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

March 12, 1990

U. S. Nuclear Regulatory Commission
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Docket Nos. 50-317 & 50-318
License Nos. DPR 53 & 69

Dear Sirs:

The attached supplemental LER 89-23, Revision 1, is being sent to you as required under 10 CFR 50.73 guidelines.

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

Very truly yours,

R. E. Denton
Manager

GAL:lrr

cc: William T. Russell
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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 10

TITLE (4) Postulated Pipe Rupture in the Turbine Building Service Water System (SRW) Renders Both Auxiliary Building SRW Subsystems Unavailable

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)
12	20	89	89	023	01	03	12	90	Calvert Cliffs, Unit 2	0 5 0 0 0 3 1 8
									N/A	0 5 0 0 0

OPERATING MODE (9): 5

POWER LEVEL (10): 000

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

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)	X 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)	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	
	AREA CODE	
Gregory A. Love, Licensing Engineer	301	260-3736

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

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) | X NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

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

This supplement to LER 89-023 is submitted to clearly identify our position as previously stated in the Calvert Cliffs Nuclear Power Plant's Safety Evaluation Report issued August 28, 1972, and to reclassify the reportability to "other" and the LER as a voluntary report.

At 0900 hours on December 20, 1989 it was postulated that a reportable condition may have existed as a result of a plant configuration that could potentially result in unavailability of both safety-related Service Water (SRW) Subsystems. At the time of determination, Unit 1 was in cold shutdown with the Reactor Coolant System (RCS) partially filled, at atmospheric pressure, and 114 degrees F. The Unit 2 reactor was defueled, with the reactor vessel partially drained, the vessel head detensioned, and the RCS at atmospheric pressure and ambient temperature.

It was postulated that a pipe rupture in the non-safety-related SRW Subsystem that serves the Turbine Building could result in rapid draining of both of the independent, safety-related SRW Subsystems that serve the Auxiliary Building. The loss of both Auxiliary Building SRW trains could subsequently result in unavailability of the Emergency Diesel Generators. The reported condition does not describe an actual event; therefore, it was not contributed to by any actual component or system failures. Based on a review of the NRC's Safety Evaluation Report for Calvert Cliffs Nuclear Power Plant (CCNPP), it is clear that we were only analyzed for a LOCA concurrent with a loss of off-site power. Therefore, it is clear our SRW System was not designed to cope with a seismic event and a simultaneous loss of off-site power.

NRC Form 366 (9-83)

I. DESCRIPTION OF EVENT

At 0900 hours on December 20, 1989 it was postulated that a reportable condition may have existed at Calvert Cliffs. The condition was the result of a plant configuration that could have potentially resulted in the unavailability of both independent, safety-related Service Water (SRW) Subsystems. This determination was made during a routine reportability review for a Non-Conformance Report (NCR). The NCR described a condition whereby a postulated pipe rupture in the non-safety-related SRW Subsystem that serves the Turbine Building could result in rapid draining of both of the independent, safety-related SRW Subsystems that serve the Auxiliary Building. The loss of both Auxiliary Building SRW Subsystems could subsequently result in unavailability of the Emergency Diesel Generators (EDGs).

At the time of determination, Unit 1 was in cold shutdown with the Reactor Coolant System (RCS) partially filled, at atmospheric pressure, and 114 degrees F. The Unit 2 reactor was defueled, with the reactor vessel partially drained, the vessel head detensioned, and the RCS at atmospheric pressure and ambient temperature.

The purpose of the SRW System is to remove heat from the main turbine-generator plant components, containment cooling units, spent fuel pool heat exchangers, and various EDG heat exchangers; and to transfer that heat to the Saltwater System. Although the SRW piping configuration differs slightly between Unit 1 and Unit 2, each unit is basically comprised of two independent, safety-related SRW Subsystems in the Auxiliary Building which operate in parallel with a single, non-safety-related SRW Subsystem in the Turbine Building.

Both Auxiliary Building SRW Subsystems and the Turbine Building SRW Subsystem are needed during normal plant operations. For Unit 2, the two Auxiliary Building SRW Subsystems are connected to the Turbine Building SRW Subsystem by a common, non-safety-related connection from the SRW discharge header where the SRW System enters the Turbine Building. For Unit 1, the two Auxiliary Building SRW Subsystems are connected to the Turbine Building SRW Subsystem by a common, non-safety-related pipe located where the SRW System exits the Turbine Building and connects to the SRW suction header. As a result of these common piping connections, the non-safety-related Turbine Building SRW Subsystem essentially cross-connects with the two safety-related Auxiliary Building SRW Subsystems.

The ability to isolate the Turbine Building SRW Subsystem from the Auxiliary Building SRW Subsystems is provided by dual, air operated isolation valves on the discharge header piping of each Auxiliary Building SRW Subsystem, and by check valves in the suction header piping of each Auxiliary Building SRW Subsystem. The isolation valves are located in the safety-related Auxiliary Subsystem piping prior to connection with the Turbine Building Subsystem piping, and the check valves are located in the safety-related portions of the Auxiliary Building SRW Subsystem suction header piping. The Turbine Building isolation valves can be operated from the main Control Room, and close automatically following receipt of a Safety Injection Actuation Signal (SIAS) or loss of instrument air. Other than SIAS or loss of instrument air, there are no other automatic closure functions associated with the isolation valves.

Calculations have been performed assuming a worst-case, double-ended guillotine pipe break in the non-safety-related Turbine Building SRW piping. It was also assumed that the break would occur in the Unit 2 SRW piping configuration. The piping configuration for Unit 2 is much less conservative than Unit 1 configuration because its' cross-connection occurs just downstream of the non-critical service water valves. The Unit 1 cross-connection is downstream of all Turbine Building loads. The calculation results indicate that under the previously mentioned conditions, breakflow could empty the SRW System in less time than is required for the isolation valves to close following receipt of a SIAS. The calculations also indicate that the SRW System could be drained before an operator could act to isolate the break under non-SIAS conditions. It should be noted that assumption of a double-ended guillotine type break is more conservative than is required under our licensing and design basis for a moderate energy break in a line that is designed as Seismic Category II, and was constructed to ANSI B31.1. However, informal calculations indicate that even a moderately sized pipe break would result in a rapid loss of SRW inventory.

Calvert Cliffs Nuclear Power Plant (CCNPP) is only analyzed for a loss of coolant accident (LOCA) concurrent with a loss of off-site power, and not for a seismic event concurrent with a loss of off-site power. Therefore, the condition described in this report is being reported under "other" as a voluntary LER.

The following identifies CCNPP current design assumptions, active and passive failures as described in our Updated Final Safety Analysis Report (UFSAR), Section 9.5.

Current Design Assumptions

Single Failure Analysis Component	# Needed For Normal OPS	# Needed For LOCI
SRW Heat Exchangers	Note (a)	1
SRW Pumps	2	1
EDGs	0	1

Note:

a) Two are needed. However, the two subsystems may be cross connected and one heat exchanger may be utilized to remove the full heat load.

Active Failures

System	Component	Type of Failure
Service Water	Turbine Building isolation valves	Fails to close on SIAS

Consequences

Valves are actuated by a redundant channel and would shut, isolating service water as required.

System	Component	Type of Failure
Service Water	12 EDG Supply/ return CVs	Fails to seek header with pressure

Consequences

Diesel generator 12 does not receive any cooling water. This could result in cross-connecting one subsystem of each unit and possibly draining one subsystem by over-flowing in the other unit's head tank. However, each unit would still have a subsystem in operation and this is sufficient to remove all necessary heat. Diesel generators 11 and 21 are cooled and provide sufficient electrical power.

System	Component	Type of Failure
Service Water	Turbine building return check valve.	Fails to close under reverse flow.

Consequences

Since in all cases two check valves are provided in series, the second valve would close providing isolation.

Note: As shown above sufficient numbers of all other active components are supplied to provide sufficient redundancy for all modes of operation.

Passive Failure During Containment Sump Recirculation

System	Location of Rupture
Service Water	12 EDG supply/return manual cross connect valves.

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

Consequences
One subsystem from each unit would be drained and rendered inoperable. However, one subsystem in each unit would continue to operate. This is adequate to provide the necessary cooling for each unit. No single rupture in any location could cause the loss of both subsystems of a unit as two normally closed valves are provided where two subsystems are tied together.

Flooding Due to a Passive Failure

Structure Flooded	Indication in Control Room	System Ruptured
Service Water Room	High level alarm in the room with normal service water head tank level.	Saltwater

Consequences
Saltwater to the Service Water Room would be stopped by closing remote manual valves from the Control Room. The containment coolers would be shut down and heat removed from the containment would be via the spray system. Service water would continue to operate until the service water temperature reached 120°F, which would occur approximately 21 minutes after loss of saltwater, based on an initial service water temperature of 95°F. This is considered to be sufficient time to determine which subsystem has ruptured and to re-establish saltwater flow in the other subsystem.

When both units are in operation, cool service water would be provided to diesel generator No. 12 by the other unit's Service Water System. Saltwater for this other unit is functioning normally. This is accomplished as follows:

a. Diesel generator No. 12 automatically provides power to the accident unit-channel ZB for Unit 1 (ZA for Unit 2).

b. Valves on the discharge of service water pump No. 13 (23) are normally open to Service Water Subsystem ZB (ZA).

c. The circuit breaker is remotely closed to provide power to service water pump No. 13(23) from channel ZA (ZB).

d. The service water pumps on the unit which has the ruptured Saltwater System are shutdown.

e. The pressure seeking valves automatically supply diesel generator No. 12 cooling water from the other unit.

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

Structure Flooded	Indication in Control Room	System Ruptured
Service Water Room	High level alarm in the room with normal service water head tank level.	Saltwater

Consequences

One subsystem from each unit would be drained. However, the other subsystem would continue to operate and is sufficient to provide all necessary service water. The entire contents of one Service Water System would not flood out the service water pumps and motors.

Based on the above and a review of NRC's Safety Evaluation Report for CCNPP, it is clear that we were only analyzed for a LOCA concurrent with a loss of off-site power. Therefore, it is clear our Service Water System was not designed to cope with a seismic event with a simultaneous loss of off-site power.

Reportability as an event or condition prohibited by Technical Specifications (T.S.) is related to T.S. 3.7.4.1, which requires that "at least two independent service water loops shall be **OPERABLE** in modes 1, 2, 3, and 4" is not an issue as described in LER 89-023, Revision 0. It is determined at this time that the current design and configuration of the SRW System meets the intent of this Technical Specification and the original licensing and design bases. The original licensing and design bases are the same as the current plant license and design bases.

The condition described in this report is not being considered for reportability as a condition that is outside the plant design basis for the SRW System and the EDGs. The SRW design basis is described in Section 9.5.2.2 of the Updated Final Safety Analysis Report (UFSAR), and states that the SRW System "has been divided into two subsystems in the Auxiliary Building to meet single failure criteria." It also states that "during normal operation both [SRW] subsystems are . . . independent to the degree necessary to assure the safe operation and shutdown of the plant assuming a single failure."

The system description for the EDGs is found in UFSAR Section 8.4.1.2, and states that "the emergency diesel generators and their auxiliaries are designed to withstand Seismic Category 1 accelerations and are installed in Category 1 structures." The SRW System directly supplies cooling water to the EDGs and is considered to be auxiliary equipment to the EDGs. UFSAR Section 9.5.2.2 and 8.4.1.2 meet the intent of the original design basis, which is the same as our current design basis.

The assumptions assumed in LER 89-023, Revision 0 are more conservative than the current licensed plant design bases. Investigations performed in late 1989 previously assumed a double-end guillotine pipe rupture in the non-safety-related portion of the SRW System as the event initiator. We recognize a seismically induced pipe rupture and concurrent loss of off-site power as a possible event scenario, however, we were not required to analyze this scenario. However, an analysis of the postulated scenario and determination if a significant safety concern exists is provided in Section III, Analysis of Event.

Calvert Cliffs Nuclear Power Plant Units 1 & 2 Safety Evaluation, issued August 28, 1972, Section 3.2.5 states, in part:

> "The Auxiliary Systems include the Chemical and Volume Control System, Shutdown Cooling System, Component Cooling Water System, Service Water System, Saltwater System,...
>
> The Service Water and Saltwater Systems provide cooling required for vital plant safety features. These systems were revised during our review to provide greater separation and redundancy so that they could sustain single failure of active or passive components without loss of the required cooling capability.
>
> The design bases, functions, and descriptions of the Calvert Cliffs Auxiliary Systems are substantially the same as for other plants that have been recently reviewed and approved for operating licenses. On the basis of our comparison of these systems with those of other approved plants and our evaluation of the adequacy of each system we concluded that the Calvert Cliffs Auxiliary Systems are acceptable."

II. CAUSE OF EVENT

N/A

III. ANALYSIS OF EVENT

The postulated event was discovered during a routine reportability review for Non-Conformance Report (NCR). NCR 8391 stated a concern that "a rupture, without a SIAS (turbine building isolation valves do not shut), occurring in the Turbine Building will cause a loss of both subsystems. In the event of a loss of off-site power this could render both EDGs inoperable."

An analysis of the problem and determination if a significant safety concern exists is provided below.

Information obtained from our Probabilistic Risk Assessment (PRA) Unit for East Coast earthquake risks put the probability for low energy earthquakes at 1.1E-7 per hour per event and 1E-9 per hour per event for potentially damaging earthquakes.

Even if we postulate a damaging earthquake, a catastrophic failure of the non-safety-related (NSR) portion of the Service Water System is unlikely because the Turbine Building is a Seismic Class II structure. It has a working stress design for 0.08 g horizontally and 0.053 g vertically (OBE accelerations). While a conservative analysis was not performed, the building is relatively stiff and would not collapse under Safe Shutdown Earthquake (SSE) conditions.

Inspections of industrial mill buildings and power plants have been performed after earthquakes much stronger than our SSE. Except for those on soft soil or of very unusual configurations, those buildings performed well. In addition, there were very few instances of piping damage. These points have been made many times with the NRC and ACRS by Seismic Qualification Utility Group (SQUG) consultants.

The few piping failures noted by SQUG consultants were caused by:

- Unanchored equipment

- Severe building displacement/relative motion with little piping flexibility (such as buried pipes entering buildings, closely spaced rigid supports at expansion joints).

Steel piping is inherently rugged. This is borne out by the testing which lead to ASME Code Case N-411 and by the recent reports suggesting far less conservative design for small bore pipe.

The NRC has placed a relatively low priority on seismic qualification (USI A-46). Their position is that seismic is not a major contributor to nuclear risk.

Walkdowns by expert teams on five of the oldest plants resulted in few corrections. Some of these plants weren't even designed for earthquakes.

It is postulated that a seismic event could occur following a LOCA. Emergency Operating Procedure EOP-5 (Loss of Coolant) directs operators during recovery to restart Turbine Building service water and restart equipment such as instrument air compressors. A calculation was performed and showed that a seismic event following a LOCA is an extremely low probability event scenario - on the order of IE-8 events in any 30 day period.

Another failure mechanism that needs to be considered is passive failure. NUREG CR 4407 (Pipe Break Frequency Estimates for Nuclear Power Plants) puts passive pipe failure for balance of plant systems at 4.4E-8 failures per hour per event.

Our UFSAR only discusses passive failures during recirculation following a LOCA. By comparing passive failure risk to a potentially damaging seismic risk, it is obvious that the passive failure is the higher risk - even though both are small.

Our Abnormal Operating Procedures (AOP) recognize a pipe rupture as a possible event. AOP 7B (Loss of Service Water) Sections IV and V (Rupture of a subsystem) provides direction to operators in the event of a loss inventory in the Service Water System. There is explicit direction given to isolate the Turbine Building "so that a rupture in one subsystem will not drain the other subsystem".

The NRC also recognized that plants of our vintage were not designed to withstand a loss of their safety-related (SR) Service Water System during non-LOCA events. Their evaluation of our May 20, 1980 loss of service water accident concluded the loss of service water event at Calvert Cliffs did not result in damage to any plant equipment either safety or non-safety-related, and taken by itself does not represent a cause for concern. The significance of the event lies in the fact that it involved two fundamental aspects considered in the design of safety-related systems:

1. Interaction between safety and non-safety-related systems and components;

2. Common caused failure of redundant safety systems.

The review of the event by the Office for Analysis and Evaluation of Operational Data (AOD) revealed no immediate safety concerns; however, there is a need to reevaluate the isolation provisions at the interface between the safety and non-safety-related portions of the Service Water System at Calvert Cliffs as well as generically.

The primary concern with a loss of service water during non-LOCA events is loss of cooling for the EDGs. This scenario would render EDGs inoperable and may place us in a station blackout. Calvert Cliffs is currently able to maintain the plant in a safe shutdown condition for four hours with no AC power. Station Blackout Procedure (EOP-7) provides direction to operators on how to restore both the Service Water System and AC System to operation.

Given the low probability of a damaging earthquake and the small likelihood that it will cause a catastrophic failure of the Service Water System, we can conclude that there is no exigent need to take immediate action to modify the system due to an earthquake risk.

There is sufficient operator guidance to cope with a postulated loss of service water with a simultaneous loss of off-site power. As an additional measure, Operations has increased the frequency of leak rate monitoring of the Service Water System.

IV. **CORRECTIVE ACTIONS TAKEN**

A task force has been assembled to determine appropriate long term corrective actions. In the interim, prior to startup, compensatory actions will be established, although the described is not part of our current licensing and design bases. The following compensatory actions will be established prior to startup.

- Change Alarm Manual to include immediate isolation of Turbine Building header on large rupture indications.

- Inform operators of the status of this issue prior to Unit 1 startup.

V. **ADDITIONAL INFORMATION**

N/A

VI. **IDENTIFICATION OF COMPONENTS REFERRED TO IN THE LER**

Component/System	IEEE 803 Component ID Code	IEEE 805 System ID Code
Auxiliary Building		NF
Auxiliary Feedwater System		BA
Containment Coolers		BK
Control Room		NA
Emergency Diesel Generator		EK
Isolation Valve	ISV	
Reactor Coolant System		AB
Reactor Vessel	RCT	
Safety Injection System		JE/BQ/BP
Saltwater System		BS
Service Water System		BI
Spent Fuel Pool Cooling System		DA
Turbine Building		NM
Turbine Generator		T-