P.O. BOX 529100 MIAMI, FL 33152

FPL

FLORIDA POWER & LIGHT COMPANY

January 2, 1981
L-81-4

Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Eisenhut:

Re: St. Lucie Unit 1
Docket No. 50-335
POST TMI REQUIREMENTS

Florida Power and Light has reviewed your letter of October 31, 1980 and submits the following enclosures as our reports on the indicated NUREG 0737 items:

Enclosure	Item	Description
1	I.A.1.1	Shift Technical Advisor
2	II.E.1.1	AFW System Evaluation
	II.E.1.2	AFW System Initiation & Flow
3	II.K.3.2	Report on PORV Failures
4	II.K.3.17	ECC System Outages
5	III.D.3.4	Control Room Habitability

We have reviewed the generic report prepared to answer Item II.K.3.2 and have determined that it is applicable to St. Lucie Unit 1. It should be noted, however, that while the control rod drop runback has been removed, a runback on loss of both heater drain pumps (to 92%) or loss of one main feed pump at full power (to 60%) is still incorporated.

Our report on Item III.A.2 (Improving Emergency Preparedness-Long Term) will be submitted as a separate letter.

Should you have any questions on these items we would be happy to meet with you or your staff to clarify our reports.

Very truly yours,

Robert E. Uhrig

Robert E. Uhrig
Vice President
Advanced Systems & Technology

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REU/PLP/mbd

cc: J.P. O'Reilly, Region II
Harold F. Reis, Esquire

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ENCLOSURE 1

Re: St. Lucie Unit 1
Docket No. 50-335
Post TMI Requirements

SHIFT TECHNICAL ADVISOR

The STA Training Program is described by St. Lucie Administrative Procedure 0005722 "Shift Technical Advisor Training Program". The program includes training in the following areas:

1. Reactor Theory. This portion of the program utilizes a series of 23 videotape presentations prepared by the NUS Corporation and is the same as that used in the St. Lucie Hot License Operator training.

2. System Descriptions. This part of the program consists of 39 lecture presentations covering St. Lucie plant systems including plant design and layout, and the capabilities of instrumentation and controls in the control room. Training material is the same as that of the Hot License Operator training program. Lectures are presented by individuals possessing a St. Lucie Plant Senior Reactor Operator license.

3. Transient and Accident Analyses. This section of the program includes a series of 17 lecture presentations developed and given by the FP&L Nuclear Analysis Department. The subject matter covers accidents and plant transients described in the St. Lucie FSAR and CEN-128.

4. Plant Procedures. This part of the program covers St. Lucie Plant procedures, including Emergency, Off-Normal, Administrative, and Emergency Plan Implementing Procedures. These are discussed in 13 lectures presented by a Senior Reactor Operator licensed individual.

5. Technical Specifications. This section consists of two lectures given by a person holding a SRO license and covers the St. Lucie Plant Technical Specifications.

6. Simulator Training. This portion of the program includes training given at the CE Simulator in Windsor, CT. Each STA is a member of a plant training shift and receives the same training as the plant operators undergoing annual requalification. The training consists of both classroom instruction and simulator practical sessions and is one weeks duration.

7. Throughout the program STA Trainees were/are required to do extensive self study to prepare for lectures and exams. Performance of this studying is verified by class participation, direction observation and examination.

During the STA Training Program a series of five written examinations is administered to the STA trainees. These exams gage the effectiveness of the program and measure individual trainee performance. To become qualified, each STA candidate must achieve an overall average exam score of 75 or greater.

For purposes of STA qualification, individuals who posses and maintain a RO or SRO license can be exempted from any or all portions of the training or requalification program.

Upon satisfactory completion of the program, each STA is designated, in writing, as being qualified as a St. Lucie Plant STA by the Plant Manager.

The STA Requalification Program is described by Administrative Procedure 0005723, "Shift Technical Advisor Requalification Program". The program is designed to maintain a high level of knowledge in plant systems, accident and transient analysis, procedural requirements, and operations assessment. To accomplish this, the following topics are covered:

1. System Descriptions
2. Emergency/Off-Normal Procedures
3. Technical Specifications
4. Emergency Plan
5. Administrative Procedures

Lectures will be held on a bi-weekly basis. This will allow all topics to be covered annually, with the exception of system descriptions which will be covered biannually. Lectures will be prepared and presented by STAs themselves, as assigned. Knowledge level will be monitored by periodic short quizzes.

Each STA will attend Combustion Engineering simulator training annually. This will be done in conjunction with the St. Lucie Licensed Operator Requalification program.

When available, presentation of significant plant events from St. Lucie and other nuclear plants will be included in the STA requalification program.

Additionally each STA has and will participate in the portions of the regular operator (RO/SRO) requalification program in facility and procedure changes. Each STA will be considered as a licensed operator for the purpose of participation in the Operating Experience Feedback Program.

Upon satisfactory completion of the program, each STA will be designated, in writing, as being requalified as a St. Lucie Plant STA by the Plant Manager.

It is the position of Florida Power & Light that the need for Shift Technical Advisors is and will continue to be an interim requirement. The STA program will eventually be phased out at such time as the Shift Supervisor's qualifications have been upgraded and the man - machine interface in the Control Room has been acceptably upgraded. Therefore, the "long-term" STA program will consist of the qualification and requalification programs described above. Selection criteria for replacement STAs, if required, will be such as to meet the requirements of an STA and those of the Plant Technical Staff since the STAs are organizationally part of that group.

NUREG 737 also requires a comparison of the proposed INPO STA program and that of the St. Lucie Plant. A direct comparison is difficult due to the apparent difference in philosophy concerning program emphasis. A best attempt to develop a one-to-one correlation is included as Attachment A.

ATTACHMENT A

GRAM ELEMENT	INPO STA PROGRAM	ST. LUCIE STA PROGRAM
Position Description	The function, general qualifications, general duties, typical responsibilities, and accountability are essentially the same for both programs.	
Experience	Minimum 18 months; at least two of which is at an operating nuclear plant.	No formal requirement; however for present STAs (including 5 people hired in 1980 for STA duties) Average: 85.8 months Minimum: 48 months Maximum: 156 months
	Minimum of 12 months at plant which position is to be filled	No formal requirements; however, for present STAs (including 5 new hires) Average: 33.6 Maximum: 60 Minimum: 9.5
ences from STA Duties	> 30 days requires training on facility procedure changes	STA personnel are required to participate in the licensed operator requal program for facility and procedure change review
	> 6 months requires annual requalification training	No requirement
Education-Prerequisites beyond High School Diploma	270 Contact Hours	Requires bachelor's degree or equivalent in a scientific or engineering discipline
Education-College Level Fundamental Education	520 Contact Hours	Requires bachelor's degree or equivalent in a scientific or engineering discipline (All present STA's have degrees)
Applied Fundamentals - Plant Specific	120 Contact Hours	None
Reactor Theory	None	23 Contact Hours
Management/Supervisor Skills	40 Contact Hours	None
Plant Systems	200 Contact Hours	43 Contact Hours

ENCLOSURE 2

Re: St. Lucie Unit 1
Docket No. 50-335
POST TMI REQUIREMENTS

AUXILIARY FEEDWATER SYSTEM EVALUATION AND AUXILIARY FEEDWATER SYSTEM AUTOMATIC INITIATION AND FLOW INDICATION

This report provides the results of an evaluation assuming a pipe break anywhere in the AFW pump discharge line plus a single active failure. It also provides a description of AFW system modifications to be implemented by January 1, 1982. This augmented AFW system will have the following features;

(1) The AFWS will have diversity in motive power sources such that system performance requirements are met with either an ac-powered flow train or a redundant dc/steam-fed flow train. All valves in the turbine-driven AFW pump flowpath will be dc-powered, thus ensuring that this flowpath is independent of ac power.

(2) The AFWS will be designed to withstand pipe rupture effects within the AFWS: a pipe whip restraint will be installed to preclude the turbine header from whipping into the motor header.

(3) The AFWS will be capable of withstanding a single active failure, in conjunction with a postulated high-energy line break in the AFWS. (Note that the original licensed design basis for the AFWS was, and remains, the capability to withstand a single active failure concurrently with a postulated high-energy line break in the Main Feedwater System.)

(4) The AFWS will automatically initiate auxiliary feedwater flow upon receipt of an Automatic Feedwater Actuation Signal (AFAS).

(5) The AFAS will automatically terminate auxiliary feedwater flow to a faulted steam generator, and automatically provide auxiliary feedwater flow to the intact steam generator.

(6) The AFAS will automatically terminate auxiliary feedwater flow to a ruptured main feedwater line downstream of the check valve, or to a ruptured auxiliary feedwater line downstream of the isolation valves, and will provide automatic auxiliary feedwater flow through the intact main feedwater line or the intact auxiliary feedwater line(s).

(7) The AFAS will meet the requirements of IEEE-323-1974, IEEE-344-1975 and IEEE-279-1971.

(8) Based on the design head-flow curves, and as verified through <u>in-situ</u> flow tests, the motor-driven auxiliary feedwater pumps have been verified as actually supplying over 350 gpm per pump. (Thus, the installed capability of the motor-driven pumps is well above the design nominal capacity of 250 gpm referenced in the FSAR.) Analyses by the

RAM ELEMENT	INPO STA PROGRAM	ST. LUCIE STA PROGRAM
Administrative Controls	80 Contact Hours	5 Contact Hours
General Operating Procedure	30 Contact Hours	None - However, all STA's have been in the regular operator requalification program for procedure changes throughout 1980
Transient/Accident Analysis and Emergency Procedures	30 Contact Hours	40 Contact Hours
Simulator Training	Trainee/instructor ratio < 4:1	No formal requirement; however, Trainee/instructor ratio = 5/1
	50 Contact Hours (classroom)	20 Contact Hours (classroom)
	50 Contact Hours (simulator)	20 Contact Hours (simulator)
al Requalification ining	40 hours (lecture)	95 hours (estimated) (lecture)
	40 hours (simulator)	40 hours (simulator)

Diverse power sources will be utilized to ensure that the Auxiliary Feedwater System is capable of performing its intended safety function. The design features incorporated into the Auxiliary Feedwater System, which assure diversity of power sources, are:

a. Each motor-driven auxiliary feedwater pump is aligned to a separate diesel generator, with its associated normally closed, motor-operated flow control valves being fed from the same diesel as the pump.

b. The turbine-driven pump and its associated normally closed steam inlet and discharge flow control valves will be fed from a dc power supply.

The AFW control system shall operate as described below:

The AFWS shall automatically actuate upon receiving on Auxiliary Feedwater Actuation Signal (AFAS) within a design actuation time of 2 minutes. The AFAS is initiated on low steam generator water level. Additionally the system control logic shall isolate feed to a steam generator with a main steam line break or high energy line break in the AFWS. The AFWS control logic shall provide safe shutdown capabilities during steam generator low water level transients main steam line break transients and auxiliary feedwater high energy line breaks (including breaks in the MFW system downstream of the MFW line check valves at the containment penetration). The AFWS operates during a steam generator low water level transient as follows:

When an AFAS is generated, all three (3) AFW pumps are started automatically. The control logic aligns all pump discharge valves such that both steam generators will be fed.

The AFWS operates during main steam line or auxiliary feed water high energy line break as follows:

Upon receipt of an AFAS, all three (3) AFW pumps are started. The control logic automatically aligns all pump discharge valves such that the effected steam generator (or AFW line) is isolated. Flow shall be aligned to the intact steam generator.

A simplified control logic block diagram is provided. (see figure 1)

If the auxiliary feedwater pumps are already operating and offsite power is lost, the pumps automatically restart using the diesel generator power.

The steam generated during decay heat removal and during cooldown after a loss of offsite power is discharged through the Main Steam Safety Valves or the atmospheric dump valves (ADVs), except for any steam used by the turbine-driven auxiliary feedwater pump.

There is one motor-operated ADV located on each main steamline. These ADV's are sized to pass the flow required to bring the Reactor Coolant System to the Shutdown Cooling System entry temperature at a cooldown rate of 75 F/hr.

NSSS vendor have verified that this flow rate, from one motor/driven AFW pump to a steam generator, is sufficient to remove reactor decay heat and maintain the RCS in a hot standby condition following a trip from full power.

(9) A cross-tie will be provided from the Unit 2 Condensate Storage Tank to the suction lines of the Unit 1 AFWS pumps, thereby providing an additional 150,400 gallons of demineralized water in the unlikely event of loss of the Unit 1 CST from a vertical tornado missile.

(10) Capability for manual initiation of the AFWS is maintained.

(11) Testibility is maintained.

I. DESIGN BASIS

The function of the Auxiliary Feedwater System (AFWS) is to ensure a sufficient supply of cooling water to the steam generators when main feedwater is not available. The design bases of the augmented Auxiliary Feedwater System will be as follows:

a. Provide sufficient cooling water to either one or both steam generators to ensure the following:

   1. Provide sufficient capability for the removal of decay heat from the reactor core during normal operation and under accident conditions.

   2. Reduce the Reactor Coolant System (RCS) temperature to the entry temperature (T = 325 F) for actuating the Shutdown Cooling System (SDCS) under normal conditions.

b. Deliver auxiliary feedwater flow against the maximum steam generator pressure.

c. Store sufficient demineralized water (116,000 gallons) in the seismic Category I Condensate Storage Tank, such that during normal operation the AFWS can cool down the RCS (at 75 F/hr) to the SDCS entry temperature.

d. Operate automatically upon receipt of a low steam generator level signal, with loss of either offsite or onsite ac power, with no operator action required outside of the Control Room.

e. Ensure system performance with redundant and diverse power sources, ie, with two ac-powered motor-driven pumps and one steam turbine-driven pump.

f. Preclude hydraulic instabilities; eg, waterhammer

g. Perform its design function following design basis natural phenomena (ie, following a hurricane or a tornado, or a safe shutdown earthquake).

h. Withstand pipe rupture effects, including pipe whip and jet impingement forces.

i. Perform its function assuming a main feedwater line break concurrent with a loss of offsite power and a single active failure in the AFWS.

j. Although not originally a design basis, provide sufficient decay heat removal capability through the steam generator(s) to maintain the Reactor Coolant System at hot standby, assuming a high energy break in the AFWS and a single active failure.

II. Summary Description

During normal operation, feedwater is supplied to the steam generators by the Main Feedwater System. The Auxiliary Feedwater System (AFWS) is used during normal plant start-up, hot standby and cooldown. The AFWS is not utilized during full-power operation. During plant start-up and hot standby, the system provides a source of water for the steam generators. During cooldown, the AFWS provides the means of heat removal to bring the Reactor Coolant System to the Shutdown Cooling System actuation temperature. With offsite power (and thus the Steam Dump and Bypass System) available, the condenser is used as the heat sink.

The major active components of the system consist of one 500-gpm design capacity steam-driven, and two motor-driven auxiliary feedwater pumps each with over 350 gpm (installed) capacity. Both electrical and steam-driven AFWS pumps are centrifugal units with horizontal split casing and are designed in accordance with ASME Section 3 requirements. The largest pump is driven by a noncondensing steam turbine, which receives steam from the Main Steam lines upstream of the Main Steam Isolation Valves and exhausts to the atmosphere. The AFWS pumps take suction from the Condensate Storage Tank, and discharge to the steam generators. The turbine-driven pump is capable of supplying auxiliary feedwater flow to the steam generators for the total expected range of steam generator pressure, by means of a variable-speed turbine driver-controlled by an electronic governor.

Each motor-driven pump supplies feedwater to one steam generator. The turbine-driven pump supplies feedwater to both steam generators by means of two separate lines, each with its own control valve sized to pass the full flow. Cross connections are provided to enable the routing of the flow of any AFWS pump to any steam generator. Each of the motor-driven auxiliary feedwater pumps utilizes a Class 1E ac power supply (4.16 kV safety-related bus). The turbine-driven pump train will rely solely on a Class 1E dc power supply; the valves associated with the turbine-driven pump will also be powered from a Class 1E dc source.

The seismic Category I Condensate Storage Tank (CST) provides the water supply from the Auxiliary Feedwater System. The CST is sized to provide a minimum (Technical Specification) of 116,000 gallons of a demineralized water for start-up, hot standby and cooldown operations. The quantity of water needed for St. Lucie Unit 1 cooldown is determined assuming the unit is brought to a hot standby and held there for one hour (this procedure requires about 22,500 gallons of water); the plant is then cooled down at a maximum rate of 75 F per hour until the shutdown cooling entry temperature of 325 F is reached (about 80,000 gallons required).

III. SAFETY EVALUATION

The auxiliary feedwater pumps are located underneath the Main Steam trestle and are surrounded by a seismic Category I structure which provides protection from external, internal and tornado missiles. The AFWS is designed to withstand design basis natural phenomena. The Condensate Storage Tank (CST) is surrounded by a structural barrier which provides horizontal missile and tornado protection for the tank. An intertie from the Unit 2 CST to the suction lines of the Unit 1 AFW pumps will be installed to provide demineralized water in the unlikely event that the Unit 1 CST contents are lost due to a vertical tornado missile. Components in the AFWS are protected from flooding as they are located above the maximum postulated flood level.

The design provisions utilized to protect the AFWS against the dynamic effects of pipe rupture and jet impingement from a Main Feedwater System line break or a Main Steam Line break have been presented in FSAR Appendix 3C. In addition, although the AFWS design basis did not include categorization as a high energy system, a pipe whip restraint will be installed to prevent the turbine-driven pump header from whipping into the motor-driven pump header; this ensures the integrity and operability of the motor-driven feedwater train. Since the AFWS is located in the steam trestle area, protection from internally-generated missiles outside of containment is provided by the missile protection barriers which are around the motor-driven pumps and around the turbine-driven pump. The auxiliary feedwater turbine-driven pump utilizes both electrical and mechanical overspeed protection with the electrical trip set at 115 percent overspeed and the mechanical trip set at 125 percent overspeed.

The potential for hydraulic instability has been considered in the original design of the Main Feedwater System and the Auxiliary Feedwater System piping. Routing of the feedwater piping is such that draining of the feedwater line is minimized. A check valve and a 32-foot vertical drop in the feedwater piping immediately outside the feedwater nozzles provides assurance that the piping will not drain and prevents entrapment of air. Design provisions are also incorporated into the feedwater sparger to minimize draining.

The Axuiliary Feedwater System is designed such that no single active failiure precludes the capability for removal of decay heat and maintenance of the plant in a hot standby condition; capability for cooldown to the Shutdown Cooling System entry temperature is maintained for all hypothesized transients.

FSAR Table 10.5-1 is a Failure Modes and Effects Analysis (FMEA) for the Auxiliary Feedwater System. The original design basis for the AFWS is a hypothetical Main Feedwater line break plus a loss of offsite power. AFWS capability is demonstrated by FSAR Table 1-.5-1A. The AFWS has also been reviewed for a nondesign basis high energy line break in the AFWS concurrent with a single failure.

The redesigned auxiliary feedwater system was evaluated against the following plant transient and accident conditions, for the purpose, of meeting NRC standard Review Plan 10.4.9, Branch Technical position 10-1 and established AFWS design flow requirements:

1) Loss of main feed (LMFW)
2) LMFW with loss of offsite AC power
3) LMFW with loss of onsite and offsite AC Power
4) Turbine trip with and without by pass
5) Main steam isolation valve closure
6) Main feed line break
7) Main steam line break
8) Small break Loca
9) Loss of offsite AC Power with AFW high energy line break
10) Plant cooldown

These trnsient and accident conditions were analyzed to identify the most limiting condition for the auxiliary feed water system and that condition was evaluated to certify the acceptability of the AFWS design. Our analysis identified condition 9 as the most limiting condition for the AFWS at PSL-1 for the following reasons. Condition 1, loss of main feed, was assumed to occur concurrent with a high energy line break in the AFWS and resulted in a condition only as limiting as condition 9. Condition 2, LMFW with loss of offsite power, was assumed to occur concurrent with a high energy line break in the AFWS and resulted in a condition that was less limiting than condition 9 because there are no reactor coolant pumps operating to supply additional heat imput. Condition 3, LMFW with loss of onsite and offsite AC power, was not assumed to occur concurrent with a high energy line break in the AFWS since loss of onsite diesel generators were the assumed failures; this resulted in the availability of the steam driven AFW pump with a 500 GPM capacity. Conditions 4 and 5, turbine trip with or without bypass and main steam isolation valve closure, was assumed to occur concurrent with the AFWS pipe break and resulted in a less limiting condition because offsite AC power was available to operate the MFW pumps. Conditions 6, 7 and 8, main steam line break or main feed line break or small break LOCA, were not assumed to occur concurrent with an AFWS pipe break and therefore the entire capacity the AFWS is available. Condition 10, plant cooldown, was assumed to occur concurrent with an AFWS pipe break and this resulted in a less limiting condition than condition 9 because offsite AC power is available to operate MFW pumps.

The detailed evaluation of condition 9 is presented below.

Evaluation of Loss of Offsite AC Power with high energy line break in the AFWS.

Loss of offsite AC Power in effect results in loss of main feed water, reactor trip due to low steam generator level, turbine trip and the necessity to power the AFWS components from emergency buses A (AC), B(AC)and AB-DC tie. The most limiting single active failure is failure of either "A" or "B" battery. This failure of battery "A" will result in failure of "A" - AC motor driven pump and the AB-DC tie bus to the A bus. Thus when evaluating the proposed AFWS automatic initiating control system against BTP 10-1, high energy line break should be considered with the single active failure of battery "A". As a result, two postulated break locations are identified as "most limiting". Each case is further evaluated below;

Condition A - high energy line break at turbine pump discharge concurrent with single active failure (Break at C in Fig. 1)

For this case the automatic initiated control logic for the AFWS will align all pump discharges to the steam generators. This will result in one motor driven pump (pump B) feeding B steam generator. Pump flow will initiate well with in the design actuation time for the system of 2 minutes. In attachment 1 we have provided the results of our analysis which demonstrates the adequacy of one motor driven pump to remove decay heat and place the plant in a safe shutdown condition.

Condition B - high energy line break at "B" pump discharge concurrent with single active failure (break at B in Fig. 1)

For this case the operators have 13 minutes to initate AFW flow, via the turbine, by transferring electrical DC loads from the dead "A" bus to the energized "B" bus. This transfer, as presented in chapter 10.4 of PSL-1 FSAR, is conservatively assumed to take a maximum of 5 minutes if necessary.

Plant cooldown is accomplished for condition A and B using either motor driven pump or turbine driven pump.

Conclusion and result of Evaluation:

The augmented AFWS for St. Lucie Unit No. 1 will meet all the acceptance criteria of Standard Review Plan (SRP) 10.4.9 (Revision 1) and Branch Technical Position (BTP) ASB 10-1 (Revision 1). Appendix A, also attached herewith, presents the demonstration of the AFWS acceptability as a line-up against the SRP and BTP.

ATTACHMENT 1

Combustion Engineering, the NSS supplier for the St. Lucie Plant was commissioned to evaluate and provide FPL minimum flow rate requirements for the augmented AFWS as described in section II. The system flow rate requirements as presented here represent the result of this evaluation.

System Flow Requirements

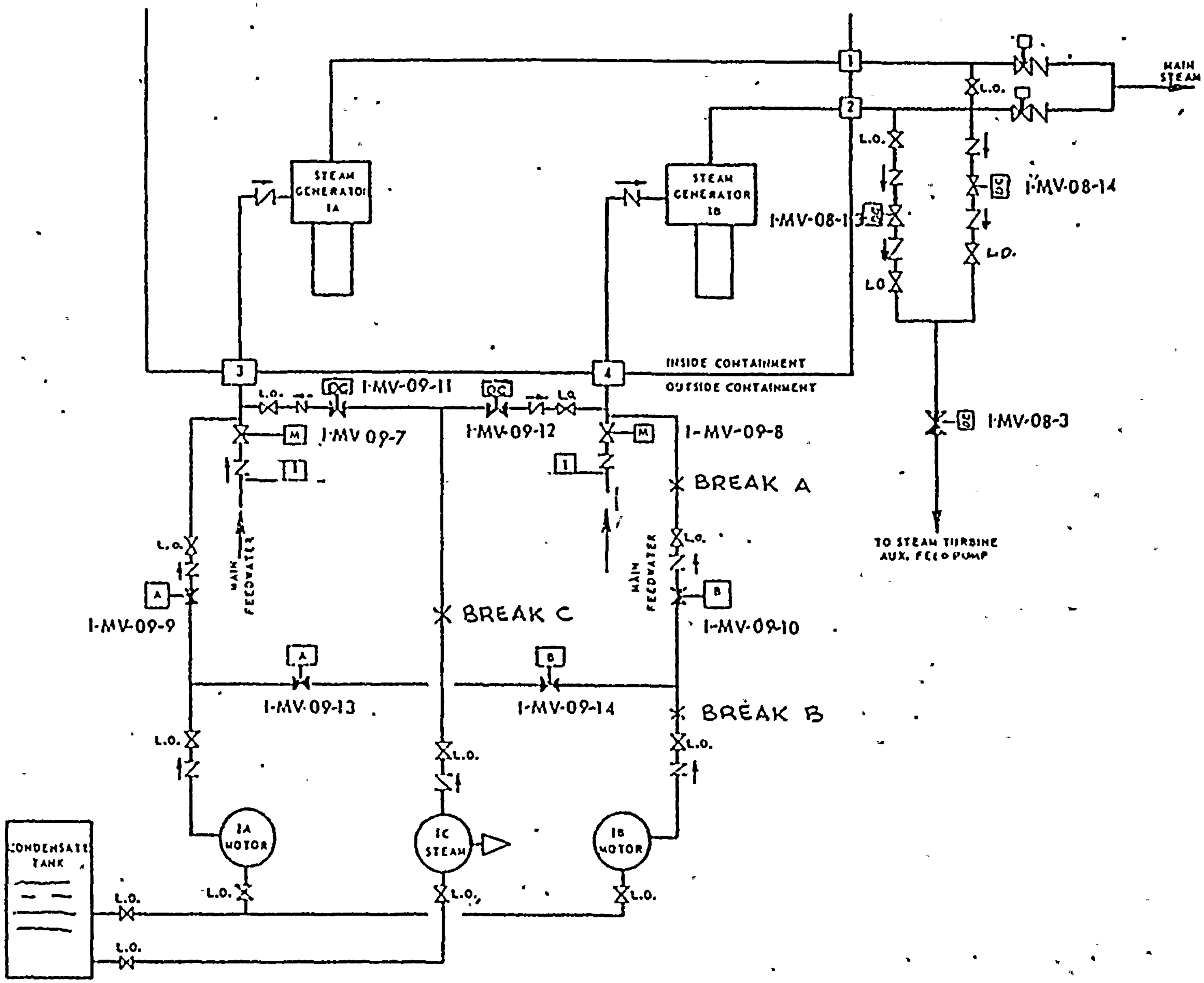
Minimum system flow rate requirements corresponding to the augmented AFWS design fuctions have been determined based on worst case plant heat loads. These requirements are presented below:

AFWS REQUIRED FLOW RATES

Flow Rate	
350 gpm[1]	Automatically maintain sufficient inventory in steam generator for residual heat removal.
500 gpm[2]	Maintain steam generator level constant during a 75°F/hr cooldown (operator action required).

[1] 320gpm supplied within 120 sec. of actuation signal. 350gpm supplied within 30 minutes of actuation signal (operator action required).

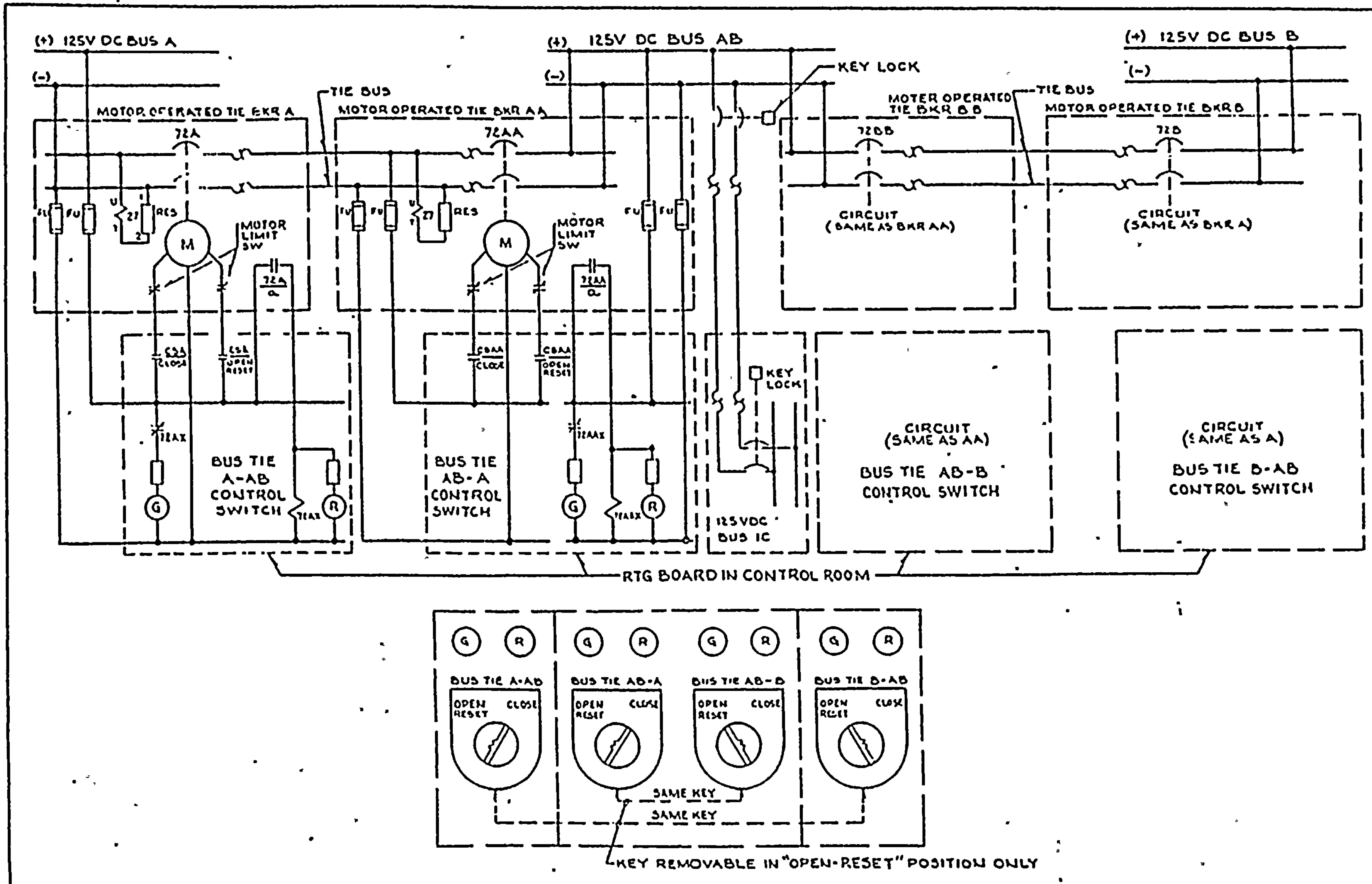
[2] Provides bases for 100% rating of AFWS pumps.



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 1

AUGMENTED AUX. FEEDWATER SYSTEM SCHEMATIC

FIGURE 1



FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 1

125V DC BUS TRANSFER CIRCUIT FROM CONTROL ROOM

FIGURE 2

APPENDIX A

ST LUCIE UNIT 1

AUGMENTED AUXILIARY FEEDWATER SYSTEM

SRP 10.4.9

ACCEPTANCE CRITERIA	COMPLIANCE	REMARKS
Acceptability of the design of the auxiliary feedwater system, as described in the applicant's safety analysis report (SAR), is based on specific general design criteria and regulatory guides. An additional basis for determining the acceptability of the AFS is the degree of similiarity of the design with that for previously reviewed plants with satisfactory operating experience. Listed below are the specific criteria as they relate to the AFS.		The Unit 1 Auxiliary Feedwater System (AFWS) will be augmented as described <u>supra</u> in the System Description and Safety Evaluation. Following is a review of that augmented AFWS which describes how the system meets present NRC Staff criteria.
1. General Design Criterion 2, as related to structures housing the system and the system itself being capable of withstanding the effects of natural phenomena such as earthquakes, tornadoes, hurricanes and floods, as established in Chapters 2 and 3 of the SAR.	1. The Auxiliary Feedwater System, including the instrumentation and controls thereto, is designated seismic Category I, designed to withstand tornadoes and hurricanes and located at an elevation above the probable maximum flood level. See FSAR Subsection 10.5.3.	1. Also see System Description and Safety Evaluation discussions in main text.

APPENDIX A

ST LUCIE UNIT 1

AUGMENTED AUXILIARY FEEDWATER SYSTEM (Cont'd)

SRP 10.4.9

ACCEPTANCE CRITERIA	COMPLIANCE	REMARKS
2. General Design Criterion 4, with respect to structures housing the system and the system itself being capable of withstanding the effects of external missiles and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks.	2. The AFWS is located in an outdoor area below the main feedwater and main steam lines, and is surrounded by tornado missile - resistant shielding. The turbine-driven pump is missile shielded from the motor-driven pumps. The only high-energy lines traversing the AFS area are the Main Steam and Main Feedwater lines above the AFW pumps. A discussion of the jet impingement forces from a MSLB or MFLB is provided in FSAR Appendix 3C. A review of the AFWS has been performed in light of current NRC criteria, and a pipe whip restraint will be installed which precludes the turbine-driven pump header from whipping into the motor-driven header.	2. The Unit 1 AFWS was not categorized as a high-energy system nor was the the Staff Safety Evaluation Report predicated on this basis; however, the AFWS meets the HELB criteria, accounting for a single active failure, as discussed in BTP ASB 10-1 position 5, below.

APPENDIX A

ST LUCIE UNIT 1

AUGMENTED AUXILIARY FEEDWATER SYSTEM (Cont'd)

SRP 10.4.9

ACCEPTANCE CRITERIA	COMPLIANCE	REMARKS
8. Regulatory Guide 1.26, as related to the quality group classification of system components.	8. The AFWS is designed Quality Group C in accordance with R.G. 1.26.	8. Those portions of the AFWS connected to the Main Feedwater line are QG B to the isolation valve(s).
9. Regulatory Guide 1.29, as related to the seismic design classification of system components.	9. The AFWS is designated seismic Category I in accordance with R.G. 1.29.	
10 Regulatory Guide 1.62, as related to design provisions made for manual initiation of each protective action.	10. The AFWS will meet the requirements of Regulatory Guide 1.62. The operator may manually initiate the Automatic water Actuation Signal (AFAS) from an easily accessible location in the control room. Manual initiation ensures that protective action goes to completion.	
11. Regulatory Guide 1.102, as re- structures, systems, and components important to safety from the effects of flooding.	11. All AFWS components are located above the maximum probable flood level.	

SRP 10.4.9

ACCEPTANCE CRITERIA	COMPLIANCE	REMARKS
3. General Design Criterion 5, as related to the capability of shared systems and components important to safety to perform required safety functions.	3. The SL 1 AFWS has no structures, systems or components important to safety which are shared with Unit 2. However, a Condition of License for SL 1 includes a commitment to provide an intertie with the Unit 2 Condensate Storage Tank (CST). Thus, the only "shared" component in the AFWS is the Unit 2 CST (capacity 400,000 gal.). A connection from the Unit 2 CST will be provided to the suction of the Unit 1 AFWS pumps for the unlikely event that a tornado missile penetrates the top of the Unit 1 CST and destroys that source of water. The connection for Unit 1 is of sufficiently high elevation up the Unit 2 tank to assure an adequate condensate supply for Unit 1 (150,400 gal.),	3. The Unit 2 CST intertie is required <u>only</u> in the event that a tornado missile somehow penetrates the top of the Unit 1 CST (which is protected on all sides by a 2-foot thick concrete tornado missile barrier to a height of 30 feet) <u>and</u> penetrates through the CST water, <u>and</u> penetrates the CST tank wall. This scenario is highly unlikely.

SRP 10.4.9

ACCEPTANCE CRITERIA	COMPLIANCE	REMARKS
3. (Cont'd)	while providing Unit 2 with a sufficient quantity (150,400 gal.) to safely shut down also, assuming a hypothetical loss of the Unit 1 CST to a tornado missile.	
4. General Design Criterion 19, as related to the design capability of system instrumentation and controls for prompt hot shutdown of the reactor and potential capability for subsequent cold shutdown.	4. Adequate instrumentation and controls are provided to assure the plant is brought to a hot standby condition and subsequent cold shutdown during both normal operation and under accident conditions, including a LOCA. The control of AFWS flow and SG level is accomplished by control room operated valves; however, local control stations are also provided, Instrumentation is also provided at the remote Hot Shutdown Panel, as indicated at FSAR Subsection 7.4.1.8, which provided capability for a prompt hot shutdown and capability for subsequent cold shutdown using appropriate procedures.	4. The augmented AFWS will be designed such that an Automatic Feedwater Actuation Signal (AFAS) automatically starts all three AFWS pumps and opens the valves for both trains to both SGs. In the event of a Main Feedwater line rupture, or an AFWS line break, the AFAS will automatically isolate the affected SG and will automatically feed to the intact SG(s).

SRP 10.4.9

ACCEPTANCE CRITERIA	COMPLIANCE	REMARKS
5. General Design Criterion 44, to assure: a. The capability to transfer heat loads from the reactor system to a heat sink under both normal operating and accident conditions.	5a. During normal operation, the AFWS provides a water inventory to the SGs for removal of decay and sensible heat to the Steam Dump and Bypass System (SDBS). Under accident conditions heat removal is via the SDBS or to the atmosphere via the Main Steam Safety Valves or the Atmosphere Dump valves.	5.a The motor-driven AFW pump capacity has been tested and shows a flowrate in excess of 350 gpm per pump. Analyses demonstrate that this flowrate is adequate for decay heat removal.
b. Redundancy of components so that under accident conditions the safety function can be performed assuming a single active component failure. (This may be coincident with the loss of offsite power for certain events.)	5b. The AFWS is designated as seismic Category I, Safety Class 3 and capable of withstanding a single active component failure. A single failure analysis of the AFWS, including loss of offsite power, is provided in FSAR Table 10.5-1.	5b. The design basis for the SL-1 AFWS is MFW rupture with loss of offsite power plus AFW single active failure. This is satisfied by the design; see FSAR Table 10.5-1A. Also see BTP ASB 10-1, position 5.
The capability to isolate components, subsystems, or piping if required so that the system safety function will be maintained.	5c. Sufficient remote-manual features are provided to permit isolation of failed components and maintain AFW flow to the steam generators.	5c. See FSAR Tables 10.5-1 and 10.5-1A. The proposed AFAS logic will detect a rupture in a MFW line or AFWS line and isolate that line so that AFW flow is maintained to the intact steam generator(s).

SRP 10.4.9

ACCEPTANCE CRITERIA	COMPLIANCE	REMARKS
6. General Design Criterion 45, as related to design provisions made to permit periodic in-service inspection of system components and equipment.	6. Design provisions are provided to assure periodic ISI of the system as required, i.e., removable insulation on Class 2 components to test welds; only visual inspection required on Class 3 components.	6. FP&L's inservice inspection and testing program has been submitted to NRC.
7. General Design Criterion 46, as related to design provisions made to permit appropriate functional testing of the systems and components to assure structural integrity and leak-tightness, operability and performance of active components, and capability of the integrated system to function as intended during normal, shutdown, and accident conditions.	7. Design provisions are provided to assure that the Auxiliary Feedwater System can be tested by flow transmitters to test pumps, pressure indicators to test integrity, and remote-manual means to activate valves from the control room.	7. FP&L's inservice inspection and testing program has been submitted to NRC.

APPENDIX A

ST LUCIE UNIT 1

AUGMENTED AUXILIARY FEEDWATER SYSTEM

SRP 10.4.9

ACCEPTANCE CRITERIA	COMPLIANCE	REMARKS
12. Regulatory Guide 1.117, as related to the protection of structures, systems and components important to safety from the effects of tornado missiles.	12. The AFWS is protected from the effects of tornado missiles as described in item 2 and in the Safety Evaluation.	12. See position of 2 SRP 10.4.9 above.
13. Branch Technical Positions ASB 3-1 and MEB 3-1, as related to breaks in high and moderate energy piping systems outside containment.	13. The SL 1 AFWS was not categorized or licensed as a high-energy system; nonetheless the AFWS meets these criteria.	13. See position 5 of BTP ASB 10-1, which is part of this Appendix.
14. Branch Technical Position ASB 10-1, as related to auxiliary feedwater pump drive and power supply diversity.	14. The augmented AFWS will have the turbine-driven train wholly independent of ac power.	14. Refer to lineup given for BTP ASB 10-1, which is part of this Appendix.

APPENDIX A

ST LUCIE UNIT 1

AUGMENTED AUXILIARY FEEDWATER SYSTEM

BTP ASB 10-1

BRANCH TECHNICAL POSITION:	COMPLIANCE	REMARKS
1. The auxiliary feedwater system should consist of at least two full-capacity, independent systems that include diverse power sources.	1. The Auxiliary Feedwater System (AFWS) consists of two full capacity motor-operated pumps in one train and another redundant full capacity turbine driven pump in the other system. One system is ac powered and the other is steam/dc power.	1. The augmented AFWS will power the steam inlet valves and AFW turbine pump flowpath outlet valves by dc power, thus being independent of ac power.
2. Other powered components of the auxiliary feedwater system should also use the concept of separate and multiple sources of motive energy. An example of the required diversity would be two separate auxiliary feedwater trains, each capable of removing the afterheat load of the reactor system, having one separate train powered from either of two ac sources and the other train wholly powered by steam and dc electric power.	2. The motor driven system (pumps, valves) is powered by the ac system whereas the turbine driven system (pumps, valves) will be wholly powered by the dc system and steam. Either train provides sufficient capability of cooling the RCS to the temperature and pressure required for initiation of shutdown cooling.	2. Analyses performed by the reactor vendor demonstrate that one motor-driven pump, with an installed capacity of over 350 gpm, is capable of of removing reactor decay heat.

BTP ASB 10-1

BRANCH TECHNICAL POSITION:	COMPLIANCE	REMARKS
3. The piping arrangement, both intake and discharge, for each train should be designed to permit the pumps to supply feedwater to any combination of steam generators. This arrangement should take into account pipe failure, active component failure, power supply failure, or control system failure that could prevent system function. One arrangement that would be acceptable is crossover piping containing valves that can be operated by remote control from the control room, using the power diversity principle for the valve operators and actuation systems.	3. The piping arrangement, both intake and discharge, permits feedwater to any combination of SGs. SL 1 uses the crossover piping scheme, so as to withstand single active component failure, where the flow path will be arranged by remote control from the control room which will use the power diversity principle. Local control provisions enable system function upon loss of control failure. For power supply failure the design will provide diversity by having ac powered and dc/steam powered trains. Additionally, upon loss of offsite power, ac power is supplied by the diesel generators.	3. Power diversity is arranged such that motor-driven AFWS train "A" is powered by ac safety bus "SA" which is automatically loaded on diesel generator 1A; the similar train "B" is on bus "SB" and loaded on DG 1B. The turbine-driven pump 1C is on dc swing bus "AB" and can be aligned to either "SA" or "SB". The augmented AFWS will have dc power to all valves in the turbine-driven flow path. Pipe failure of the AFWS is addressed in position 5 below.
4. The Auxiliary Feedwater System should be designed with suitable redundancy to offset the consequences of any single active component failure, however, each train need not contain redundant active components.	4. The AFWS is designed such that single active failures are accommodated as per FSAR Table 10.5-1. The cross ties and valves are arranged such that single active failure of a component is accommodated. For example, on failure of a valve	4. The augmented AFWS will contain dc-powered valves in the turbine-driven pump flowpath.

BTP ASB 10-1

BRANCH TECHNICAL POSITION:	COMPLIANCE	REMARKS
4. (cont'd)	in a motor-driven pump line to open, or on failure of a motor-driven pump to start, the turbine-driven pump supplies both SGs; or on failure of a valve/pump in the turbine-driven train, the motor-driven pumps supply both SGs.	
5. When considering a high energy line break, the system should be so arranged as to permit the capability of supplying necessary emergency feedwater to the steam generators, despite the postulated rupture of any high energy section of the system, assuming a cocurrent single active failure.	5. Postulation of an HELB in the Auxiliary Feedwater System was never a design basis for St. Lucie Unit 1. Nevertheless, the system has been reviewed for this postulate also assuming a concurrent single active failure. Results for the worst cases indicate that the unfaulted SG is always fed by at least one motor-driven pump, and for most single failures the unfaulted SG is fed by at least one motor-driven and the turbine-driven pump, or both motor-driven pumps.	5. Design criteria for Unit 1 was MFW rupture and single failure in AFWS. The AFAS will detect the rupture in the affected line and and close the appropriate valves to isolate the ruptured line. As-built capacity of the motor-driven pump is over 350 gpm. Analyses indicate that this is sufficient flow to remove RCS decay heat and remain at hot standby conditions. For an AFWS HELB, hot standby is the safe condition.