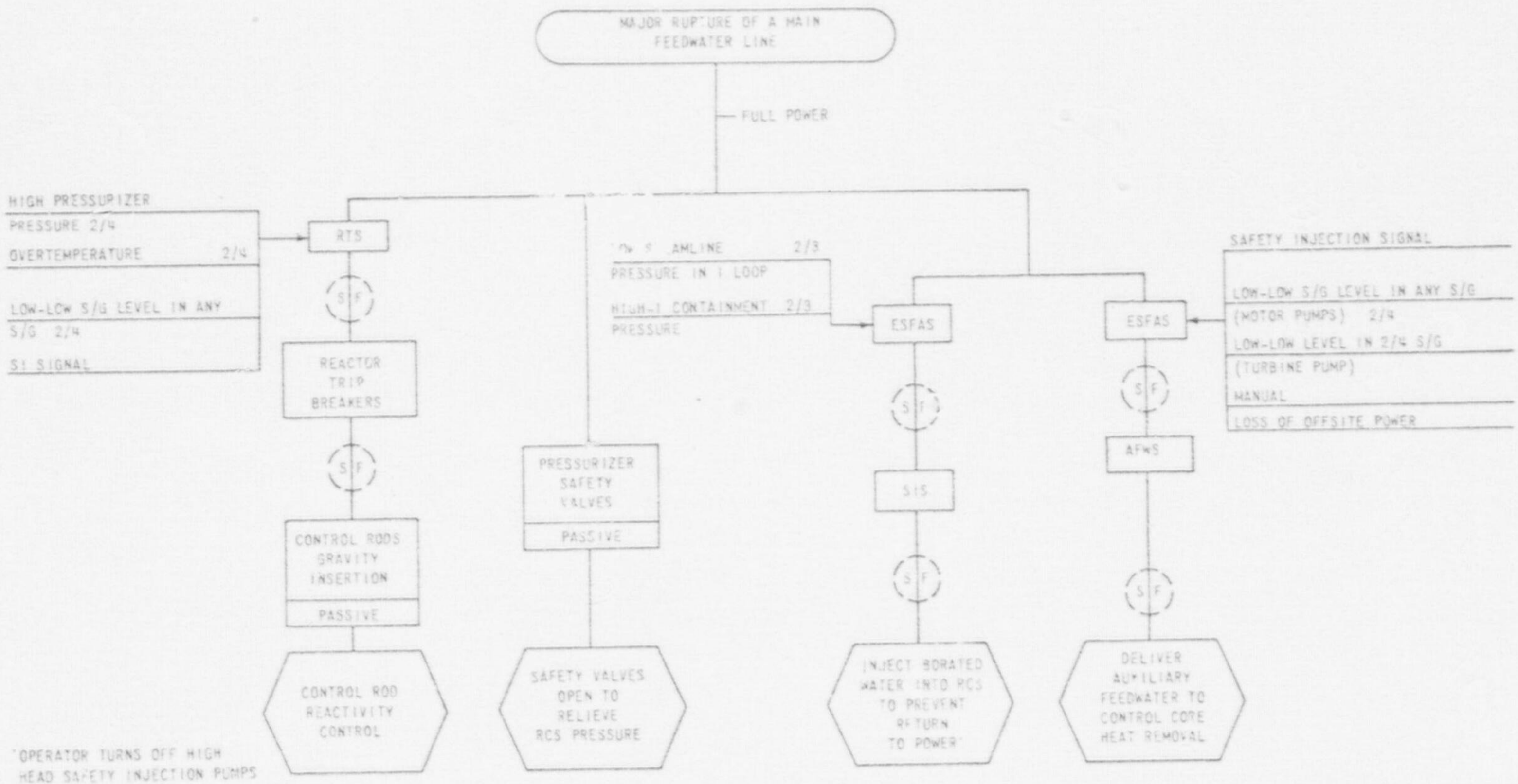
LOSS OF NORMAL FEEDWATER

FIGURE Q032.1-6



*OPERATOR TURNS OFF HIGH HEAD SAFETY INJECTION PUMPS SUBSEQUENT TO RECOVERY OF LEVEL IN THE INTACT S/G'S

SEE TABLE 7.5-1 FOR INDICATORS AND RECORDERS AVAILABLE TO THE OPERATOR FOLLOWING THE EVENT.

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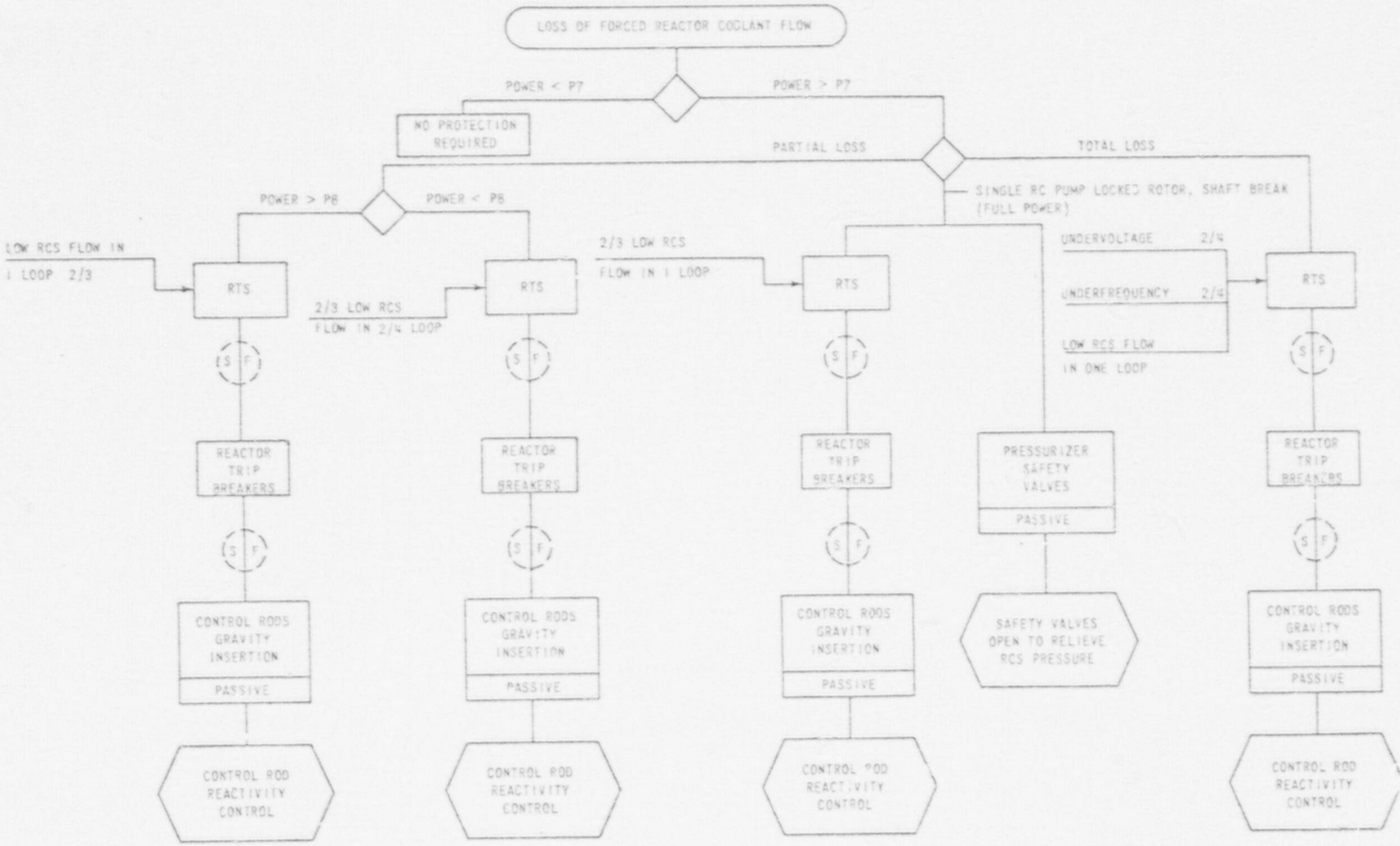
MAJOR RUPTURE OF A MAIN FEEDWATER LINE

FIGURE Q032.1-7



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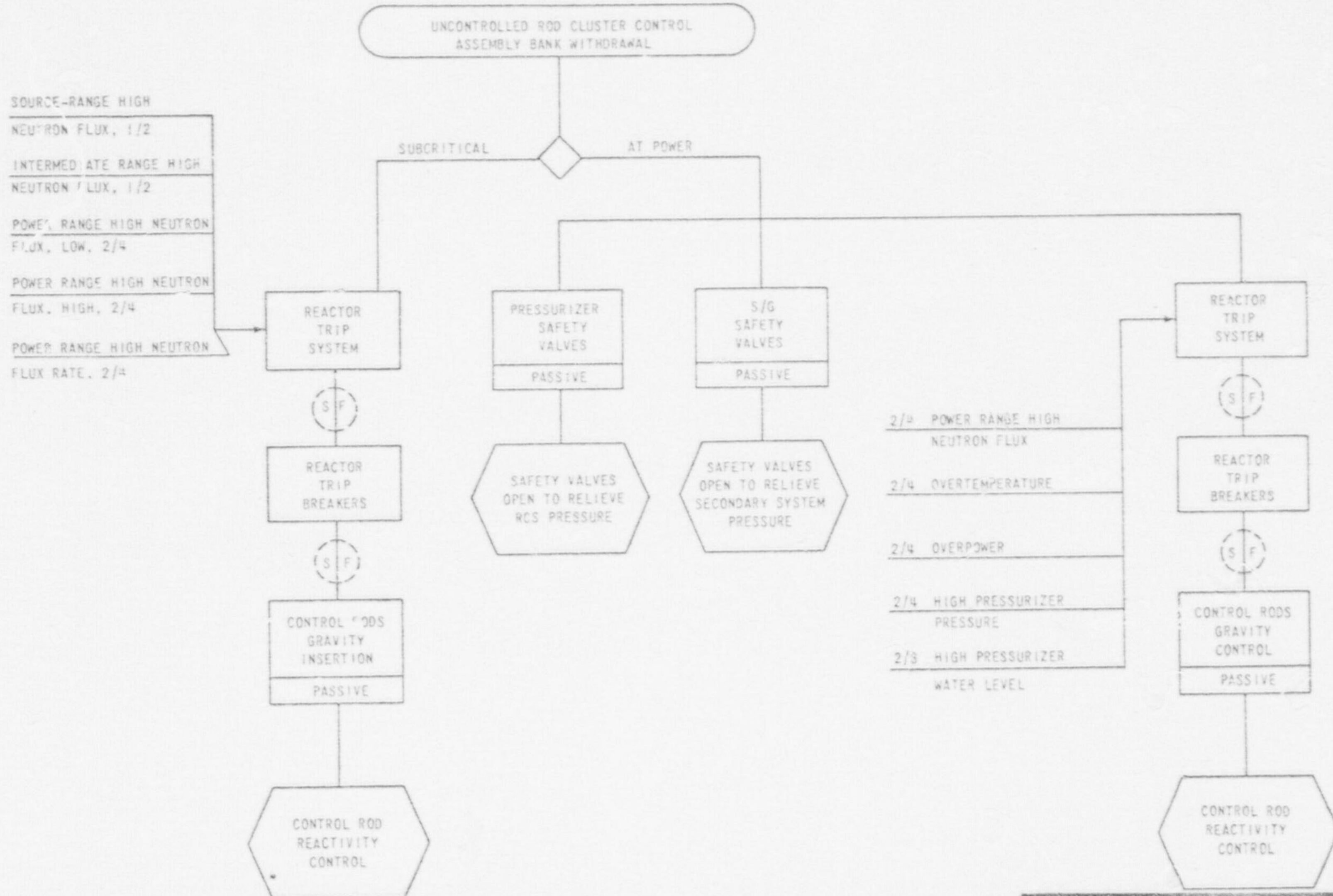
LOSS OF FORCED REACTOR COOLANT FLOW

FIGURE Q032.1-8



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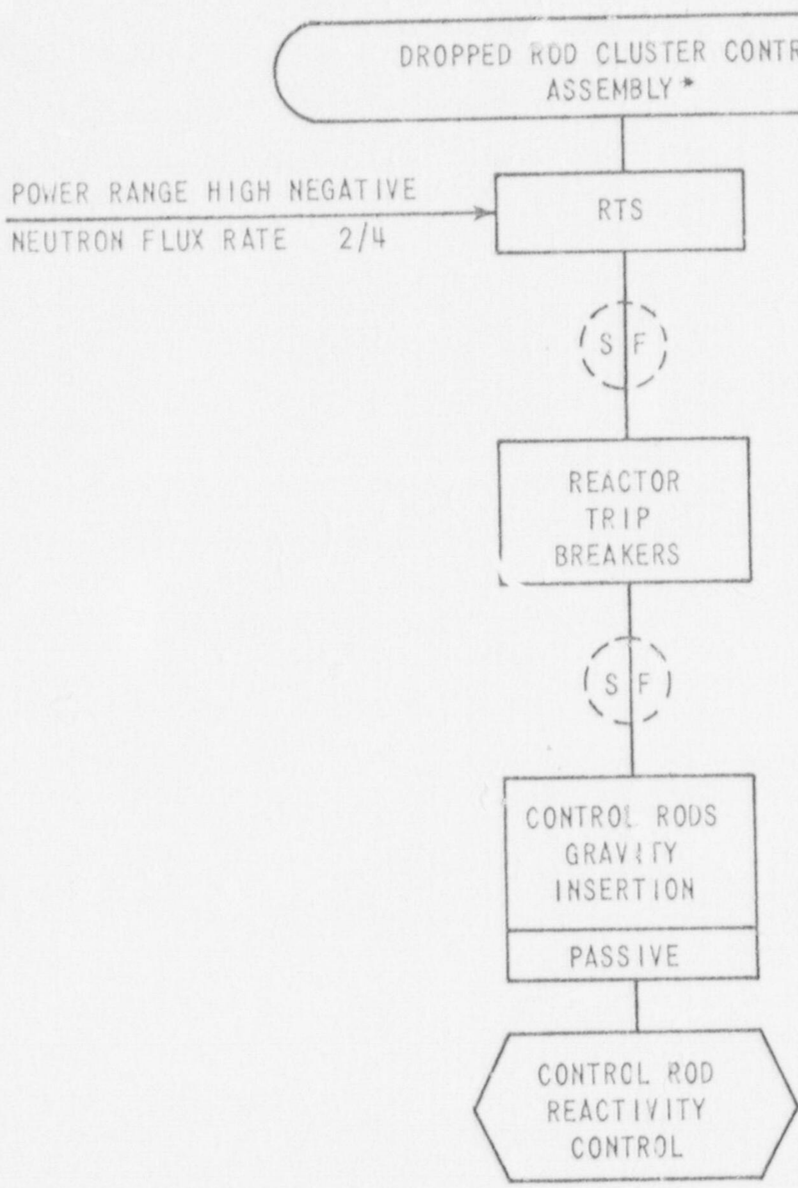
UNCONTROLLED ROD CLUSTER CONTROL ASSEMBLY BANK WITHDRAWAL



*TRIP SEQUENCE OCCURS ONLY IF ROD WORTH IS GREATER THAN MINIMUM REQUIRED TO TRIGGER THE FLUX RATE TRIP, OR IF AN ENTIRE RCCA BANK DROPS. FOR OTHER ROD WORTH, OR FOR MISALIGNMENT, NO PROTECTION REQUIRED.

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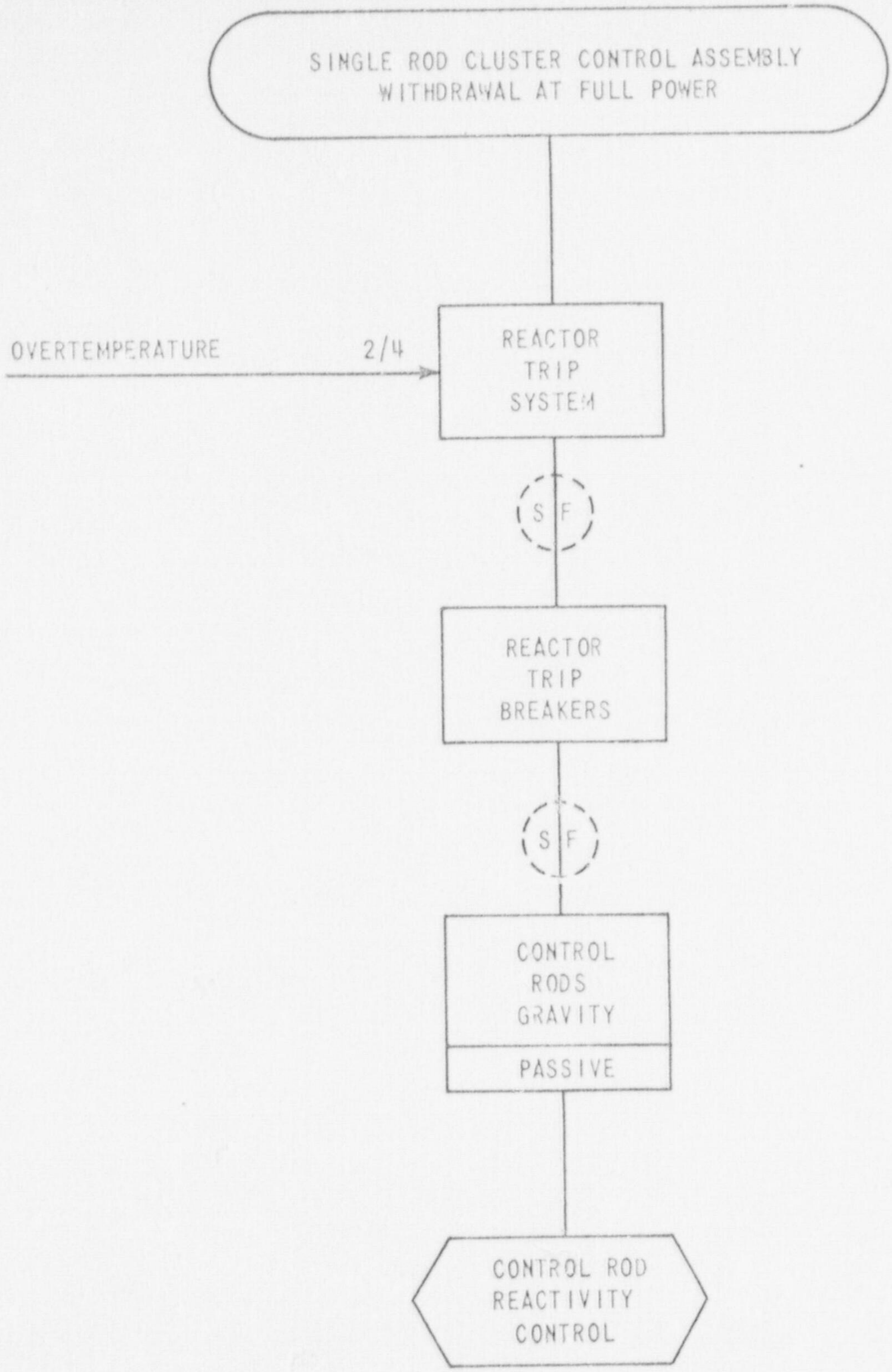
DROPPED ROD CLUSTER CONTROL ASSEMBLY

FIGURE Q032.1-10



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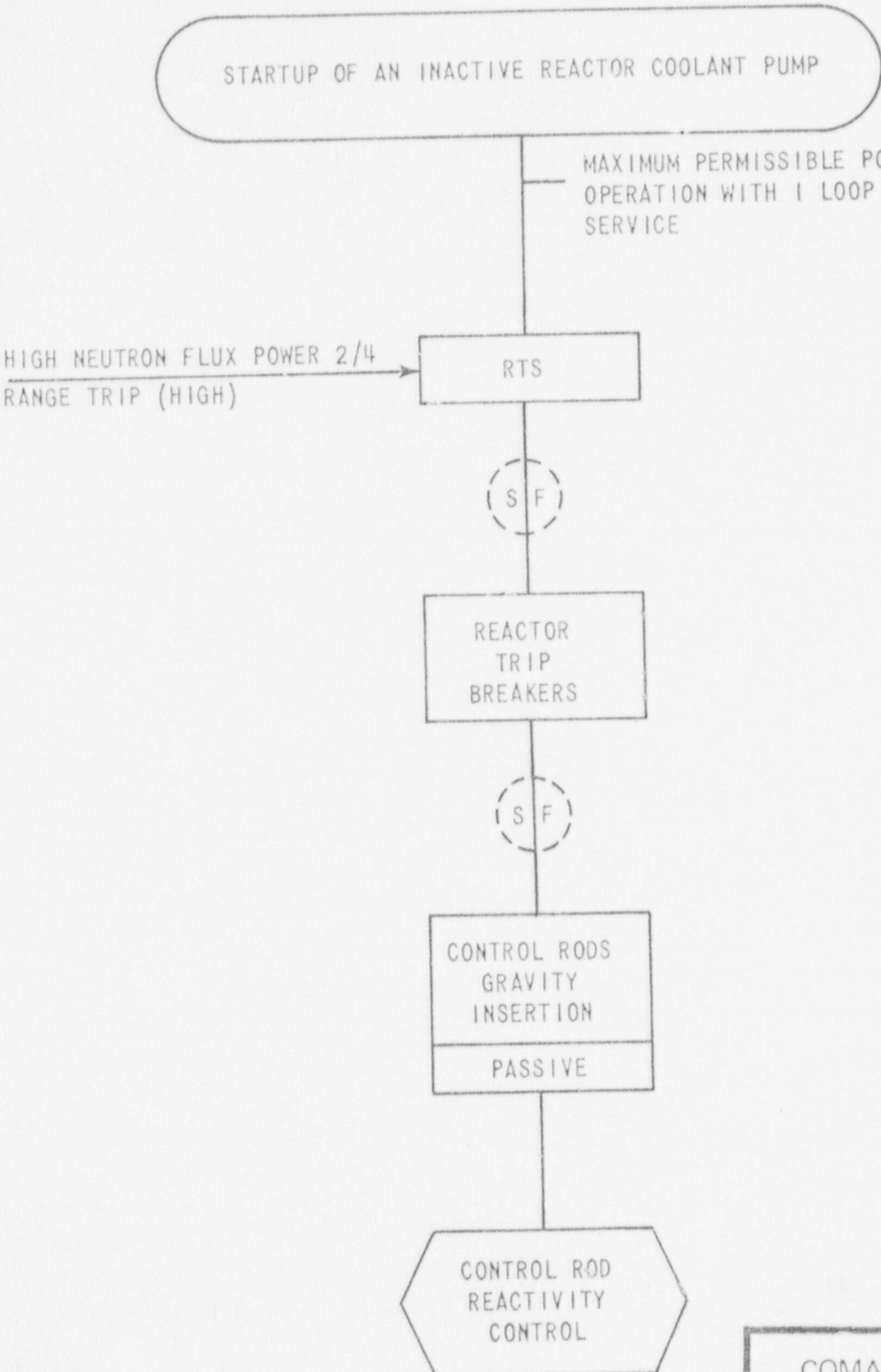
SINGLE ROD CLUSTER CONTROL
ASSEMBLY WITHDRAWAL AT
AT FULL POWER

FIGURE Q032.1-11



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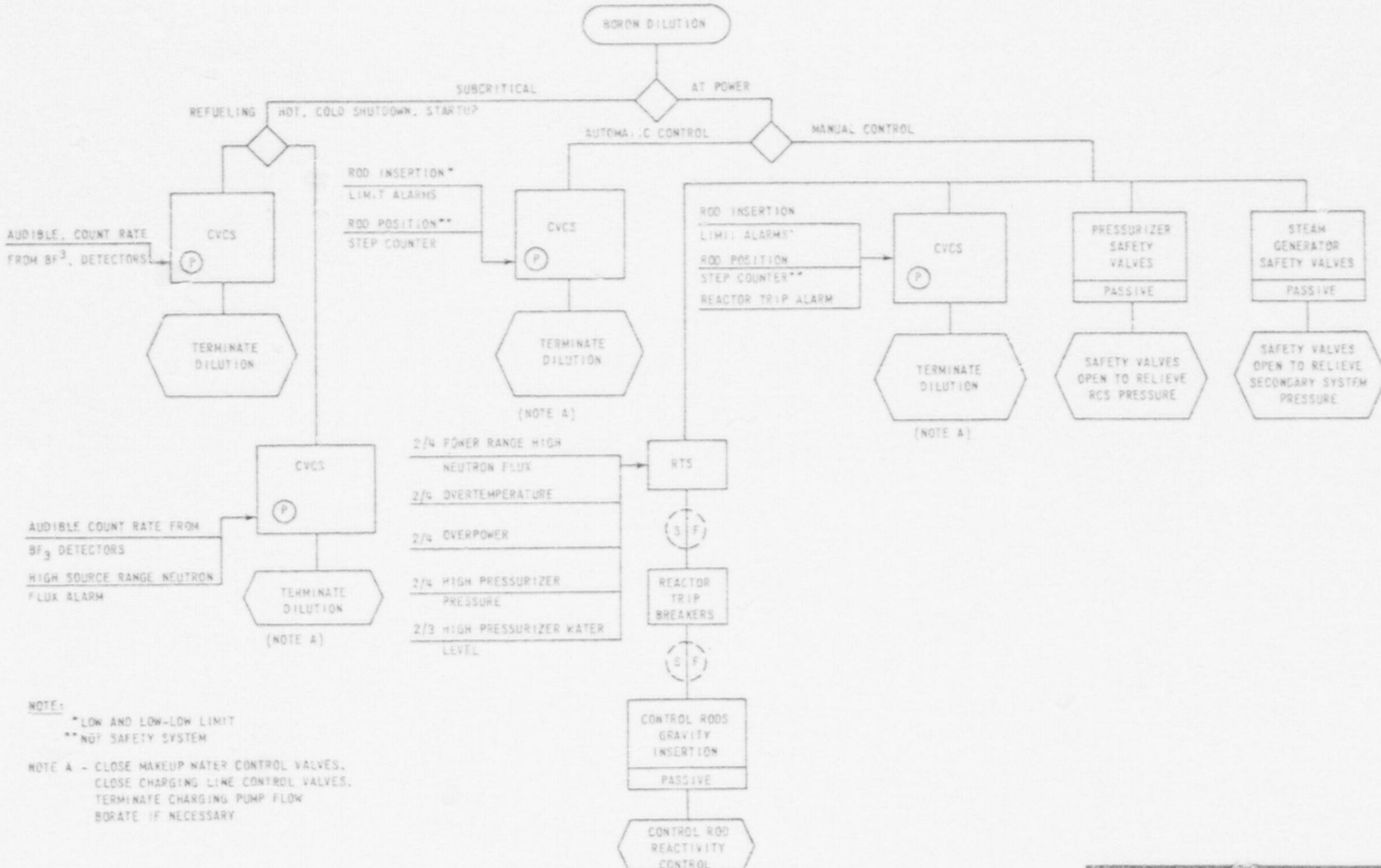
STARTUP OF AN INACTIVE REACTOR COOLANT LOOP

FIGURE Q032.1-12



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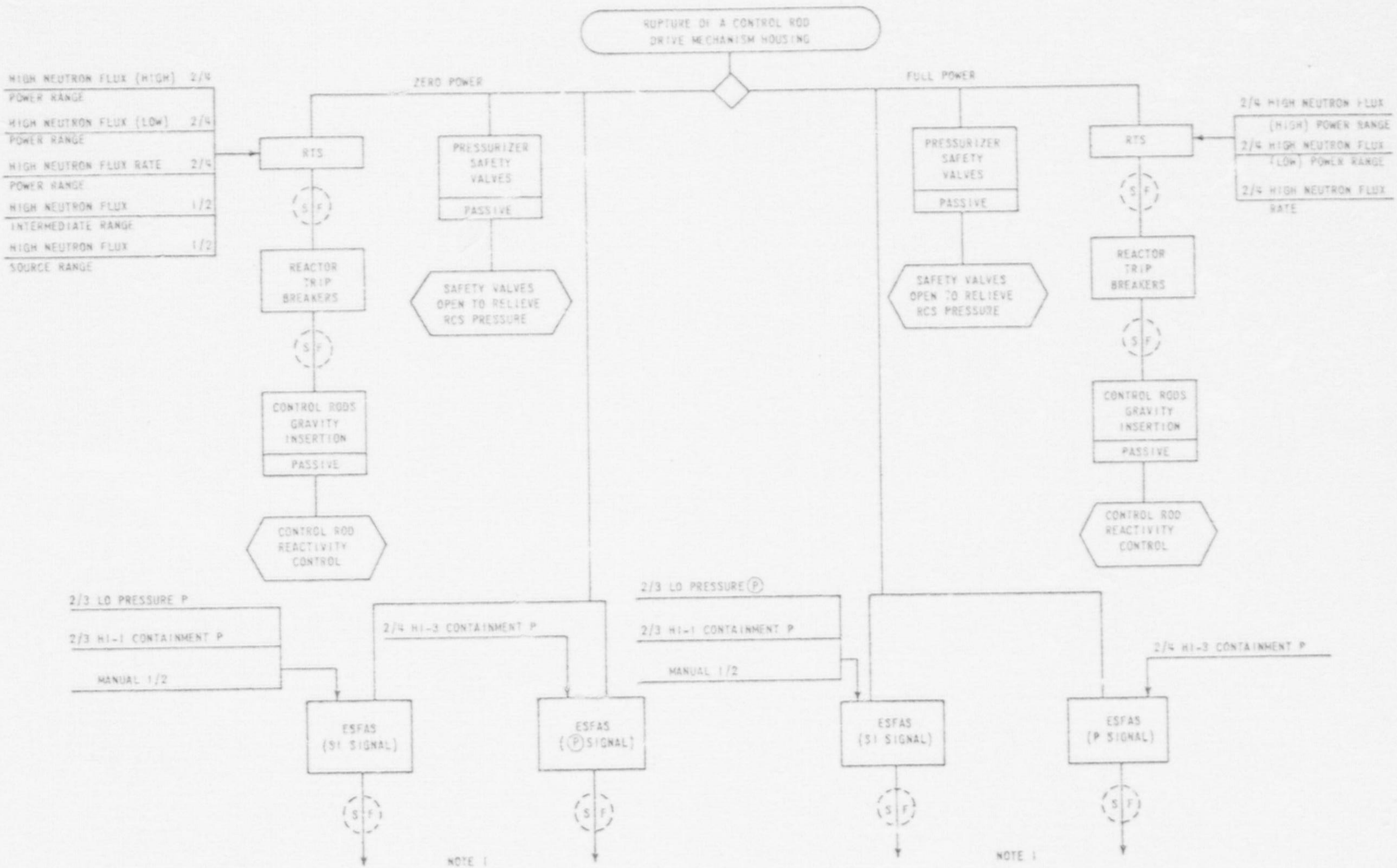
BOPON DILUTION

FIGURE Q032.1-13



NOTE 1: SEQUENCE FOLLOWING ESFAS ACTUATION IS SIMILAR TO THAT FOR A SMALL LOSS OF COOLANT EVENT (LOCA) SEE FIGURE Q211.39-17

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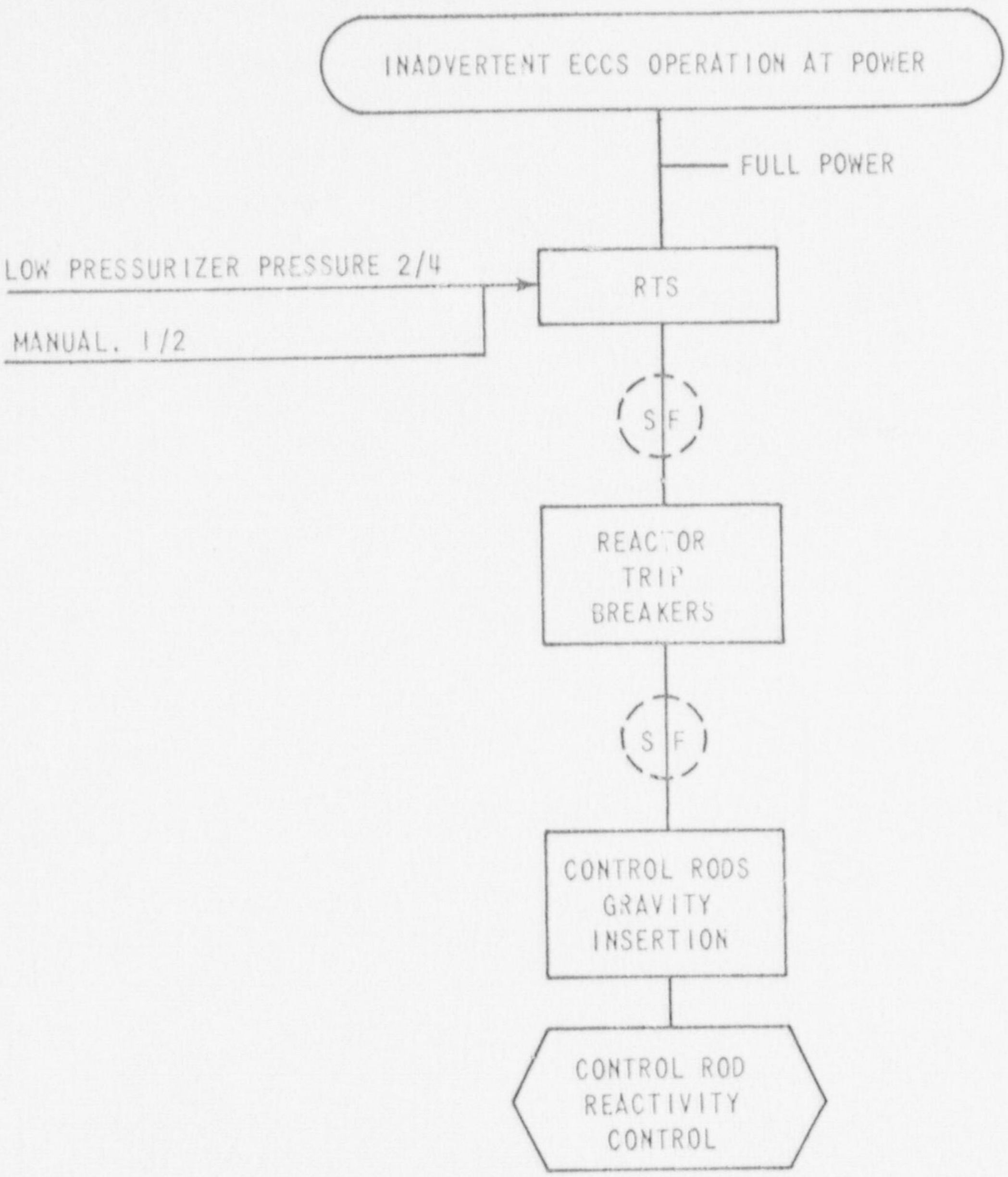
RUPTURE OF CONTROL ROD DRIVE MECHANISM HOUSING

FIGURE Q032.1-14



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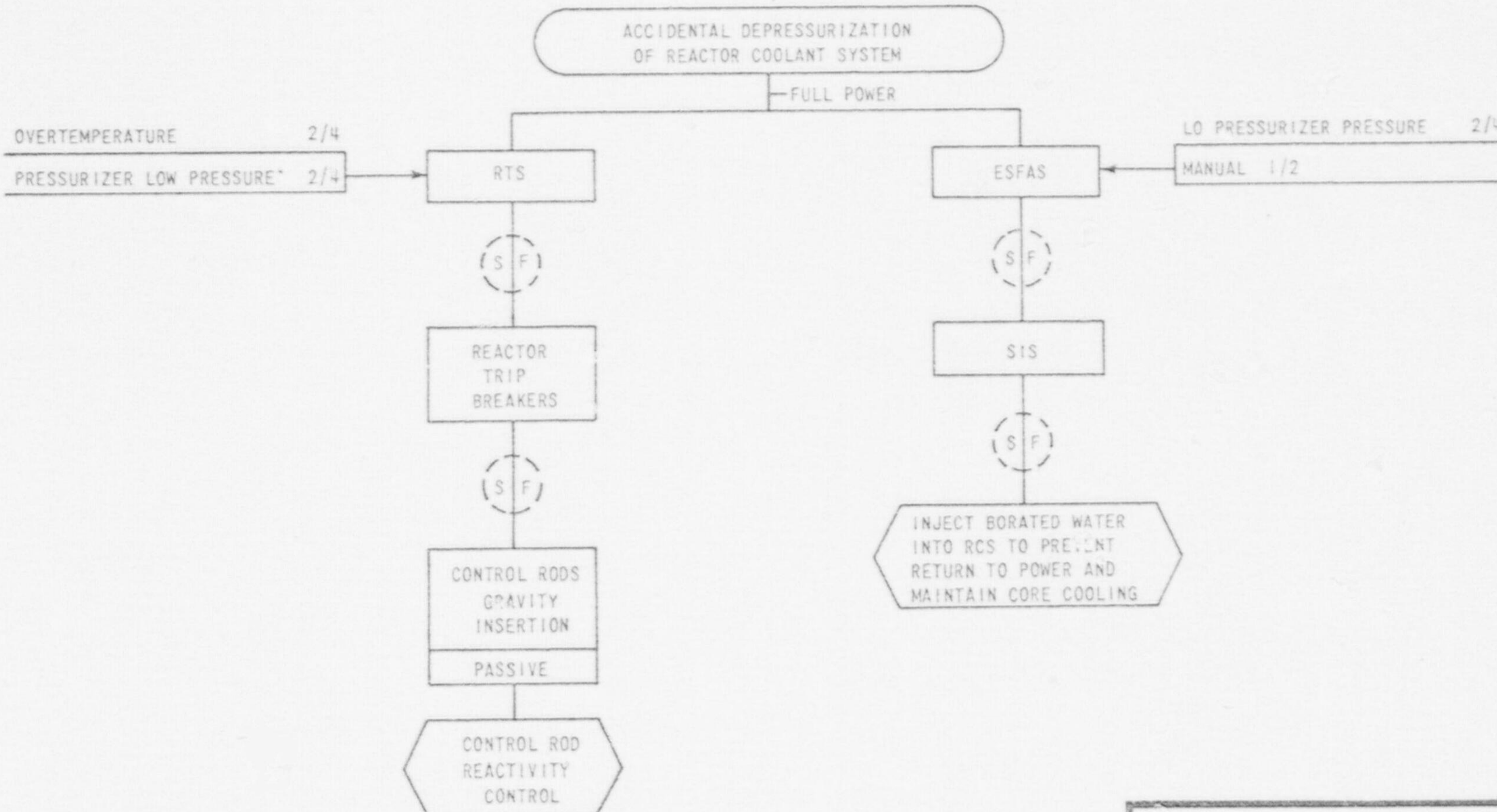
INADVERTENT ECCS OPERATION
AT POWER

FIGURE Q032.1-15



*POWER P7

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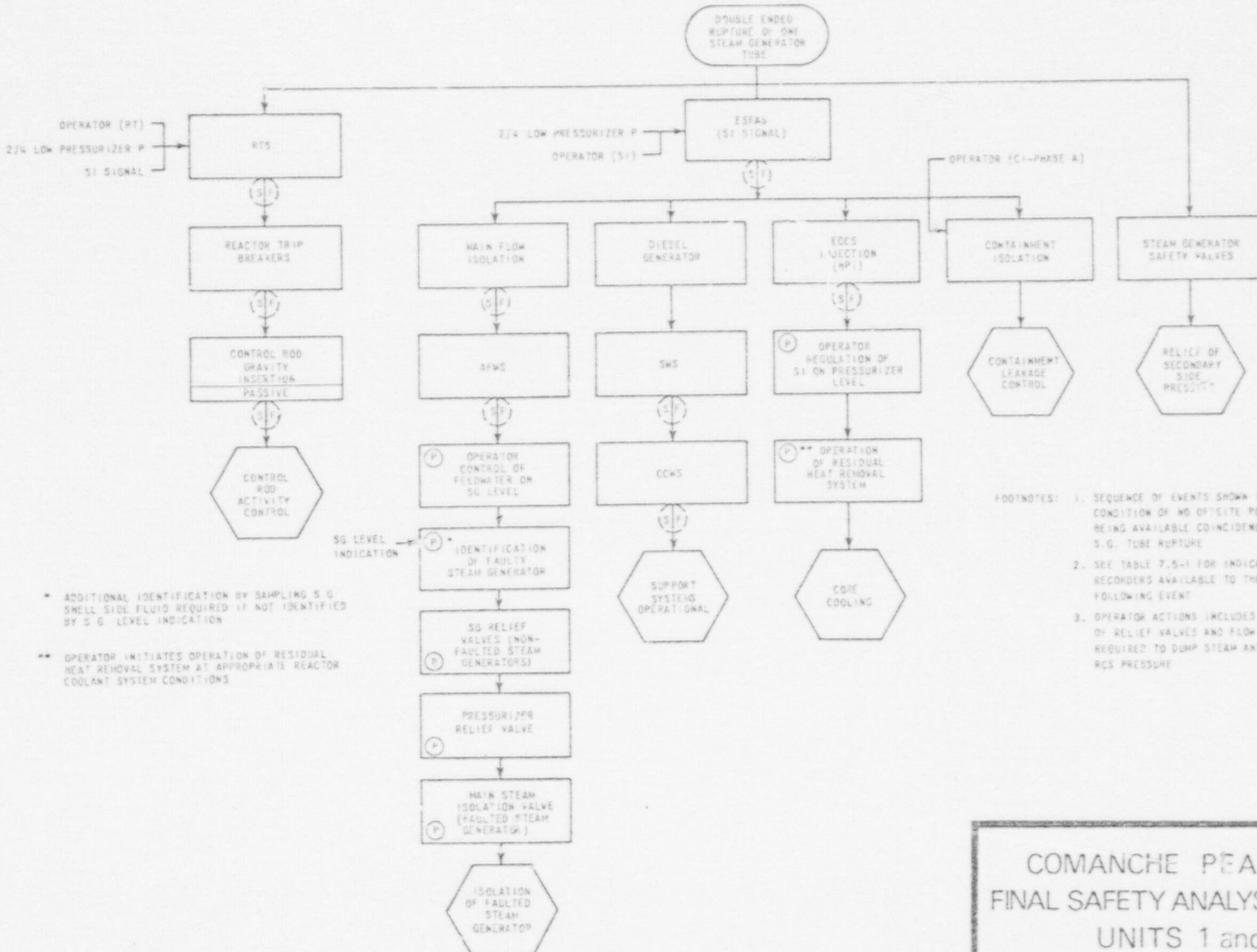
ACCIDENTAL DEPRESSURIZATION OF
REACTOR COOLANT SYSTEM

FIGURE Q032.1-16



* ADDITIONAL IDENTIFICATION BY SAMPLING S.G. SHELL SIDE FLUID REQUIRED IF NOT IDENTIFIED BY S.G. LEVEL INDICATION

** OPERATOR INITIATES OPERATION OF RESIDUAL HEAT REMOVAL SYSTEM AT APPROPRIATE REACTOR COOLANT SYSTEM CONDITIONS

FOOTNOTES:

1. SEQUENCE OF EVENTS SHOWN IS FOR A CONDITION OF NO OFFSITE POWER BEING AVAILABLE COINCIDENCE WITH S.G. TUBE RUPTURE
2. SEE TABLE 7.5-1 FOR INDICATORS AND RECORDERS AVAILABLE TO THE OPERATOR FOLLOWING EVENT
3. OPERATOR ACTIONS INCLUDES OPERATION OF RELIEF VALVES AND FLOW CONTROL REQUIRED TO DUMP STEAM AND REDUCE RCS PRESSURE

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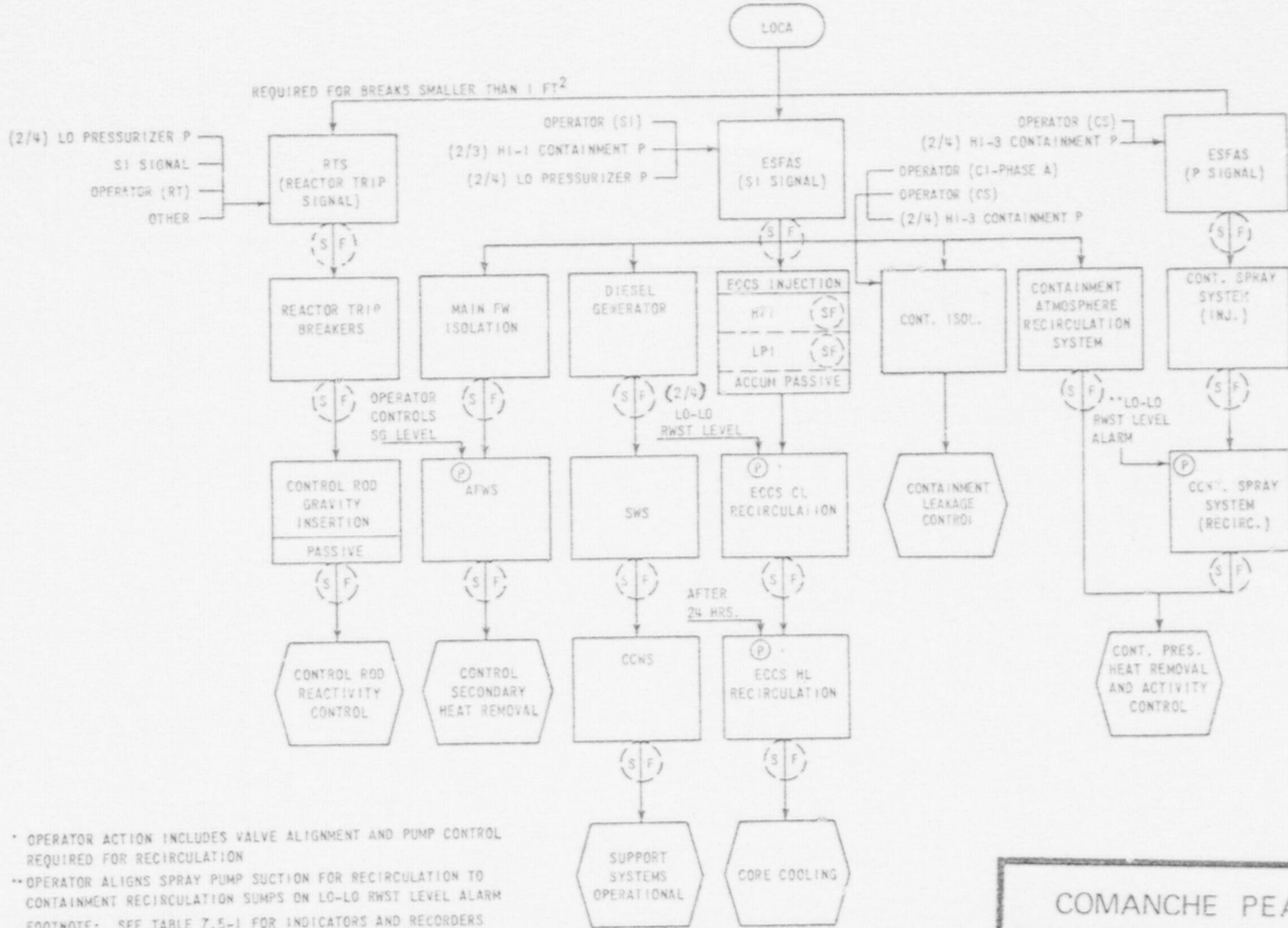
STEAM GENERATOR TUBE RUPTURE

FIGURE Q032.1-17



* OPERATOR ACTION INCLUDES VALVE ALIGNMENT AND PUMP CONTROL REQUIRED FOR RECIRCULATION

** OPERATOR ALIGNS SPRAY PUMP SUCTION FOR RECIRCULATION TO CONTAINMENT RECIRCULATION SUMPS ON LO-LO RWST LEVEL ALARM

FOOTNOTE: SEE TABLE 7.5-1 FOR INDICATORS AND RECORDERS AVAILABLE TO THE OPERATOR FOLLOWING EVENT

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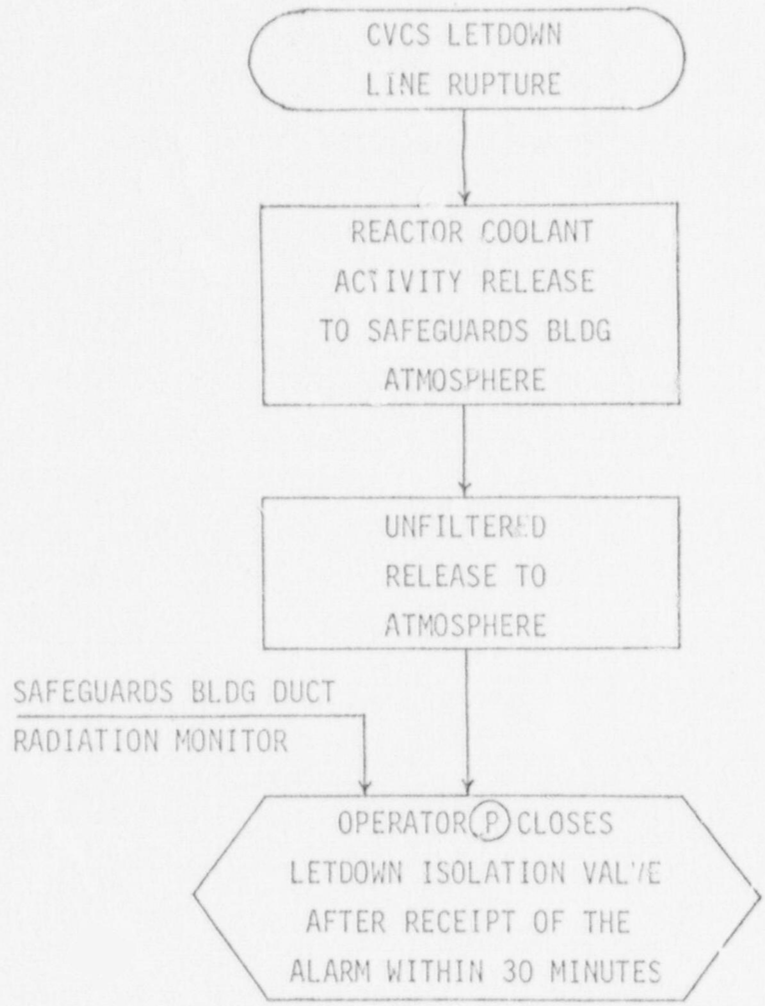
LOSS OF COOLANT ACCIDENT

FIGURE Q032.1-18



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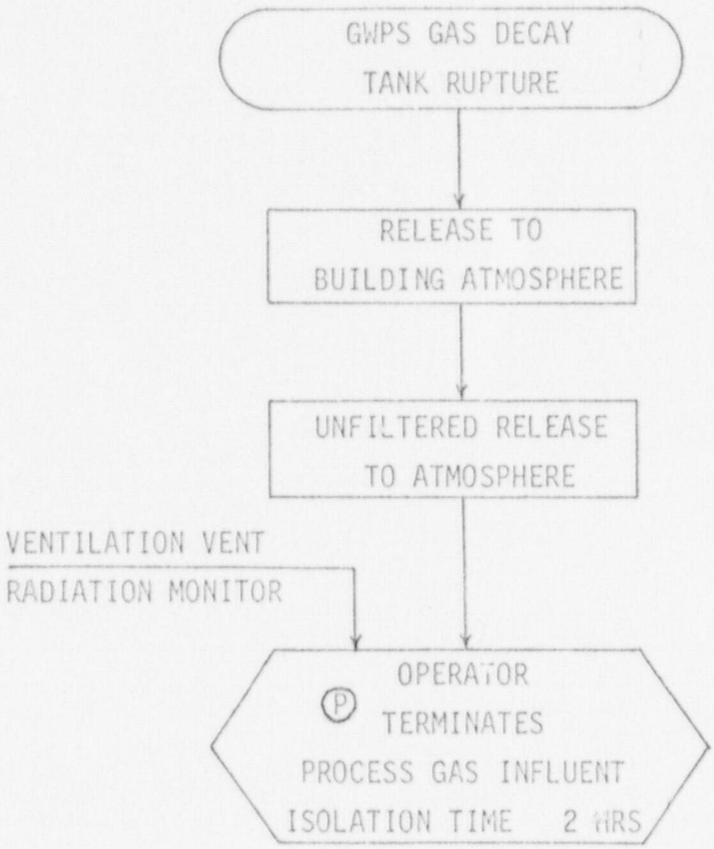
CVCS LETDOWN LINE RUPTURE

FIGURE Q032.1-19



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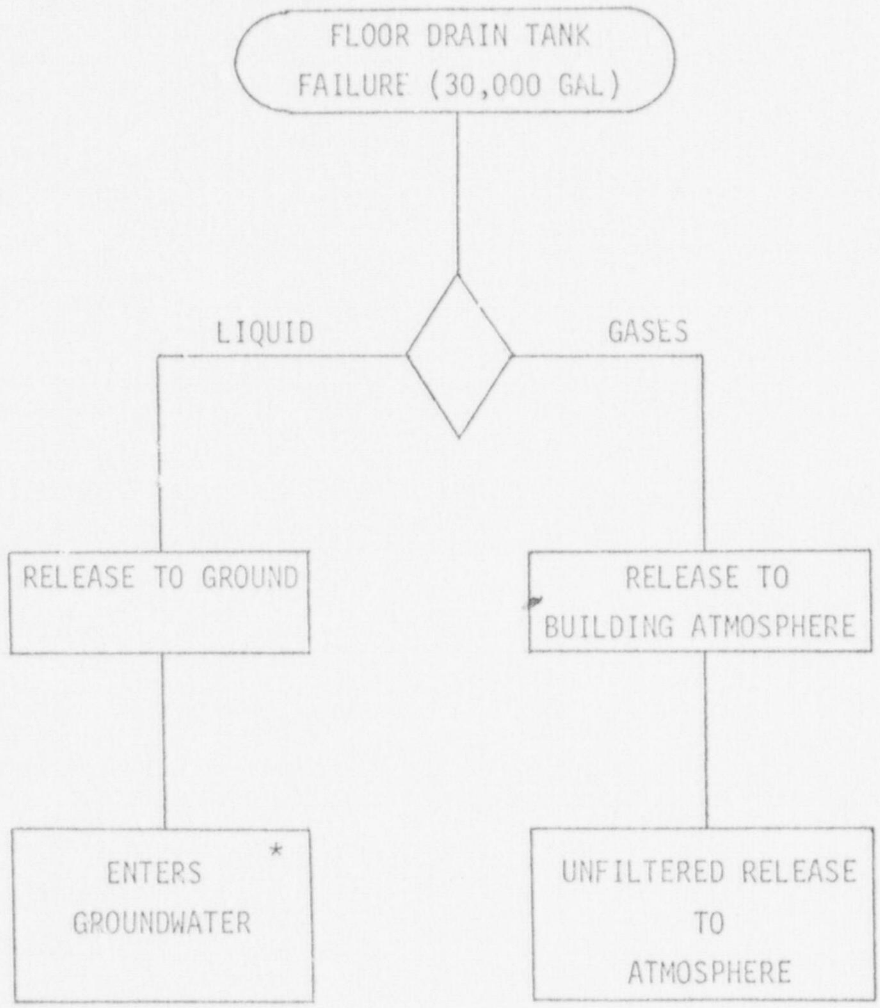
GWPS GAS DECAY
TANK RUPTURE

FIGURE Q032.1-20



*See Section 2.4.13

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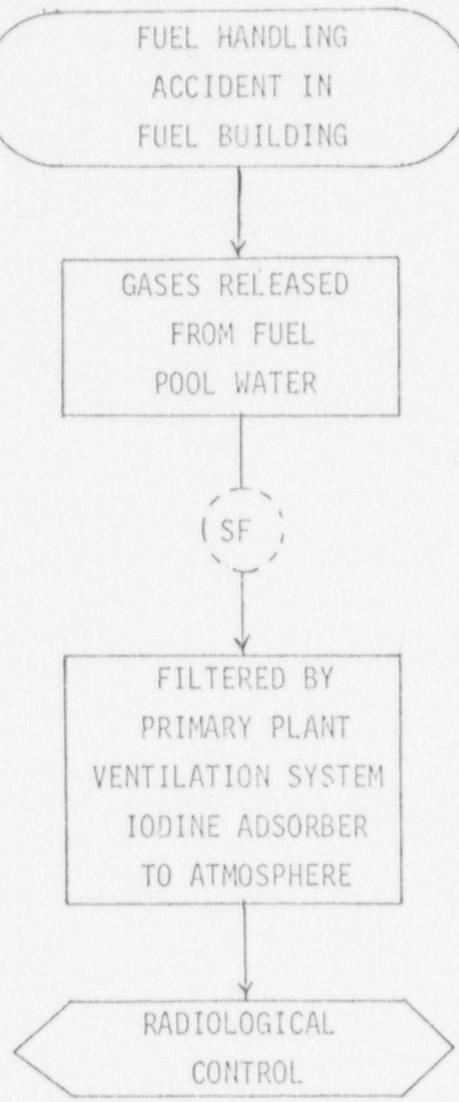
FLOOR DRAIN TANK FAILURE

FIGURE Q032.1-21



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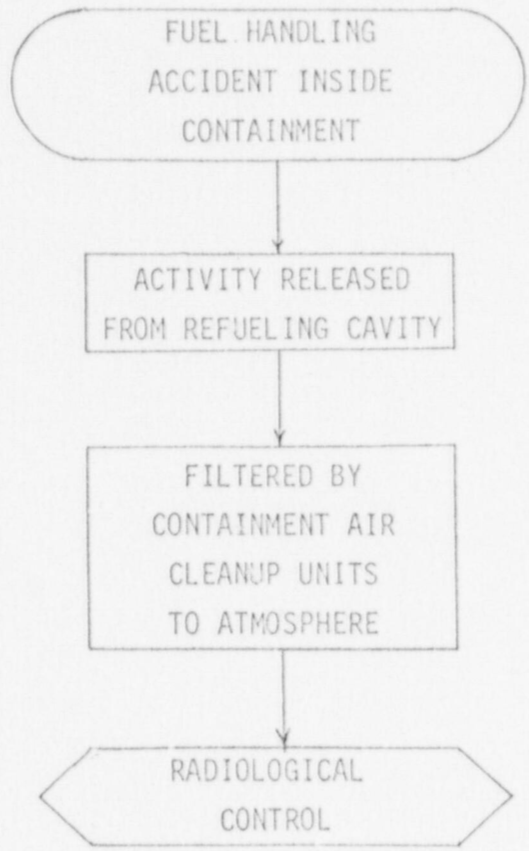
FUEL HANDLING ACCIDENT
IN FUEL BUILDING

FIGURE Q032.1-22



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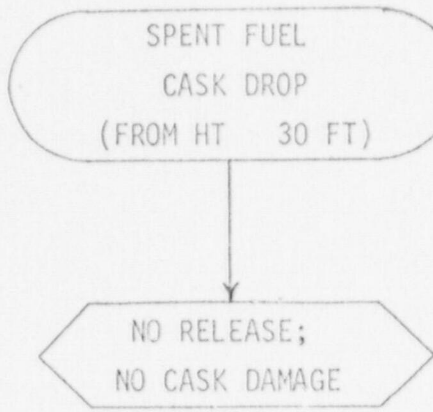
FUEL HANDLING ACCIDENT INSIDE CONTAINMENT

FIGURE Q032.1-23



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SPENT FUEL CASK
DROP ACCIDENT

FIGURE Q032.1-24

To prevent cold spots and stratification within the tank during normal operation, the contents of the boron injection tank are continuously recirculated with the boron injection surge tank via a boron injection recirculation pump. The boron injection tank incorporates a sparger type inlet which distributes the incoming boric acid in a 360 degree fan as it enters the tank. This prevents channeling and also ensures homogeneity of the boric acid solution. This recirculation path is automatically isolated on receipt of an "S" signal.

Redundant tank heaters and line heat tracing are provided to ensure that the solution will be maintained at a temperature in excess of its solubility limit (135°F at a nominal 12 percent concentration of 21,000 ppm boron).

6.3.2.2.3 Boron Injection Surge Tank

The boron injection surge tank provides surge capacity for the boron injection tank recirculation loop. The boron injection surge tank contains the same concentration of boric acid as the boron injection tank during normal plant operation. The recirculation lines to and from the boron injection surge tank are automatically closed and the boron injection recirculation pumps stopped by the safety injection "S" signal. An immersion heater is provided to keep the temperature of the solution high enough to prevent precipitation of the boric acid.

INSERT B

6.3.2.2.4 Residual Heat Removal Pumps RESAR-3 (Q31.15)

In the event of a LOCA the residual heat removal pumps are started automatically on receipt of an "S" signal. The resi-dual heat removal pumps deliver water to the RCS from the refueling water storage tank during the injection phase and from the containment sump during the recirculation phase. Each residual heat removal pump is a single stage vertical position centrifugal pump.

A minimum flow bypass line is provided for the pumps to recirculate and return the pump discharge fluid to the pump suction should these pumps be started with their normal flow paths blocked. Once flow is established to the RCS, the bypass line is automatically closed. This line prevents deadheading of the pumps and permits pump testing during normal operation.

The residual heat removal pumps are discussed further in Section 5.4.7. A pump performance curve is given in Figure 6.3-3.

6.3.2.2.5 Centrifugal Charging Pumps

In the event of an accident the charging pumps are started automatically on receipt of an "S" signal and are automatically aligned to take suction from the refueling water storage tank during injection. During recirculation, suction is provided from the residual heat removal pump discharge.

These pumps deliver flow through the boron injection tank to the RCS at the prevailing RCS pressure. Each centrifugal charging pump is a multistage diffuser design, barrel-type casing with vertical suction and discharge nozzles.

A minimum flow bypass line is provided on each pump discharge to recirculate flow to the pump suction after cooling via the seal water heat exchanger during normal plant operation. The minimum flow bypass line contains two valves in series which close on receipt of the safety injection "S" signal. This signal also closes the valves to isolate the normal charging line and volume control tank and opens the charging pump/refueling water storage tank suction valves to align the high head portion of the ECCS for injection. The charging pumps may be tested during power operation via the minimum flow bypass line. A pump performance curve is given in Figure 6.3-4.

6.3.2.2.11 Accumulator Motor Operated Valve Controls

As part of the plant shutdown administrative procedures, the operator is required to close these valves. This prevents a loss of accumulator water inventory to the RCS and is done shortly after the RCS has been depressurized below the safety injection unblock setpoint. The redundant pressure and level alarms on each accumulator would remind the operator to close these valves, if any were inadvertently left open. Control power is disconnected to these valves after closure via Control Room switches.

During plant startup, the operator is instructed via procedures to energize and open these valves when the RCS pressure reaches the safety injection setpoint. Monitor lights in conjunction with an audible alarm will alert the operator should any of these valves be left inadvertently closed once the RCS pressure increases beyond the safety injection unblock setpoint.

The accumulator isolation valves are not required to move during power operation or in a post accident situation. For a discussion of limiting conditions for operation and surveillance requirements of these valves, refer to Section 3/4 5.1 of the Technical Specifications.

For further discussions of the instrumentation associated with these valves refer to Sections 6.3.5, 7.3.1 and 7.6.4.

6.3.2.2.12 Motor Operated Valves and Controls

Remotely operated valves for the injection mode which are under manual control (i.e., valves which normally are in their ready position and do not require a safety injection signal) have their positions indicated on a common portion of the control board. If a component is out of its proper position, its monitor light will indicate this on the control panel. At any time during operation when one of these valves is not in the ready position for injection, this condition is shown visually on the board, and an audible alarm is sounded in the Control Room.

The ECCS delivery lag times are given in Chapter 15. The accumulator injection time varies as the size of the assumed break varies since the RCS pressure drop will vary proportionately to the break size.

Spurious movement of a motor operated valve due to an electrical fault in the motor actuation circuitry, coincident with a LOCA has been analyzed and found to be a very low probability event. However, to comply with the NRC's present position on this issue, the applicant has committed to compliance with BTP-EICSB-18. Compliance is accomplished by providing a control board control power cut-off switch for each valve whose spurious movement could result in degraded ECCS performance. The applicant, nevertheless, reserves the right to retract this commitment in light of further analysis being generically conducted by Westinghouse.

Table 6.3-3 is a listing of motor operated isolation valves in the ECCS showing interlocks, automatic features and position indications.

RESAR-3 (Q 5.2.7 and 6.3) INSERT A

6.3.2.3 Applicable Codes and Classifications

Applicable industry codes and classifications for ECCS components are discussed in Section 3.2.

6.3.2.4 Materials Specifications and Compatibility

Materials employed for components of the ECCS are given in Table 6.3-4. Materials are selected to meet the applicable material requirements of the codes in Table 3.2-2 and the following additional requirements:

1. All parts of components in contact with borated water are fabricated of or clad with austenitic stainless steel or equivalent corrosion resistant material.

INSERT A

Periodic visual inspection and operability testing of the motor operated valves in the ECCS insures that there is no potential for impairment of valve operability due to boric acid crystallization which could result from valve stem leakage.

INSERT B

If the boron injection surge tank heater is inoperable, sufficient design capabilities of the 12 weight percent boric acid system are available to prevent precipitation within the boron injection surge tank.

The boron injection recirculation pumps are designed to continuously circulate the concentrated boric through the 12 weight percent boric acid system in order to maintain a uniform temperature in the system and to assure a uniform concentration of boric acid throughout the system. Heat is provided by redundant strip heaters located on piping, valves and pumps. In addition, the operating recirculating pump provides a heat input.

Finally, there are two temperature indicator-controllers located in the boron injection tank. They indicate locally the temperature of the concentrated boric acid and control the electrical strip heaters on the boron injection tank to maintain a predetermined fluid temperature. They are set to alarm if the fluid temperature deviates from this predetermined temperature by more than a set amount.