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SUBJECT: Forwards response to GL 96-06, "Assurance of Equipment Operability & Containment Integrity During Design-Basis Accident Conditions."

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JAN 28 1997

L-97-021
10 CFR §50.54(f)

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

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 251
NRC Generic Letter 96-06
ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY
DURING DESIGN BASIS ACCIDENT CONDITIONS

NRC Generic Letter 96-06, "ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN BASIS ACCIDENT CONDITIONS", issued September 30, 1996, requested licensees take specific actions and provide information to the NRC. Florida Power and Light Company provided the 30 day response in L-96-270 dated October 23, 1996. In accordance with NRC Generic Letter 96-06, Florida Power and Light Company provides the attached response relative to the 120 day required response.

Should there be any questions, please contact us.

Very truly yours,

R. J. Hovey
Vice President
Turkey Point Plant

JAH

Attachment

cc: L. A. Reyes, Regional Administrator, Region II, USNRC
T. P. Johnson, Senior Resident Inspector, USNRC, Turkey Point Plant

A072/1

L-97-021

STATE OF FLORIDA)
) ss.
COUNTY OF DADE)

R. J. Hovey being first duly sworn, deposes and says:

That he is Vice President, Turkey Point Plant, of Florida Power and Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this document are true and correct to the best of his knowledge, information and belief, and that he is authorized to execute the document on behalf of said Licensee.

R. J. Hovey

Subscribed and sworn to before me this 28th day of January, 1997.

Cheryl A. Stevenson
Name of Notary Public (Type or Print)

CHERYL A. STEVENSON
MY COMMISSION # CC 564017
EXPIRES: June 19, 2000
Bonded Thru Notary Public Underwriters

NOTARY PUBLIC, in and for the County of Dade, State of Florida.

My Commission expires________________
Commission No. ________________

R. J. Hovey is personally known to me.

On September 30, 1996, the NRC issued Generic Letter 96-06 "ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN BASIS ACCIDENT CONDITIONS". L-96-270 dated October 23, 1996, was submitted by Turkey Point to confirm the requested actions stated in Generic Letter 96-06 would be performed by January 28, 1997. As required by Generic Letter 96-06, L-97-021 is a summary report which provides the following:

> "...conclusions that were reached relative to susceptibility for waterhammer and two-phase flow in the containment air cooler cooling water system and overpressurization of piping that penetrates containment, the basis for continued operability of affected systems and components as applicable, and corrective actions that were implemented or are planned to be implemented. If systems were found to be susceptible to the conditions that are discussed in this generic letter, identify the systems affected and describe the specific circumstances involved."

Generic Letter 96-06 identifies potential concerns regarding void formation within the cooling water supplied to containment fan coolers, and overpressure conditions in isolated piping inside containment. The evaluation of these concerns has been performed independently and each area will be discussed separately.

Component Cooling Water Waterhammer and/or Two Phase flow to the Normal and Emergency Containment Coolers

Component Cooling Water (CCW) is the cooling medium supplied to the Normal Containment Coolers (NCCs) and the Emergency Containment Coolers (ECCs). The CCW system is a closed loop system consisting, in part, of three 50% capacity CCW heat exchangers, three 100% capacity CCW pumps, and two headers with a surge tank open to the atmosphere. While the system has two headers, it is normally operated as a common (cross-tied) system. Two CCW pumps receive start signals in response to a Loss of Off-site Power (LOOP).

Turkey Point Units 3 & 4 utilize two sets of containment coolers: four (4) NCCs for normal operation and three (3) ECCs for accident conditions. The NCCs perform no active safety function, but are part of the safety related CCW system pressure boundary. The NCCs are vertical coolers with finned tubes of Admiralty brass. The ECCs are horizontal coolers with smooth tubes of Admiralty brass. The ECCs are classified as safety related components. During normal operation, the NCCs are placed in service as required to support equipment operation and control containment temperature. The ECCs, while in standby, have a constant supply of CCW for the purpose of chemistry control. This is accomplished via a bypass line around the ECC isolation valves which ensures a nominal flow (200-500 gpm) through the coolers.

Piping System Design Basis

The design requirement for the CCW piping system is specified in the Turkey Point Updated Final Safety Analysis Report (UFSAR). The design requirements are further clarified in FPL Standard CN-3.01, Piping and Pipe Support Analysis Requirements. The CCW piping has been designed to the requirements of USAS B31.1 (1955) except as discussed in the UFSAR. The UFSAR discussion specifies load combinations and allowable stresses associated with low probability events not covered explicitly by B31.1. In practice, from CN-3.01, the 1973 Edition of B31.1 is used for piping analysis. The 1973 Edition prescribes in equation form the calculation of stresses resulting from Occasional Loads such as seismic events or waterhammer loadings.

As provided in the UFSAR, a seismic event is not considered to initiate a Loss of Coolant Accident (LOCA). Therefore, the combination of seismic and LOOP/LOCA is not considered in the design basis and the combination of seismic loading with waterhammer for this scenario is not required. Using UFSAR design criteria and guidance from CN-3.01, the load combinations for the LOOP/LOCA event piping and pipe support evaluation are as follows:

<u>Piping</u>

Normal: Deadweight + Pressure $\leq S_h$ (B31.1, Eq 11)
Thermal $\leq S_A$ (B31.1, Eq 13)
where S_h is the allowable stress at temperature
$S_A = f(1.25S_c + 0.25S_h)$
S_c = allowable stress at 70 °F
f = stress range reduction factor

LOOP/LOCA: Dynamic Effects: Deadweight + Pressure + Waterhammer $\leq 1.2S_h$ (B31.1, Eq 12)

<u>Supports</u>

LOOP/LOCA: Deadweight + Waterhammer + Thermal $\leq 1.33S$
where S is allowable stress from the AISC Code

Where the design criteria cannot be satisfied for the existing condition, the piping and pipe supports can be accepted on a short term basis if the operability criteria as described in NRC Generic Letter 91-18 is satisfied. This allows the utilization of Section III, Appendix F of the ASME Code.

Waterhammer Event Scenario

A review of the accident analyses for the Main Steam Line Break (MSLB) and LOCA provided in the UFSAR shows the limiting containment transient for this issue is the large break LOCA. The bounding event for the evaluation is a LOCA occurring coincident with a LOOP. A large break LOCA is assumed because it bounds all other events including a MSLB and small break LOCA. The MSLB containment air temperature can be higher than a large break LOCA. However, full steam saturation conditions are not reached during the interval of interest. The large break LOCA provides a greater heat input than the MSLB through condensation heat transfer based on fully saturated conditions. For a small break LOCA, the containment temperature would not increase significantly prior to the re-start of the CCW pumps. The postulated LOOP results in stagnant CCW flow conditions and maximizes the potential for void formation in the coolers prior to CCW pump restart.

CCW isolation valves are provided on the inlet and outlet of each ECC. The outlet isolation valve is equipped with a bypass valve. All ECC valves are pneumatically operated. The inlet valves are normally open and fail open on a loss of power to the fan. The outlet valves receive an actuation signal and will open when power is available. The outlet valves will fail closed on the loss of electrical power. The bypass valves are open to a throttled position. The bypass valves will fail to the throttled position on loss of electrical power.

The inlet and outlet NCC isolation valves are motor operated and are located outside containment. The motor operated valves will receive a close actuation signal, but will not actuate during the initial phase of the LOOP. Since the common NCC flow circuit has only one inlet and one outlet valve, several failures of the motor operated valves were considered. The limiting case is the failure of the NCC inlet valve to close as the outlet valve isolates.

The CCW pumps will stop as a result of a postulated LOOP and are not re-started until after power is restored to the ECC fans. Two CCW pumps are assumed to start via load sequencing. This combination of CCW pumps and closure of a cooler outlet valve produces the highest postulated system pressure which results in the most severe piping transient.

In the event of a LOCA coincident with a LOOP, the response times are as follows:

t < 0	CCW in normal operation, NCCs aligned, ECCs receiving bypass flow (main ECC outlet isolation valves are closed).
t = 0	LOCA/LOOP event.
t = 16.5 seconds	Load Centers re-energized and the NCC motor operated isolation valves begin to stroke closed.
t = 27 seconds	ECC fans start, air operated outlet isolation valves begin 2 second open stroke.
t = 41 seconds	CCW pumps start.

Event Analysis

In the event of a LOOP/LOCA, the containment environment is assumed to become a homogeneous steam-air mixture with containment temperature reaching approximately 270 °F in less than 20 seconds. Component Cooling Water within the NCCs and ECCs will become stagnant due to the temporary loss of the CCW pump function. The relatively low component cooling water temperature will cause steam in the containment atmosphere to condense on the cooler tubes. The condensing steam will provide a high heat flux into the stagnant component cooling water, initiating nucleate boiling within the tube bundles. Under these conditions, a steam void of limited size is assumed to form in the NCC and the higher elevation ECC piping loops. The size of the void is limited by the CCW surge tank. Upon propagation of the void, the system pressure increases due to the hydraulic resistance created by the outflow of water from the NCCs and ECCs into the CCW surge tank.

Upon the re-start of two CCW pumps, it is assumed that the inlet isolation valve to the NCCs fails to close or an ECC outlet valve fails to open. The CCW pump head is sufficient to collapse the void. However, the rate of the collapse is limited by the system resistance to flow from the CCW surge tank back into the CCW piping. This is because the water required to fill the collapsing steam void can only be supplied from the surge tank. Both calculations and confirmatory testing at a vendor laboratory were used in the voiding evaluation and the significant conclusions are:

1) Voiding is likely to occur in the NCCs and higher elevation ECCs (3A,4A, and 4C) prior to pump re-start.

2) Voiding will not occur in the lower elevation ECCs (3B,3C, and 4B). The additional static head within the lower ECCs maintains cooler pressure above saturation pressure precluding the formation of a void.

3) The void formed will not propagate beyond the NCC isolation valves or the ECC outlet and bypass valves.

4) Although not credited in the evaluation, when the collapse does occur, the resultant forces are mitigated by air which is expected to come out of solution from the CCW system.

5) The piping and pipe supports have been evaluated using the design basis criteria previously discussed and the guidance of ASME Section III Appendix F as required. The resulting analyses confirm that the coolers, piping and pipe supports would not be subjected to forces which would exceed the operability requirements for the system.

Susceptibility to Two-Phase Flow

The CCW system is designed and flow balanced based on expected post accident heat loading to limit return temperature to less than 170°F. The Turkey Point CCW system is pressurized by the static head of water in the surge tank and the ECC throttle valves are located at a low elevation relative to the tank. The water downstream of the throttle valves is always maintained sub-cooled. Therefore, flashing downstream of the throttle valves is not a concern and the CCW system is not susceptible to sustained two-phase flow conditions.

Emergency Containment Cooling and Component Cooling Water Operability
Waterhammer and Two-phase Flow

Upon pump re-start, the void collapses, the resulting loads exceed the UFSAR licensing basis allowables. However, the postulated loads imposed on the piping system have been demonstrated to be within the operability requirements of the piping, pipe supports and coolers utilizing ASME Section III Appendix F. CCW would be available to the ECCs and the ECCs would be capable of performing their intended function. Therefore, the Emergency Containment Coolers and CCW system would remain operable.

Thermal Overpressurization of Isolated Piping

Identification of Susceptible Piping

NRC Generic Letter 96-06 requires that licensees evaluate if piping systems that penetrate the containment are susceptible to thermal expansion of fluid such that overpressurization of piping could occur. System responses during accident conditions and as a result of normal operating temperature variations were both considered. Two separate areas of concern are addressed:

(1) Overpressure conditions that may prevent opening of safety related valves.

(2) Overpressure conditions which may result in piping/valve pressure boundary failure.

Screening criteria which were applied to identify the piping inside containment that may be subjected to overpressure conditions:

a) Flow diagrams of systems handling liquid with piping inside containment were reviewed.

b) Piping sections of liquid systems inside containment between two isolation valves that are normally closed or may be closed during accident conditions were identified. This included non-safety related piping which is isolated by containment isolation valves.

c) Containment isolation valves located outside containment with isolated pipe sections resulting from inboard non-safety check valves were also considered.

d) Only systems handling liquid were considered.

Evaluation of Valve Performance

None of the piping sections identified were determined to have the potential to pressurize during normal or accident conditions sufficiently to prevent a required valve from opening. This conclusion is based on the existence of one or more of the following attributes at each identified location :

(1) The piping section is isolated by two globe valves and at least one is pressurized under the disc. The valve pressurized under the disc will open, depressurizing the section and allowing the second valve to open.

(2) The piping section is isolated by two pneumatic operated diaphragm type valves. The pressure under the valve diaphragm will facilitate opening of the valve.

(3) The valves are normally open and their safety function is to close during accident conditions.

(4) The valves are normally closed and are not required to be open during normal plant operation or accident conditions.

(5) The valves have been previously identified as being susceptible to pressure locking and have been modified to preclude the event.

(6) The affected portion of piping is normally not filled with liquid.

(7) The valves identified perform a containment isolation function but do not have an active safety function to open.

Piping and Valve Pressure Boundary Overpressurization

The following criteria which were utilized to exclude piping and valves from consideration of pressure boundary overpressurization:

a) Piping sections inside containment with thermal reliefs or relief valves for overpressure protection from valve seat leakage were identified and no further evaluation was required.

b) Piping sections which are isolated by at least one pneumatic operated or solenoid valve which could lift when higher than design pressures are applied under the seat were identified and no further evaluation was required.

c) Piping sections which are isolated by gate valves with flexible or spring loaded parallel discs on which one of the disc sealing surfaces will leak when pressures higher than design are applied. This is applicable to only those gate valves with downstream wedges that are drilled to prevent bonnet overpressurization.

d) Piping sections which were free to discharge to a component not subject to overpressurization (e.g., steam generators) were not considered.

Evaluation of Piping and Valve Pressure Boundary

A review of the remaining affected piping sections revealed that there are three categories that are to be considered: a) isolated piping sections that have self pressure relieving capabilities based on the associated valve designs b) sections of piping that are isolated after being drained or partially drained c) isolated piping sections that will be evaluated to demonstrate compliance with operability requirements.

Isolated Piping Sections with Known Self Relieving Capabilities

These piping sections are capable of relieving the overpressure conditions by being inherently pressure self-limiting. Pressure is relieved by one of the following mechanisms;

(1) The isolation valves are solenoid operated and designed to operate with pressure above the valve disc. When pressure is applied below the valve disc, the valve will open with a relatively low differential pressure.

(2) The isolation valves are fail closed air operated valves. When system pressure is applied under the seat, the force developed under the seat is sufficient to lift the disc well before reaching the piping system pressure rating.

(3) The valves have been previously identified susceptible to pressure locking and have been modified to preclude the event.

Isolated Piping Sections Drained or Partially Filled with Liquid

Several piping sections have been identified as being drained or partially filled. These piping sections have all been evaluated and it has been concluded that no credible overpressurization scenario can be postulated.

Isolated Piping Sections without Known Self Relieving Capabilities

Twelve piping sections have been identified as not having self relieving capabilities (See Table 1). These remaining sections were evaluated based on the thermal overpressure conditions determined by calculation. The calculation utilized ASME Section III Appendix F acceptance criteria as permitted in NRC Generic Letter 91-18 for operability determinations of piping and pipe supports. The results of the calculation indicate that all affected piping and valves would be within Appendix F allowable stresses under the conditions associated with Generic Letter 96-06.

Isolated Piping Operability

Thermal Overpressurization of Isolated Piping and Valve Performance

Based on the evaluations and calculations performed, none of the identified piping sections will prevent a required valve from opening under normal or accident conditions. The affected valves and piping would exceed the UFSAR licensing basis allowables. However, the postulated loads have been analyzed to be within the ASME Section III Appendix F allowable stresses and are therefore operable (See Table 1 for a list of affected sections of piping).

Corrective Actions

Emergency Containment Cooling and Component Cooling Water Waterhammer and Two-phase Flow

The long term corrective action is to preclude void formation. In order to eliminate the void formation within the CCW system, the pressure within the piping loop would have to remain above saturation pressure. One potential system modification under consideration is to provide an elevated CCW system head tank to ensure the NCCs and higher elevation ECCs remain at a pressure in excess of saturation for the design basis LOCA containment temperature profile. As such, the atmospheric tank would provide sufficient elevation head to increase system pressure above saturation pressure at approximately 270 °F. The tank itself would be located outside the containment and would be equipped with the appropriate monitoring and alarm functions. Other modifications under consideration include the gas pressurization of the CCW system or re-sequencing of Emergency Diesel Generator loads such that voiding does not occur prior to CCW pump start.

Based on NUREG/CR-4550, the probability of a large break LOCA is 3.0×10^{-4}/yr. The LOOP probability is 1.0×10^{-3}. The combined LOOP/LOCA probability would be 3.0×10^{-7}/yr. Therefore a LOOP/LOCA is considered to be an extremely low probability event. Turkey Point Units 3 & 4 have demonstrated that the reactor coolant system main loop piping will Leak-Before-Break, which further reduces the probability of a large break LOCA. The Turkey Point Unit 3 Spring 1997 Refueling Outage commences March 3, 1997. It is not prudent to implement modifications during this outage as the design package must be prepared, material procured, construction activities planned, safe installation windows for the modification established, and training performed prior to unit restart. This process cannot be performed in an effective and controlled manner prior to restart from the Spring 1997 outage. Based on the imminent start of the Unit 3 Refueling Outage, implementation of the modifications to address containment cooler voiding have been scheduled for the Fall 1997 Unit 4 Refueling Outage and the Fall 1998 Unit 3 Refueling Outage.

Thermal Overpressurization of Isolated Piping

The evaluations and calculations performed conclude operability is maintained for all components within the scope of the review and continued operation is acceptable. However, not all these components are within UFSAR licensing basis allowables and therefore, some corrective actions are required.

> Turkey Point will submit a proposed license amendment to incorporate into the UFSAR, the methodology of Section III, Appendix F for use in analyzing isolated piping sections in containment under post accident conditions. The proposed license amendment will be submitted by April, 30, 1997.

Table No. 1
Piping Sections without Self Relieving Capabilities

Item	Location	Portion of Piping Between Valve(s) and	Valve(s)
1	Penetration 9 - Pressurized Liquid Space Sample	CV-*-953	CV-*-956B
2	Penetration 23 - Containment Sump Discharge	*-4692A *-4692B	CV-*-2822
3	Penetration 25 - RCP Seal Water Leakoff/Excess Letdown	MOV-*-6386	MOV-*-381
4	Penetration 47 - Primary Water Supply to Wash Header	*-10-582	*-10-567
5	Penetration 55 - Accumulator Sample	CV-*-955C CV-*-955D CV-*-955E	CV-*-956D
6	Excess Letdown Piping	CV-*-387	HCV-*-137
7-12	Safety Injection Test Line	CV-*-850A CV-*-850B CV-*-850C CV-*-850D CV-*-850E CV-*-850F	*-884A *-884B *-884C *-884D *-884E *-884F