FPL

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L-2004-124

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 50-251
Request for Additional Information Regarding
Station Blackout Analysis (TAC Nos. MB8728 and MB8729)

By letter dated October 16, 2003, the NRC issued a request for additional information regarding the Station Blackout (SBO) analysis for Turkey Point Units 3 and 4. The information requested was needed to resolve Unresolved Item No. 50-250 (251)/02-06-01, "Adequacy of Station Blackout (SBO) Strategy/Analysis and Loss of AC Power Emergency Operating Procedures." The response to the request for additional information was provided by FPL letter L-2003-286 dated November 25, 2003.

Subsequent discussions with NRC Staff identified that additional information and clarifications are needed to complete the review of the Turkey Point Units 3 and 4 SBO analysis. The requested information is provided in the attachment to this letter. Please contact Walter Parker at (305) 246-6632 if there are any questions.

Very truly yours,

Terry Jones

Terry O. Jones
Vice President
Turkey Point Nuclear Plant

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Attachment

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant

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Response to Request for Additional Information
Turkey Point Units 3 and 4 Station Blackout Coping Analysis

This attachment documents the responses to the NRC request for additional information on the station blackout (SBO) RETRAN coping analysis for Turkey Point Units 3 and 4. The purpose of this analysis was to demonstrate that Turkey Point Units 3 and 4 have maintained compliance with their licensing basis with respect to changes that modified the method of cooling the reactor coolant pump (RCP) shaft seals under SBO conditions.

By letter dated October 16, 2003, the NRC issued a request for additional information on the Turkey Point SBO coping analysis. The requested information primarily focused on the validity of using RETRAN for the subject reactor coolant system transient, given that it resembles a small break LOCA in that the pressurizer drains and a void forms in the upper region of the reactor pressure vessel. Information on specific analysis assumptions (e.g., the basis for assumed charging pump discharge flow rate) was also requested. A response to the information request was transmitted by FPL to the NRC by letter L-2003-286, dated November 25, 2003.

In 2004, a second set of questions in draft format was received by FPL requesting additional information on the previous Turkey Point response. A conference call was held between FPL and the NRC reviewers on May 10, 2004, to clarify the intent of the proposed questions. The draft questions were subsequently reduced to five principal requests. These requests are documented below with the applicable FPL response.

1. ***Perform a hand calculation to take into account metal wall heating effects for the first thirty minutes of the event prior to starting the charging pump. The purpose of the hand calculation is to show that there is no voiding at the U-bends in the steam generators.***

   The original RETRAN analysis, (PTN-BFSF-02-142) discussed in FPL letter L-2003-286, has been rerun with the metal heat in the reactor vessel upper head included to assess its impact on RCS voiding. Specifically, the new analysis is intended to evaluate the impact that the vessel head metal stored energy has on the dynamics of the upper head bubble and whether or not the top steam generator tubes would void thus interrupting RCS natural circulation cooling. In addition to upper vessel metal heat, the new analysis also includes the modeling of the upper vessel region as a separated non-equilibrium region with two regions (vapor and two-phase mixture) allowed to be at different temperatures. That is, superheating of the vapor region is allowed. For conservatism, minimum inter-region heat transfer has been assumed. The results of the reanalysis are summarized below.

   The additional heat load in the vessel upper head results in more voids being formed in that region. As Figure 1 shows, it also takes longer for these voids to start collapsing when metal heat is included. The upper head bubble is not entirely collapsed until around 7.5 hours with metal heat included versus around 6.25 hours without metal heat. However, the bigger upper head bubble generated with metal heat slightly increases the RCS pressure (Figure 2) and the amount of subcooling. Figures 3 and 4 confirm that subcooling is maintained throughout the event and that its magnitude increases when metal heat is included. Figure 5 shows that a substantial amount of liquid mass is always maintained above the top of the hot legs. Similarly, Figure 6 shows the response of the upper vessel liquid level with respect to the top of the hot legs and top of the core.

To address the uncertainty associated with estimating the metal heat from the metal components in the vessel upper head, a sensitivity RETRAN analysis was performed with approximately twice the amount of metal heat assumed in the above analysis. The results of the sensitivity analysis were consistent with the previous results and confirmed that RCS subcooling increases with metal heat. Voiding in the hot legs or the steam generator tubes is not predicted to occur even with the assumption of twice the amount of metal heat normally expected from the vessel upper head metal components.

The results from the above reanalysis of the Turkey Point SBO event with the inclusion of the stored energy from the metal components in the upper vessel confirm that the hot legs and steam generator tubes remain covered and subcooled, and that natural circulation is not challenged at any time throughout the event.

2. ***Re-affirm RETRAN analysis conservatism. The items discussed with the NRC include:***
   a) ***Waiting to start charging at thirty minutes.***
   Realistically when would charging start. Discuss EDG loadings versus EOP required loadings.
   b) ***Confirm that HHSI pump can be loaded at anytime and EDG has enough capacity to allow this.***

Based on simulator validation, an operator starts a charging pump at 23 minutes following SBO, which is a realistic charging pump start time and is bounded by the RETRAN analysis assumption of 30 minutes. Simulator validation also established that a High-Head Safety Injection (HHSI) pump should be started when RCS pressure decays below 1600 psia (HHSI pump shutoff head). When this condition occurs, any operating charging pump or energized bank of pressurizer heaters will be stopped/de-energized to provide enough power to load a HHSI pump. The SBO Emergency Diesel Generator (EDG) loading drawings confirm that a HHSI pump can be loaded on the EDG and maintain loading within the 2000-hour rating. This provides adequate capacity to load a HHSI pump once pressure is below the HHSI pump shutoff head.

3. ***If HHSI pump is started instead of the charging pump, how does the plant achieve the cool down and depressurization to reach RHR conditions when the pressurizer is refilled with hot fluid?***

The safe shutdown condition for Turkey Point Units 3 and 4 is hot standby. That evaluation and supporting RETRAN analyses confirm that the SBO unit can remain at hot standby for eight hours with a 100 gpm RCS inventory loss using all available equipment, without uncovering the core or challenging containment integrity. Given that the SBO unit does not need to reach RHR entry conditions during the 8-hour blackout duration, the main objective of the operator response is to stabilize the plant, which includes maintaining pressurizer level at approximately 50%. The RETRAN analysis assumed a very conservative cool down rate to maximize the reduction in RCS volume; and thus maximizing the challenge to maintain core cooling. However, if a cool down scenario were attempted, voiding in the head occurred, and the pressurizer re-filled with hot fluid, the operator would use the HHSI pump to refill the RCS. Then the operator would maintain pressure and temperature (not attempt to commence a cool down) until a charging pump could control pressurizer level (i.e. charging flow would exceed break flow). Alternately, the pressurizer power-operated relief valves (PORVs) may be opened to establish a fill and drain configuration; however, this would not be a preferred option. The overall logic with respect to RCS inventory control is as follows:

1. Establish flow with a charging pump
2. If pressurizer level cannot be controlled, stop charging and start an HHSI pump once RCS pressure is < 1600 psia. Refill pressurizer.
3. Reestablish charging once charging flow exceeds RCS leakage rate.
4. Utilize charging pump and pressurizer heaters to control pressure and cool down as required.
5. Utilize PORV to fill and drain RCS; this is not a preferred option since it introduces another RCS inventory loss path.

4. *Explain what type of validation has been done of RETRAN's containment peak pressure calculations.*

The containment response was analyzed without the ADV forced RCS cool down, thus maintaining the RCS at hot standby conditions. The main purpose of the analysis was to assess the containment capability to withstand the consequences of a continuous hot RCS leakage for 8 hours with only passive heat removal available (no emergency containment fan coolers and no containment spray). The capability and options in the RETRAN code to model a global containment response to RCS blow down was used for this purpose.

WCAP-14291 provides the containment response to a High RCS T-avg 2.3-inch cold leg small break analysis with containment passive and delayed active heat removal assumed. The break flow for the 2.3-inch break throughout the transient is at least 5 times larger than the total RCS flow released into containment in the SBO RETRAN analysis. In terms of containment response, the 2.3-inch cold leg break is a relatively benign event that does not even result in the actuation of the containment sprays (analysis assumption actuation set point: 25 psig). The containment temperature peaks at around 235 °F. The containment response predicted by RETRAN in the SBO analysis is consistent with the results of the 2.3-inch break in the sense that it predicts more benign results. The RETRAN containment peak pressure and temperature are approximately 22 psia and 180 °F, respectively.

Given the margin to peak pressure and the consistency between the RETRAN predicted containment response and that predicted in the small break analysis of WCAP-14291, it is concluded that the analyzed SBO RCS leakage will not challenge containment integrity. A more sophisticated evaluation of the containment response is not necessary.

5. *State your decay heat uncertainty assumptions [in the attachment to L-2003-286].*

The Turkey Point RETRAN analysis of a Turkey Point SBO utilized the ANS 1979 Decay Heat Standard option in the RETRAN code with a 10% uncertainty. No sensitivities on decay heat were performed because as it occurs with metal heat, as long as the secondary heat sink is maintained, increases in the RCS heat load will be accommodated by the heat released through the atmospheric dump valves (ADVs) or the secondary heat sink.

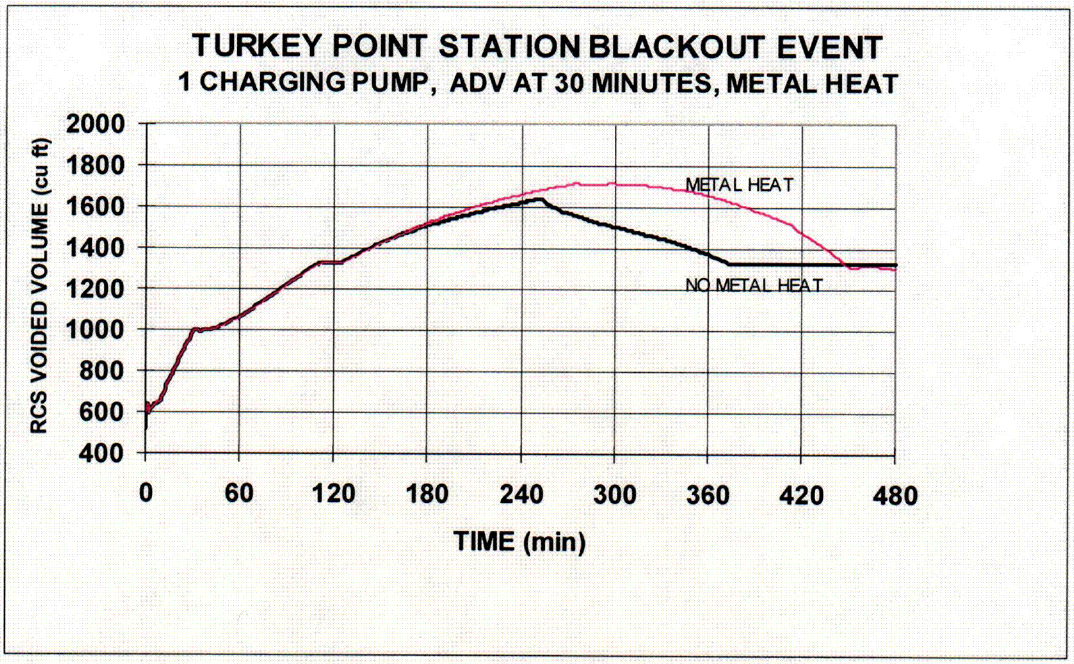

FIGURE 1. RCS VOIDED VOLUME

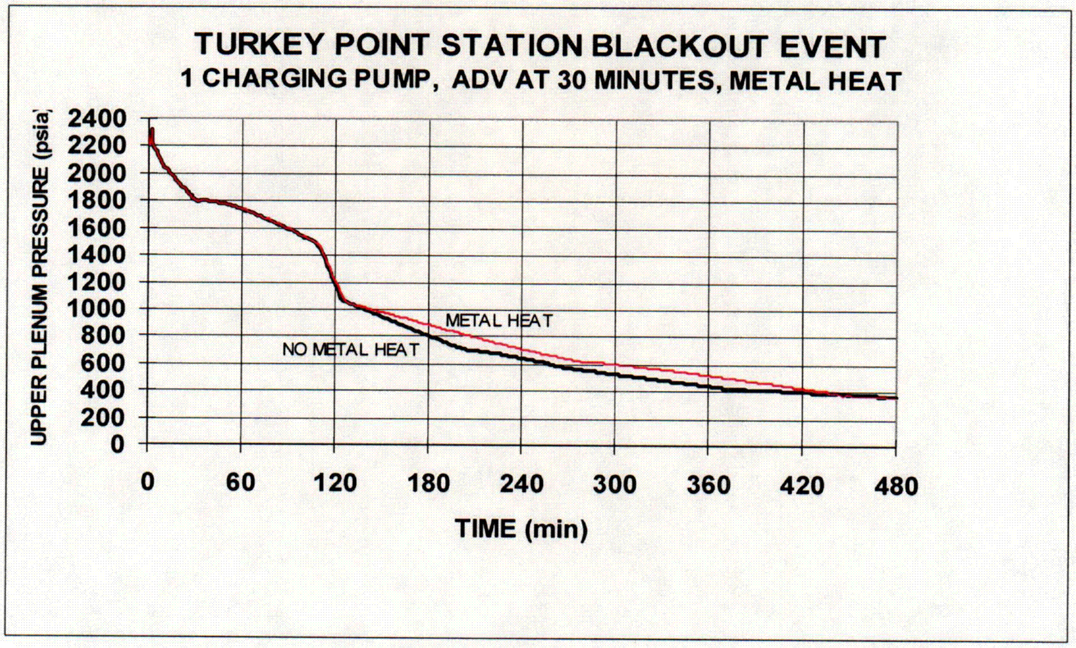

FIGURE 2. VESSEL UPPER PLENUM PRESSURE

C-01

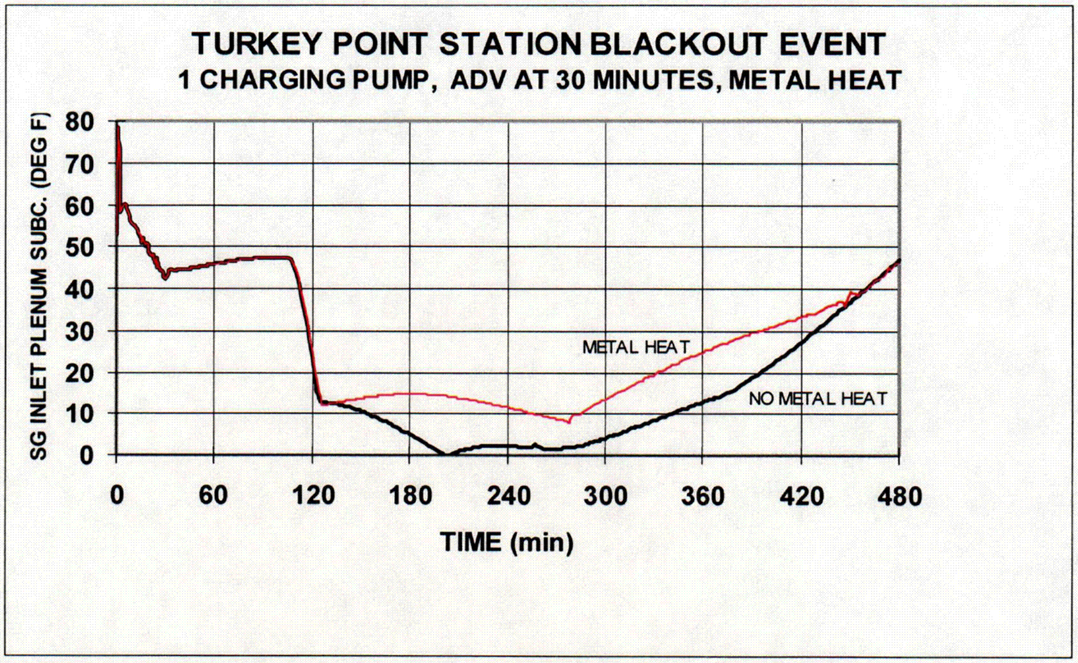

FIGURE 3. STEAM GENERATOR INLET PLENUM SUBCOOLING

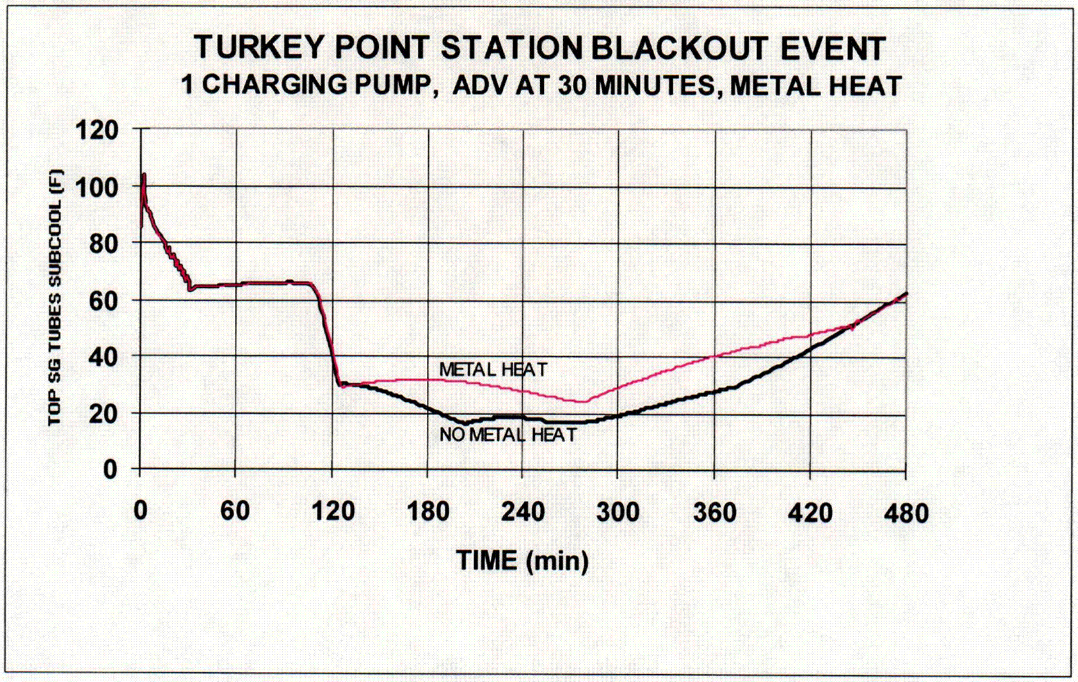

FIGURE 4. TOP OF STEAM GENERATOR TUBES SUBCOOLING

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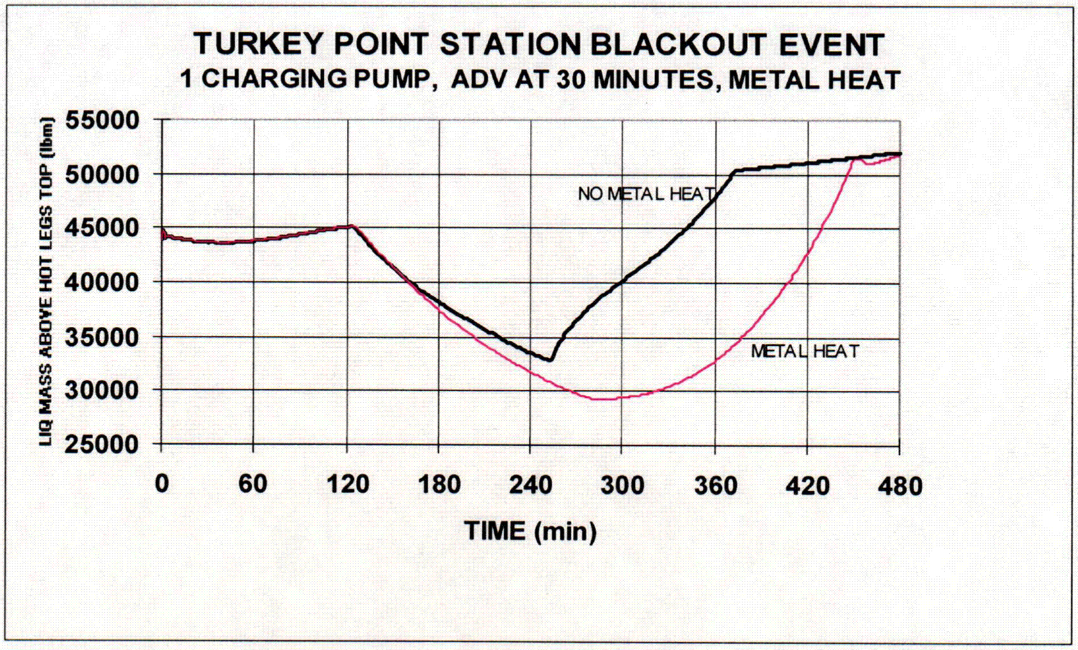

FIGURE 5. LIQUID MASS ABOVE TOP OF HOT LEGS

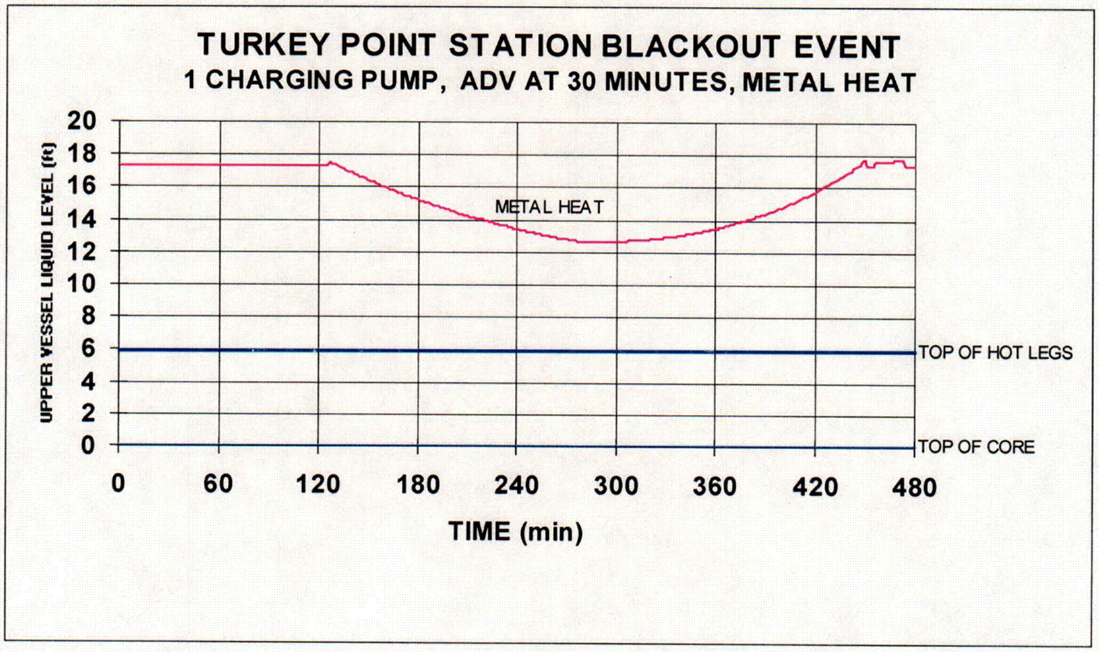

FIGURE 6. UPPER VESSEL LIQUID LEVEL

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