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FACIL:50-335 St. Lucie Plant, Unit 1, Florida Power & Light Co. 05000335
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SUBJECT: LER 94-006-01:on 941023,containment integrity outside of FSARassumptions under limited circumstances due to design error.Relief valve path in I removal sys was isolated. W/941202 ltr.

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Florida Power & Light Company, P.O. Box 128, Fort Pierce, FL 34954-0128

December 2, 1994

L-94-305
10 CFR 50.73

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

Re: St. Lucie Unit 1
Docket No. 50-335
Reportable Event: 94-006 - Revision 1
Date of Event: November 23, 1994
Containment Integrity Outside of FSAR Assumptions
Under Limited Circumstances Due to Design Error

The attached Licensee Event Report is being revised pursuant to the requirements of 10 CFR 50.73 to provide an update on the subject event.

Very truly yours,

D. A. Sager
Vice President
St. Lucie Plant

DAS/msd

Attachment

cc: Stewart D. Ebneter, Regional Administrator, USNRC Region II
Senior Resident Inspector, USNRC, St. Lucie Plant

080023

JE22

NRC FORM 366 (5-92) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 5/31/95

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
St. Lucie Unit 1	05000335	1 OF 8

TITLE (4) Containment integrity outside of FSAR assumptions under limited circumstances due to design error.

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 NAME	DOCKET NUMBER
10	23	94	94	006	1	12	2	94	N/A	
									FACILITY NAME N/A	DOCKET NUMBER

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (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)		OTHER
	20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)
	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 (Include Area Code)
Michael J. Snyder, Shift Technical Advisor	(407) 465-3550

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
N/A	---	-----	---	---						

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On October 20, 1994, Unit 1 was in mode 1 operating at 100% steady state power. Differential pressure testing of a motor operated valve resulted in the lifting of a suction supply header relief valve for the Emergency Core Cooling System (ECCS). On 23 October, an engineering evaluation confirmed that this relief valve could lift under certain accident conditions and result in sump inventory loss in excess of design basis into the Reactor Auxiliary Building.

The root cause of the deficiency was design error in the Iodine Removal System. A common header in that system permitted cross train pressurization of an idle Containment Spray pump, pressurization of the ECCS suction header and the potential to lift the relief valve on that header. This design deficiency had existed since the Iodine Removal System was installed in 1978.

Corrective actions: 1) The relief valve path in the Iodine Removal system was isolated. 2) FPL Engineering evaluated the effects of increased pressure in the ECCS suction header with satisfactory results. 3) The two reliefs were then disabled. 4) A satisfactory leak check test of the ECCS suction header system was performed. 5) The Architect Engineer of the Iodine Removal System was informed of the design deficiency. 6) A Unit 1 and 2 design review indicated no other similar problems in the ECCS. 7) The common header was physically separated prior to restart from the refueling outage.

DESCRIPTION OF THE EVENT

On 20 October, 1994, at 1700 hours Unit 1 was at 100% power steady state operations. Immediately after successful performance of a B train High Pressure Safety Injection pump (EIIS:BQ) motor operated valve (V3662) differential pressure test as required by NRC Generic Letter 89-10, utility maintenance personnel noted water pooling to a floor drain in the pipe tunnel in the Reactor Auxiliary Building (EIIS:NS). The source of the water was found to be from a reseated A train relief valve SR-07-1A, located on the 1A Emergency Core Cooling (ECCS) (EIIS:BP) suction piping. Health Physics personnel determined that the water was from the Refueling Water Tank.

Later that same shift, utility licensed operators determined that the relief had lifted during the performance of the valve differential test due to a previously unrecognized pathway for cross train pressurization. The alignment for the test revealed a flow path from the discharge of the 1B Containment Spray pump (EIIS:BE) to the suction of the 1A Containment Spray pump through a common header in the Iodine Removal System (EIIS:BE) (See Figure One). A review of plant records showed that during this testing, the maximum pressure at the A ECCS suction piping was 85 psig. The design pressure of the line is 60 psig. The relief setpoint of SR-07-1A and 1B is 60 psig.

On 21 October, FPL Engineering was requested to determine potential adverse effects of overpressurizing the 1A ECCS suction piping and to review the operability concern related to the potential to lift SR-07-1A during a postulated design basis accident.

On 23 October, preliminary results from that review prompted Operations to isolate the NaOH system from the 1B Containment Spray pump and enter its 72 hour Action statement at 1255 hours. At 1915 hours, FPL Engineering completed a calculation which determined that the components whose design pressure had been exceeded were capable of withstanding considerably higher pressures. The suction piping and components, therefore, did not suffer any damage as a result of the event. However, it was concluded that a design basis scenario existed which could result in lifting the relief valve. In the event of a postulated Loss of Coolant Accident (LOCA) concurrent with a Loss Of Offsite Power (LOOP) and the failure of one Emergency Diesel Generator (EIIS:EK) to start, SR-07-1A or 1B could open in the idle train, and after a Recirculation Actuation Signal (RAS) (EIIS:JE) would release containment sump inventory in excess of the Engineered Safeguards equipment external leakage rate of 2 liters per hour. This would result in a condition outside of the design basis of the Engineered Safeguards systems. This design deficiency had existed since the NaOH system was backfit to Unit 1 in 1978.

On 26 October, Unit 1 exited the 72 hour LCO when the partially disabled Iodine Removal system was fully restored to service. This was done after FPL Engineering had performed a Safety Evaluation which concluded the acceptability of disabling the two relief valves in the ECCS suction headers as an interim measure. After the suction header reliefs were disabled, a leak test on each ECCS header confirmed the acceptability of this mode of operation until the commencement of the Unit 1 refueling outage scheduled to begin five days later.

CAUSE OF THE EVENT

The root cause of this event was a design deficiency in the Iodine Removal System. The Iodine Removal system is a subsystem of the Containment Spray system which is used to remove post-accident iodine from the containment atmosphere following a LOCA by adding controlled amounts of sodium hydroxide (NaOH) to the containment spray water. This is accomplished by maintaining the containment spray solution pH within specifications to achieve rapid absorption of the radio-iodines and to minimize caustic corrosion of materials and protective coatings within the containment. The specific design error was that the backfit of the NaOH system in 1978 did not consider the adverse potential consequences of using a common return header from the discharge of the two Containment Spray pumps to the two NaOH eductors located near the suction of each Containment Spray pump. The discovery of this event occurred during the GL 89-10 differential pressure testing of the 1B Containment Spray pump cross tie connection to the 1B High Pressure Safety Injection pump. Other plant test and surveillance procedures had isolated the NaOH system and therefore had not detected this design deficiency.

ANALYSIS OF EVENT:

The postulated lifting of SR-07-1A or 1B is reportable to the NRC under 10CFR50.73.a.2.ii as "Any event or condition that resulted in the nuclear power plant being in a condition that was outside the design basis of the plant."

The purpose of the Containment Spray system is to prevent the containment vessel from exceeding its design pressure of 44 psig following a LOCA, assuming a single active or passive failure. The Containment Spray system consists of two redundant trains. The heat removal capacity of either train is adequate to keep containment pressure and temperature below design values. The purpose of the ECCS suction relief valves, SR-07-1A and 1B, is to provide relief capability between the low pressure suction piping and the higher pressure portion of the suction piping used for shutdown cooling. Low Pressure Safety Injection pump (LPSI) (EIIS:BP) check valves and ECCS suction header relief valves were installed to protect against leakage across motor operated isolation valves or the failure to isolate this portion of the low pressure system prior to initiating shutdown cooling. The ECCS suction header relief valves are one and one-half inch reliefs.

One design basis scenario of concern is a large break LOCA with a Containment Spray Actuation Signal and a LOOP coincident with one Emergency Diesel Generator failing to operate. This would result in cross train pressurization to the non-running ECCS train, and open a suction header relief valve. After an RAS, containment sump inventory release would be in excess of the Engineered Safeguards equipment external leakage rate of 2 liters per hour assumptions (FSAR section 15.4.1). The maximum leakage rate from the relief would be limited by the design flow of the NaOH spray additive system eductor at 128 gallons per minute.

ANALYSIS OF THE EVENT (continued):

Two additional scenarios which result in relief valve lifting were identified. One scenario postulated a large break LOCA and one containment sump recirculation valve failing to automatically open after an RAS. This would necessitate shutdown of the affected ECCS train to avoid cavitation of pumps in that train. The second scenario postulated a small break LOCA which does not actuate containment spray. A relief valve would lift on an idle ECCS train during recirculation when a containment spray pump is procedurally aligned to a High Pressure Safety Injection pump for NPSH enhancement. These small and large break LOCA scenarios described above were evaluated for past significance to plant operation and safety.

FPL Engineering completed calculations to show that the containment spray system's ability to supply the containment with the design flow rate of at least 2700 gallons per minute was not compromised with the diversion through the idle spray pump's header and out an ECCS suction header relief under the design basis scenarios of concern. An additional calculation determined that the components whose design pressure had been exceeded during the MOV differential pressure testing on 20 October were capable of withstanding considerably higher pressures and therefore did not suffer any damage as a result of this event.

A review of flooding effects in the ECCS pump rooms was performed. For large break LOCAs, an RAS will stop LPSI pumps which provides an ECCS header vent path back to the Reactor Coolant System (RCS) (EIIS:AB), allowing the suction relief to reseat and terminate flooding. For small break LOCAs without Containment Spray actuated, if the size and location of the RCS break allows Shutdown Cooling (SDC) (EIIS:BP) to be placed in service prior to RAS, the idle ECCS train would not be pressurized. If during a small break LOCA the SDC system could not be placed in service prior to RAS, then Emergency Operating Procedure 3 (EOP-3), Loss of Coolant Accident, directs the operators to align a Containment Spray pump to a High Pressure Safety Injection pump for NPSH purposes. This alignment would open an idle train's ECCS suction relief. The volume of water from the relief valve could be contained for 3 hours without disabling the equipment in the idle ECCS train, and would be contained for 18 hours without adversely affecting the ECCS pumps and safety related equipment on the operating ECCS train. This is a reasonable time for which procedural and plant staff initiated contingencies would be implemented to diagnose and mitigate flooding effects in an ECCS pump room. In any LOCA scenario, operators would be alerted to flooding by control room annunciation of the ECCS sump level monitors. EOP-3 requires operators to check the status of these four sump monitor alarms; then to investigate and attempt to isolate the leakage causing high level alarms in either of the two sumps. Prior to RAS, operators may have enough time to disable the relief by installing a gagging device mounted on the valve. After RAS, procedural guidance for remotely pumping down the ECCS room back to the Reactor Containment Building (RCB) (EIIS:NH) via a dedicated sump pump system is a specific step in EOP-3. However, this system would be unavailable during a LOOP. In the event that these success paths were not implemented, the onsite emergency response organization would have sufficient time to diagnose and mitigate the flooding in the ECCS pump room prior to reaching the opposite ECCS train. More importantly, since the ECCS suction relief lift is dependent upon a high (greater than 37 psig) RCB pressure or continued Containment Spray pump operation, it is unlikely that unmitigated flooding in an affected ECCS pump room would continue for more than 3 hours.

ANALYSIS OF THE EVENT (continued):

This review also concluded that the unaffected train's safety related equipment located throughout the Reactor Auxiliary Building would operate within the bounds of their environmental qualifications in the event of an ECCS suction relief lift.

Leakage from ECCS components during a LOCA and recirculation phase provide a source of fission product leakage external to the containment. All ECCS components containing recirculating sump water are within the controlled ventilation area served by the ECCS area ventilation system. This safety related system processes leakage from ECCS components through a charcoal filter before release to the atmosphere via the plant vent. Relief valves SR-07-1A and 1B both relieve in compartments which are served by the ECCS ventilation system. FSAR section 15.4.1.7 describes the assumptions for determining the offsite dose component from ECCS leakage. The offsite and onsite dose consequences of the relief valve's leakage rate were analyzed using the source term factoring described in NUREG 1465 and by increasing the particulate filtration efficiency to operational values. Results from that analysis showed that the offsite dose consequences from the three postulated scenarios would not exceed 10 CFR Part 100 Guidelines, and that the onsite dose consequences would not exceed 10 CFR Part 50 General Design Criteria.

Therefore, the health and safety of the public were not affected by this condition.

CORRECTIVE ACTIONS:

1) As an interim measure, Operations isolated one train of the Iodine Removal system to preclude cross connecting the ECCS headers and lifting the suction reliefs.

2) FPL Engineering evaluated the effects of exceeding the design pressure of the ECCS suction header during this event and found that the components were capable of withstanding considerably higher pressures and had not been overpressurized or suffered damage.

3) FPL Engineering performed a Safety Evaluation which determined that the ECCS suction headers could withstand pressurization up to the Containment Spray pump discharge head concurrent with the disabling of the relief valves.

4) As an interim measure, the two ECCS suction header relief valves were disabled.

5) The Technical Staff performed satisfactory leak testing of the ECCS suction header.

6) Operations fully restored the Iodine Removal system to service within the 72 hour LCO time limit.

7) A review of the Unit 2 Iodine Removal system verified that it was not susceptible to a similar design deficiency as noted on Unit 1.

CORRECTIVE ACTIONS (continued):

8) A design review was conducted on the Unit 1 and Unit 2 ECCS piping used during injection and recirculation modes of operation. No other paths for cross flow were identified to be outside the license design basis.

9) A permanent modification to physically separate the common NaOH eductor was accomplished prior to unit restart from the refueling outage. (See Figure Two)

10) FPL Engineering has informed the plant Architect Engineer of the this design deficiency.

11) Lessons learned from this event were shared on the INPO's Nuclear Network.

ADDITIONAL INFORMATION

System Identification:

Iodine Removal System: NaOH System with eductors
Architect Engineer: Raytheon (Ebasco)
NSSS: Combustion Engineering

Previous Similar Events:
A previous LER at St. Lucie related to design deficiencies which resulted in a condition of the plant being outside of the design assumptions in the FSAR is LER 335-80-27, "Unanalyzed Boron Dilution Transient."

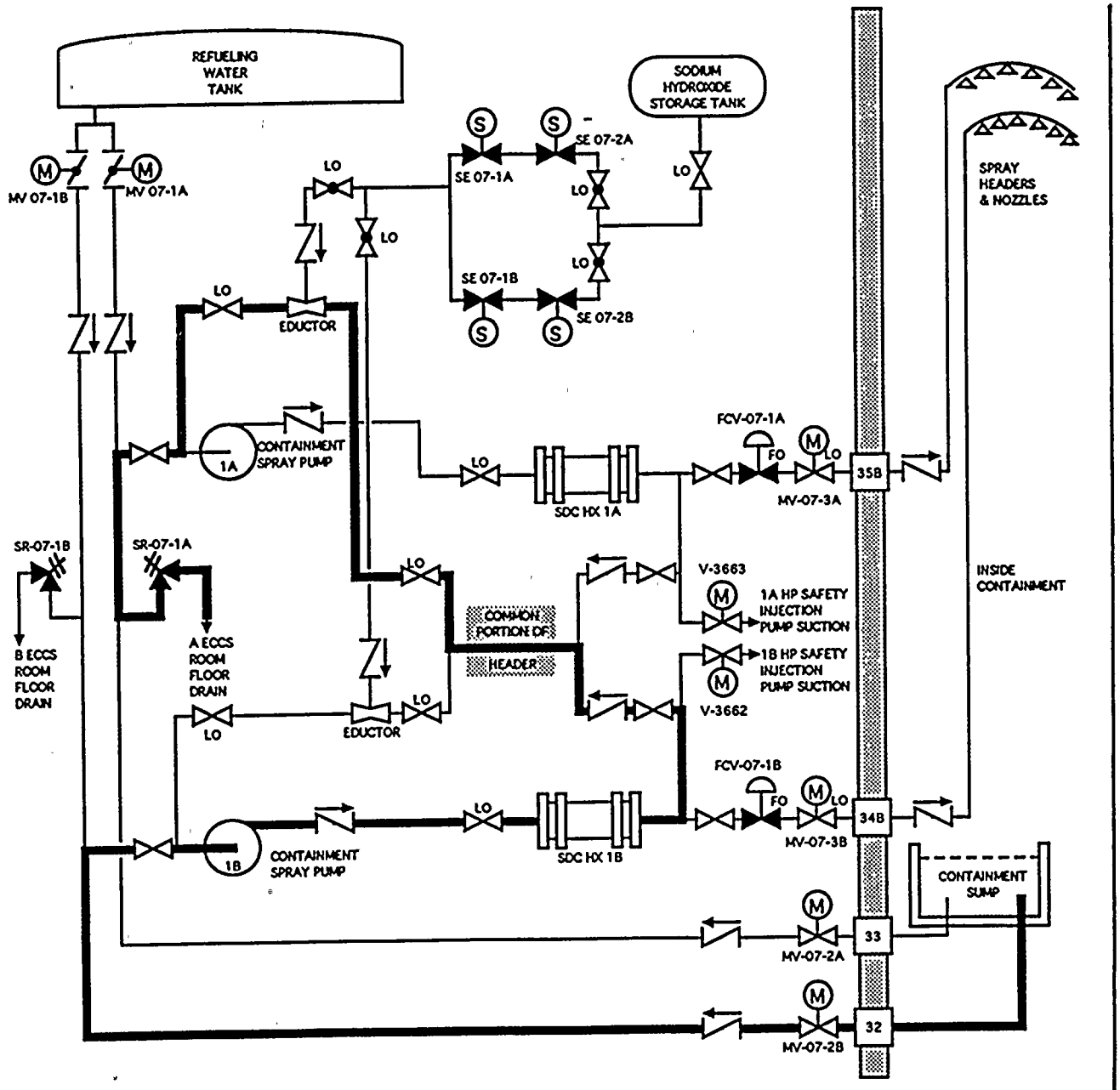

FIGURE ONE - CONTAINMENT SPRAY SYSTEM (ORIGINAL NaOH ADDITION DESIGN)

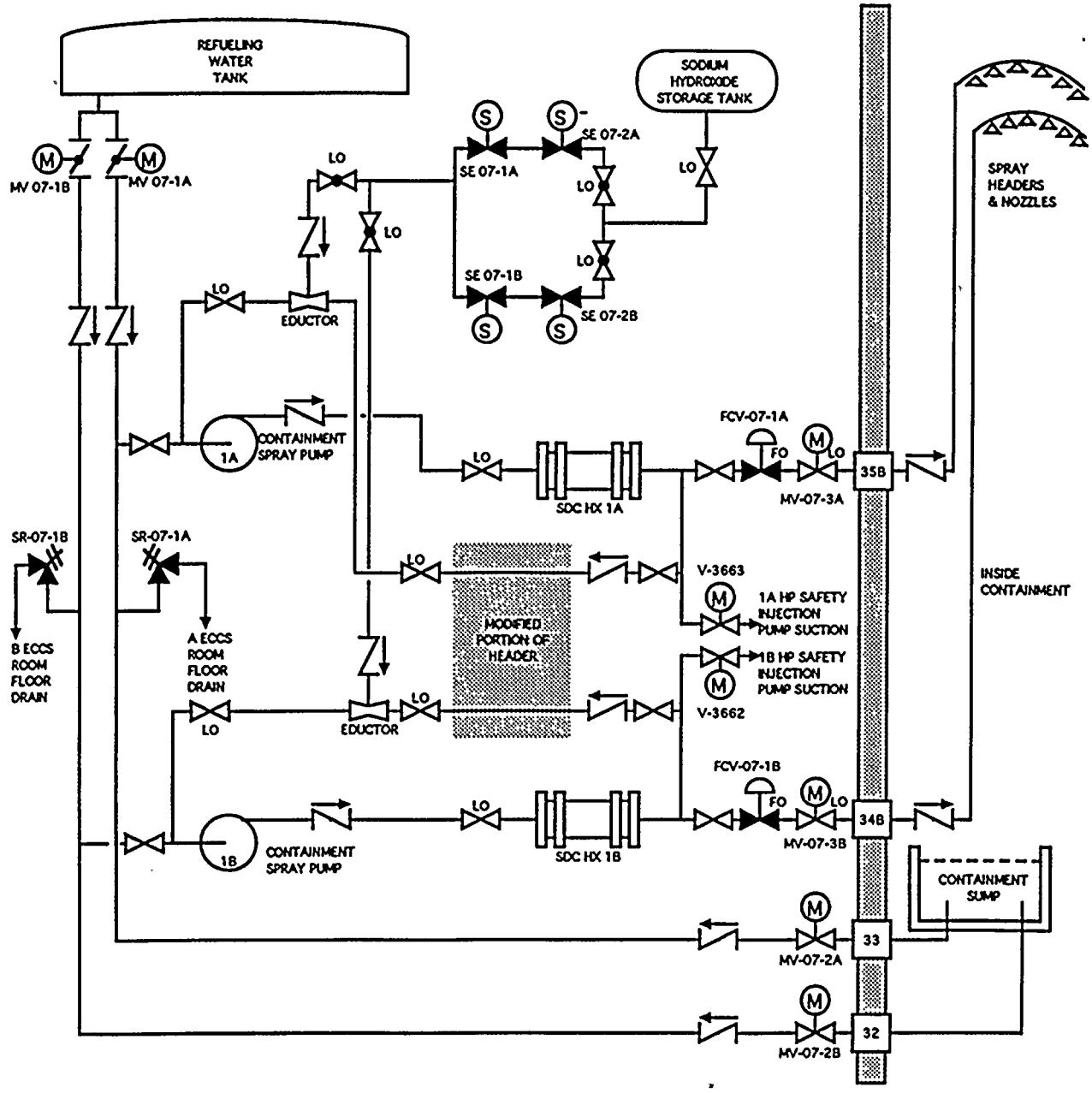

FIGURE TWO - CONTAINMENT SPRAY SYSTEM (MODIFIED NaOH ADDITION DESIGN)