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CALVERT CLIFFS NUCLEAR POWER PLANT DEPARTMENT
CALVERT CLIFFS NUCLEAR POWER PLANT
LUSBY, MARYAND 20657

April 5, 1990

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Docket No. 50-317
License No. DPR 53

Dear Sirs:

The attached LER 89-020, Revision 1, is being sent to you as required under 10 CFR 50.73. This supplement contains a complete description of the root cause analysis and corrective actions for this event.

Should you have any questions regarding this report, we would be pleased to discuss them with you.

Very truly yours,

Mr. R. E. Denton
Manager

RED:CDS:mdc

cc: William T. Russell
Director, Office of Management Information
and Program Control
Messrs: G. C. Creel
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NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES 8/31/88

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Calvert Cliffs, Unit 1	0 5 0 0 0 3 1 7	1 OF 1 1

TITLE (4)
Non-Seismic Solenoid Valves and Solenoid Valve Power Supplies on Class 1 Systems Results in a Condition Outside the Plant's Design Basis

EVENT DATE (5)			LER NUMBER (6)				REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR		SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
1 1	1 3	8 9	8 9	—	0 2 0	— 0 1	0 4	0 5	9 0	Calvert Cliffs, Unit 2	0 5 0 0 0 3 1 8
											0 5 0 0 0

OPERATING MODE (9)	5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Craig D. Sly - Nuclear Regulatory Matters Department	AREA CODE 3 0 1 2 6 0 - 4 8 5 8

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)

		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (16)

On November 13, 1989, a condition was discovered at Calvert Cliffs Units 1 and 2 which was concluded to be outside the design basis of the plant as described in the Updated Final Safety Analysis Report (UFSAR). Certain solenoid valves (SV) and some SV power supplies associated with our Saltwater System may not have been able to perform their intended design function after a design basis seismic event. At the time of the discovery, Unit 1 was in cold shutdown with reactor pressure and temperature at atmospheric and 116°F, respectively. Unit 2 Reactor Coolant System was at atmospheric pressure with the core off-loaded.

The root cause of both events has been determined to be a lack of adequate administrative control of changes to our Q-List and equipment design.

Facility Change Requests have been initiated to upgrade the deficient SVs and SV power supplies. A Q-List upgrade project is currently in progress that includes a new change procedure that requires extensive cross-disciplinary reviews of Q-List changes. Recent extensive enhancements to our Design Engineering Section Procedures will ensure that adequate control of design changes are maintained in the future.

1. DESCRIPTION OF EVENTS

On November 13, 1989, a condition was discovered at Calvert Cliffs Units 1 and 2 which was concluded to be outside the design basis of the plant as described in the Updated Final Safety Analysis Report (UFSAR). Certain solenoid valves (SV) and some SV power supplies associated with our Saltwater System may not have been able to perform their intended design function after a design basis seismic event. At the time of the discovery, Unit 1 was in cold shutdown with reactor pressure and temperature at atmospheric and 116°F, respectively. Unit 2 Reactor Coolant System was at atmospheric pressure with the core off-loaded.

The UFSAR Section 5A.2, "Classes of Structures Systems and Equipment," states, in part;

> "Throughout the context of this Section, Class 1 shall mean Category 1 (Seismic) structures, systems, and equipment. Class I structures, systems, and equipment are those whose failure could cause uncontrolled release of radioactivity or those essential for immediate and long-term operation following a loss-of-coolant incident."

Contrary to the above statement, it was discovered that portions of the electrical supplies to five SVs in Class 1 applications may not have been able to withstand a seismic event. It was also discovered that four solenoid valves in Class 1 applications were not built to withstand a seismic event. The condition was discovered during a review to determine the ability of Saltwater System Instrument Air components to withstand a seismic event. The Control Room notified the NRC at 1614 hours on November 13, 1989.

The investigation started on November 13, 1989 when it was discovered that several SVs were listed in the Calvert Cliffs Q-List as safety-related (SR), but were listed on the electrical schematic diagrams as non-safety-related (NSR). A walkdown was later performed to ascertain if the SVs were actually provided power from a SR source. It was determined that the power sources were indeed SR, but that the cables were not routed through a fully seismically-qualified path. The SV's power sources were found to satisfy all other requirements of SR cabling with the exception of the incomplete seismically-qualified cable paths. The affected SVs are listed in Table 1.

During the review of the Saltwater System Instrument Air components, four SVs were found which were not built to withstand a seismic event. As part of the review, analyses were performed to determine if the SVs could survive a seismic event. These analyses included design reviews and destructive examination of the solenoid valves.

The analyses showed that this type of SV could be compromised during a seismic event because the core tube could "crimp." This SV type was intended for use in commercial design and not intended by the vendor for nuclear service. The SVs are listed in Table 2.

These issues were assigned to the project team established to address several outstanding Facility Change Requests (FCRs) and the air accumulator failures discussed in LER 317/89-018. The project team was established to assure that corrective actions associated with these issues were coordinated and implemented in a manner that ensured the safe operation of the Units was maintained.

II. CAUSE OF EVENTS

The root cause of the SVs in Table 1 having incomplete seismic support for their power cables has been determined to be inadequate control of changes to our Q-List. Specifically, the consequences associated with a Q-List upgrade of the SVs was not adequately reviewed. The SVs were dedicated as SR without performing a review to verify that the support functions to the SVs were adequate for SR service. Contributing to the event was apparent confusion over the relationship between 1-E and seismic design and installation requirements.

The root cause of the non-seismically qualified SVs being used in the Saltwater System has been determined to be inadequate administrative control of facility changes. The consequences associated with past design changes to the SVs were not adequately reviewed to determine the net effect on the SVs to perform their intended design function. Contributing to this was the fact that the safety significance of the SVs (i.e. SR or NSR) was not well established in the original design specification.

III. ANALYSIS OF EVENTS

The Saltwater System is designed to provide cooling water for the Service Water and Component Cooling Water heat exchangers, and ECCS Pump Room Coolers. The Component Cooling and Service Water Systems are designed to remove heat from the plants' various auxiliary systems during normal and shutdown conditions and remove heat during a LOCA. Figure 1 shows the normal Saltwater System flow path.

During the recirculation mode after a LOCI, should a piping rupture occur in the common discharge header of the Saltwater System, the alternate (overboard) Saltwater System flow path to the Chesapeake Bay would be employed. Figure 2 shows the alternate Saltwater System flow path. The control valves (CVs) used to position this lineup are air-operated with accumulators supplied by the normal (NSR) Instrument Air System. Most of the CVs would have to be repositioned from their failed position to achieve the alternate discharge path lineup. Some of

these CVs cannot be manually operated after a LOCI because they are located in a very high post-LOCI radiation area.

Table 1 shows a list of SVs having an incomplete seismically-supported path for their power supplies. All of these SVs supply air to CVs associated with the Saltwater System Alternate Discharge Path. Failure of the SVs would result in a loss of air pressure to the associated CVs. The CVs would fail to the closed position.

Failure of these valves to open during a LOCI and concurrent piping rupture of the Saltwater System normal discharge header would have resulted in the loss of the plants' ultimate heat sink. We have performed an analysis to evaluate the contribution of the alternate discharge header to the overall calculated failure rate of the Saltwater System. We have concluded that Saltwater System operation with the alternate discharge path unavailable does not significantly increase the probability of Saltwater System failure during a 60 day time period.

Table 2 is a list of SVs which were not built to withstand a seismic event. All of these SVs are associated with the Service Water Heat Exchanger saltwater outlet throttle valves. Failure of these SVs after a seismic event could have a wide range of effects on the ability of the Saltwater System to remove residual heat from the Service Water System heat exchangers. If the throttle valves were to fail open, there is a danger of saltwater pump failure due to pump runout. If the throttle valves failed to the closed position, no cooling water would be available to the Service Water System Heat Exchangers.

Operators are trained to maintain saltwater pump discharge pressure greater than 13 PSIG at all times to prevent damage or loss of the saltwater pumps. Although this would normally be done by throttling CVs 5210 and 5212, steps exist in various operating procedures that direct the throttling of the saltwater pump discharge valves to maintain proper discharge pressure. Therefore, had the failure of the Service Water heat exchanger throttle valves occurred, causing them to open, operators would have been dispatched to throttle the saltwater pump discharge valves.

The saltwater pump discharge valves are accessible to operators after a LOCI. Thus, we believe that the consequences of the failure of the CVs to the open position would be mitigated by manual control of these throttle valves.

This event is considered reportable per 10 CFR 50.73(a)(2)(ii)(B), "Any event or condition that resulted in the nuclear power plant being in a condition that was outside the design basis of the plant."

IV. CORRECTIVE ACTIONS

FCR 89-0180 was initiated to upgrade the electrical power supplies of the SVs in Table 1 to SR. The upgrade will require drawing changes and a conduit upgrade for each of the five SVs. FCR 89-95 was initiated to replace the SVs in Table 2 with seismically-qualified SVs.

A detailed design review of Q-list discrepancies was started in 1988 and is now nearly complete. This project recognized the fact that the Q-List has some deficiencies that require resolution. Part of this project was to develop a design review process to determine review requirements such as walkdowns, specifications, procurement, maintenance, etc. This process has been used to review and give direction to resolve discrepancies between the Q-List and field installation.

Addition of new items to the Q-List is now stringently controlled by a Q-List Amendment Procedure. After a proposed Q-List Classification has been reviewed by the Q-List Chairman, it is sent to Q-List Committee members for approval or disapproval in accordance with Design Engineering Section Procedure (DESP) 3. DESP-3 requires extensive cross-disciplinary review of the proposed change. A review of applicable drawings is also required to determine if drawing changes are required as a result of Q-List changes.

All modifications must now be evaluated according to DESP-7, "Design and Design Review." All modifications are required to be subjected to a design input requirements and a design review. The list/form both require attention be directed and documented towards seismic issues. Design review is required to be independent. As required by the Lead Design Engineer (LDE), Unit checklists are filled out. These checklists verify that all aspects of a design are reviewed in detail. Guidance is given to the LDE to assist in determining which checklists should be completed for a particular modification.

DESP-2, "Control of Changes, Tests, and Experiments," has been subjected to significant changes in the past year and now contains adequate administrative controls and screening methodology to assure that all Facility Change Requests (FCRs) receive adequate cross-disciplinary review. Among those changes was the addition of a screening form. This new form includes the screening for 50.59 evaluations, design verification/evaluation, ALARA, Human Factors, Q-List, Equipment Qualification/Electrical Modifications, Calvert Cliffs Equipment Data Base, Electrical Load, Fire Protection, Seismic, and Reportability. A positive answer to any of the screening tests requires additional action by the person performing the screen. For example, a positive answer to a Q-List screen requires that a Q-List Change Request Form be initiated per DESP-3.

This new screening process ensures that FCRs are adequately reviewed for the potential consequences associated with changes, tests, and experiments. The process also ensures the change review process is documented and gives appropriate follow-up direction to assure that changes do not adversely impact plant and/or personnel safety.

DESP-4, "Procurement", requires that the person who initiates a purchase order (PO) is responsible for using the Q-List, Classification of Work Order, or FCR to determine the classification of each item purchased. There are other controls to ensure that the initiating PO specifies the proper SR/NSR designation. DESP-4 also specified that when there is any doubt about classification, the item must be treated as SR until it is classified as either SR or NSR in accordance with DESP-3, "Establishment and Control of the List of SR Items".

DESP-5, "Specification", now requires that specifications for procurement of Class 1-E systems or equipment shall be reviewed by authorized representatives from the following groups.

1. Electrical Environmental Qualification
2. Mechanical Engineering Unit
3. Civil Engineering Unit
4. Human Factors Engineering for Control Room displays

The above cross-disciplinary review ensures that the specifications have appropriate requirements specified for the intended service.

DESP-5 also requires that if one specification is prepared to cover several different items, it shall meet all of the requirements of a single-item specification. It is also required that every item listed on a multi-item specification be subject to the appropriate controls and requirements of DESP-5.

V. ADDITIONAL INFORMATION

There has been one previous similar event involving Saltwater System components being outside their design basis. The event is discussed in LER 317/89-008. The root cause of that event was poor maintenance practices.

There has been one previous similar event involving a potential loss of instrument air to Saltwater System components. The event is discussed in LER 317/89-018. The root cause of the event was lack of an adequate documented design basis for the Instrument Air System.

IDENTIFICATION OF COMPONENTS REFERRED TO IN THIS LER

Component	IEEE 803 E11S FUNCT	IEEE 805 SYSTEM ID
Saltwater System	N/A	NN
Instrument Air System	N/A	LD
Component Cooling System	N/A	CC
Service Water System	N/A	BI
ECCS	N/A	BP, BQ, BE
Heat Exchanger	HX	N/A
Solenoid Valve	PSV	N/A
Control Valve-Air Operated	V	N/A

TABLE 1

SOLENOID VALVES HAVING INCOMPLETE SEISMIC SUPPORT FOR POWER CABLES

SV No. CV No.	CV Function	CV Safety-Related Position	CV Failure Position	Comments
SV-5149 CV-5149	Saltwater Alternate Discharge Valve	Closed	Closed	Must Open for Alternate Discharge Lineup
SV-5155 CV-5155	SRW Hx 12 Outlet to Alternate Discharge Path (1st)	Closed	Closed	Must Open for Alternate Discharge Lineup
SV-5156 CV-5156	SRW Hx 12 Outlet to Alternate Discharge Path (2nd)	Closed	Closed	Must Open for Alternate Discharge Lineup
SV-5165 CV-5165	Component Cooling Hx 12 Outlet to Alternate Discharge Path (1st)	Closed	Closed	Must Open for Alternate Discharge Lineup
SV-5166 CV-5166	Component Cooling Hx 12 Outlet to Alternate Discharge Path (2nd)	Closed	Closed	Must Open for Alternate Discharge Lineup
SV-5152 CV-5152	Service Water Hx 12 Inlet	Open	Open	Must Open for Alternate and Normal Discharge Lineup

* Alternate discharge lineup is required during the recirculation mode after a LOCA only if a piping rupture should occur in the common normal discharge header of the Saltwater System.

TABLE 2

SOLENOID VALVES NOT BUILT TO WITHSTAND A SEISMIC EVENT

SV No. CV No.	CV Function	CV Safety-Related Position	CV Failure Position	Comments
SV-5210 CV-5210	SRW HX 11 Saltwater Outlet Throttle Valve	Open (Throttled)	Full Open	Must Close for Alternate Discharge Path
SV-5210A CV-5210	SRW Hx 12 Saltwater Outlet Throttle Valve	Open (Throttled)	Full Open	Must Close for Alternate Discharge Path
SV-5212 CV-5212	SRW Hx 12 Saltwater Outlet (1st) Throttle Valve	Open (Throttled)	Full Open	Must Close for Alternate Discharge Path
SV-5212A CV-5212	SRW Hx 12 Saltwater Outlet (1st) Throttle Valve	Open (Throttled)	Full Open	Must Close for Alternate Discharge Path

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92
ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Calvert Cliffs, Unit 1	0 5 0 0 0 3 1 7	8 9	0 2 0	0 1	1 0 OF 1 1

TEXT (If more space is required, use additional NRC Form 366A's) (17)

FIGURE 1

SALT WATER SYSTEM NORMAL SUPPLY/DISCHARGE PATH

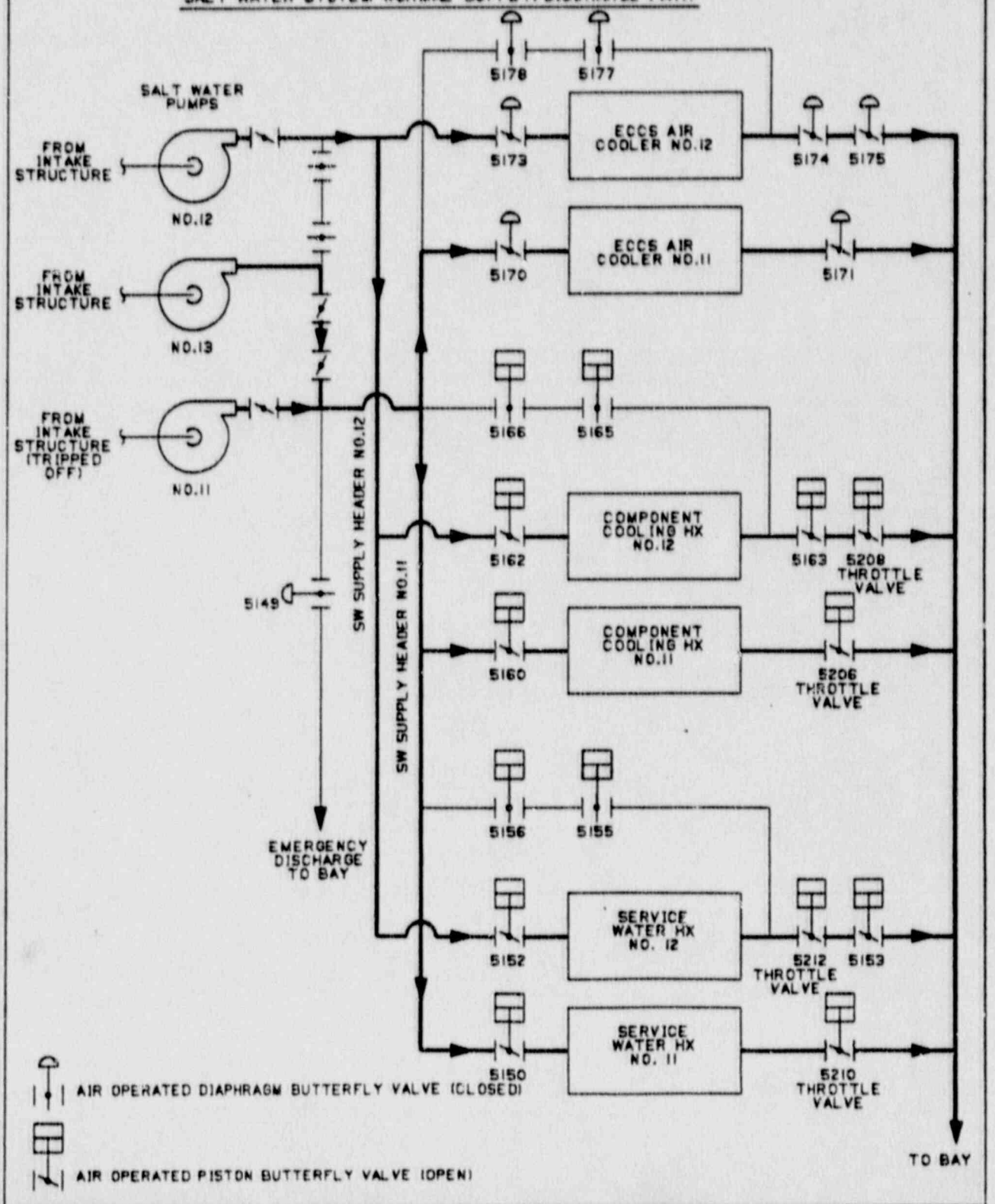

FIGURE 2

SALT WATER SYSTEM ALTERNATE SUPPLY/DISCHARGE PATH