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SUBJECT: Forwards response to 860708 request for addl info re emergency diesel generator load evaluation.

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WOODY,C.O. Florida Power & Light Co.
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MCDONALD,D.G. PWR Project Directorate 2

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	PWR-A PSB	1	1	PWR-A RSB	1	1
INTERNAL:	ADM/LFMB	1	0	ELD/HDS4	1	0
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FPL

FLORIDA POWER & LIGHT COMPANY

JUL 1 6 1986

L-86-295

Office of Nuclear Reactor Regulation
Attention: Mr. D. G. McDonald, Project Manager
PWR Project Directorate #2
Division of PWR Licensing - A
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. McDonald:

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Request for Additional Information
Emergency Diesel Generator Load Evaluation
NRC TAC Nos. 61211 and 61212

Attached is Florida Power & Light Company's response to your July 8, 1986 request for additional information regarding our emergency diesel generator load evaluation for concurrent operation of Turkey Point Units 3 and 4.

If you have any further questions, please call us.

Very truly yours,

C. O. Woody
Group Vice President
Nuclear Energy

COW/TCG/gp

Attachment

cc: Dr. J. Nelson Grace, Region II, USNRC
Harold F. Reis, Esquire

A001
1/1

TCG5/017/1

Following are Florida Power & Light Company responses to the NRC's July 8, 1986 Request for Additional Information (RAI) regarding the Emergency Diesel Generator Load Evaluation. For your convenience, the response to each question immediately follows the duplicated RAI.

RAI-1

In the event that a LOCA coupled with loss of offsite power were to occur at one unit with the other unit in the RHR cooling mode, we understand that RHR cooling at the non accident unit may be interrupted for a period in excess of 30 minutes. Loss of RHR cooling would cause reactor temperature to increase. If the unit were in Hot Shutdown (Mode 4) the temperature might rapidly increase above the RHR cut in temperature so that RHR might not be readily restored.

(a) Provide an evaluation of heatup in the non accident unit with RHR interrupted. Include a description of operator procedures which would be followed to restore decay heat removal. If steam generator cooling would be initiated in the event that the RHR cut in temperature were exceeded, justify that Technical Specifications or other administrative requirements require that the steam generators and AFW are operable during modes 4 and 5 while in RHR cooling.

(b) During modes 4 and 5 operation the reactor system might be brought solid. Provide an evaluation of reactor system pressure during solid operation if RHR cooling were interrupted. Justify that acceptable pressure limits would not be exceeded.

(c) Consider a LOCA/loss of offsite power in one unit with the other unit undergoing refueling. Provide an evaluation of reactor system heatup in the event that RHR cooling were interrupted at the non accident unit. Describe the procedures and operator training that will be followed to ensure core cooling at the non accident unit.

Response to RAI-1 (a), (b) & (c)

The Turkey Point Emergency Diesel Generator (EDG) load management strategy, as discussed in the Safety Evaluation, is designed to maintain short term loading (no more than a few hours) less than 2850 kW and transient load conditions less than 2950 kW. The Safety Evaluation describes the Failure Modes and Effects Analysis performed to evaluate the ability of the EDGs to accommodate various combinations of accident conditions and single failures. Although the FSAR design basis does not address this case, the FMEA evaluated the occurrence of an accident on one unit in combination with the other unit in, or approaching, cold shutdown. To maintain EDG loading less than the short term loading value of 2850 kW, the non-accident unit's operating RHR pump could be secured for 30 minutes following an accident on the other unit. At the 30 minute point, securing either the accident unit RHR or Containment Spray pumps would allow loading of the non-accident unit RHR pump and reestablishment of decay heat removal. This scenario, as shown on Table 9 of the EDG Load Evaluation, places a maximum loading of 2686 kW on the EDG in the 1-30 minute load interval for the worst case condition where one diesel fails to start and the remaining diesel must carry both the accident and non-accident unit loads. (The case where two diesels start is enveloped by the scenario described above).

As described in the Safety Evaluation, if the non-accident unit has been shutdown for a time in excess of 30 hours, it is acceptable for the RHR pump to be secured for a period of 30 minutes. This is based on a Westinghouse evaluation, which evaluated the restart of an RHR pump on the non-accident unit given the following conditions:

I. Cold Shutdown (RCS loops full at Tavg of 200°F) and with either

   A. Steam bubble in the Pressurizer or
   B. Pressurizer solid

II. Cold Shutdown (RCS loops drained to mid-nozzle and prior to RPV heat removal)

Westinghouse concluded that if the RCS is placed in cold shutdown condition at time greater than 29 hours following shutdown, a 30 minute delay in RHR cooling will not exceed any RHR system design limit (including pressure and temperature) on the non-accident unit.

Additionally, the NPSH available for the RHR pump at the end of the 30 minute period versus NPSH requirements was also evaluated for the cold shutdown conditions specified. The results of the calculations of the NPSH requirements demonstrated that as long as saturated water is supplied to the RHR system suction nozzle, the NPSH requirements of the RHR pump are met. The calculations of the RCS conditions at the end of the 30 minute period without RHR cooling for Condition I show that there is no problem in meeting the NPSH requirements for the RHR pump. For Condition II, as long as the water level is above mid-nozzle at the end of the 30 minute period, the NPSH requirements of the RHR systenm are met. The mid-nozzle level is required to minimize the chances of vortex formation. As described in the Safety Evaluation, two charging pumps taking suction from the RWST provide sufficient flow to restore RCS level. The loading of two charging pumps on the operating diesel prior to RHR restart places 202 kW on the diesel, less than the 220 kW represented by the RHR pump.

The Safety Evaluation also addresses the case where the non-accident unit has been shutdown for less than thirty hours. For the first part of the cooldown (at least ten hours with full decay heat levels), the Steam Generators will be used for decay heat removal via either Main Feedwater, Auxiliary Feedwater or the Standby Steam Generator Feedpumps. Should the other operating unit experience an accident during this time period, the non-accident unit may be maintained at hot standby and the concern for loading of the RHR pump on the diesel is moot.

Should the non-accident unit be in the RHR cooling mode and shutdown for less than 30 hours, the RHR pump may be restarted during the first half-hour of the accident. Should this be required, one Control Room Air Conditioner (CRAC) will be secured prior to starting the RHR pump (Note: one of the three CRAC units is required to operate to maintain Control Room environmental and habitability limits). Securing a CRAC unit reduces EDG loadings by 27kW. Consequently, the loads shown on Table 9 of the EDG Load Evaluation are reduced as follows:

Auto-connected	2667 kW
1 - 30 minutes	2879 kW
30 minutes - 1 hour	2584 kW

Based on 95% confidence bounds on the individual pump kW values, the diesel loading is 2879 kW in the 1-30 minute load interval. Although this value is greater than the short term continuous rating of 2850, this loading will only be placed on the diesel until the accident unit's RHR or Containment Spray pump is secured at 30 minutes (less than 30 minutes elapsed time). Since this load value is conservatively based on 95% confidence bounds on the individual pump kWs, the expected EDG loadings for the 1-30 minute load interval will be over 75 kW less than shown above. It should be noted that the probability of an accident occurring during this time period is acceptably low. As stated in the Safety Evaluation, the probability of this combination of events occurring is about 6.8 x 10^{-3} less than the design basis event, assuming one refueling per unit per year.

The operator actions cited above have already been identified in the Safety Evaluation and will be incorporated into the plant procedures prior to dual unit operation (including operator training). In order to expedite the loading of the non-accident unit RHR pump (for the less than 30 hours shutdown case), the operator will be instructed to deenergize CRAC Unit "C" prior to placing a unit on RHR in Mode 4. The CRAC will be secured locally at the motor control center. This will ensure that no more than one CRAC unit will load onto the available EDG following a Loss of Offsite Power.

RAI-2

Provide the plot of containment atmosphere pressure that corresponds with the plot of containment atmosphere temperature provided as Figure 3 in the June 12, 1986, submittal.

Response to RAI-2

The requested pressure versus time curve is attached as Figure RAI-2.

RAI-3

Describe the methodology which was used to calculate the containment atmosphere temperature and pressure transient response to a LOCA, with the containment spray terminated 30 minutes after onset of the accident. Include a description of the pipe break size and location, and the name and description of any computer codes used.

Response to RAI-3

The analytical approach utilized a calculated parametric correction to the containment pressure curves found in FSAR Section 14.3.4 (i.e., Figure 14.3.4-8). The calculation was tabulated by Lotus 123. For each interval addressed in the analysis, the heat capacity of the affected component(s) is calculated based on the capacity used in the original analysis. In addition, the impact on capacity due to higher containment temperature is also assessed using original capacity criteria. These net changes, in BTU, are then converted to pressure gain (or loss)

CONTAINMENT PRESSURE ANALYSIS

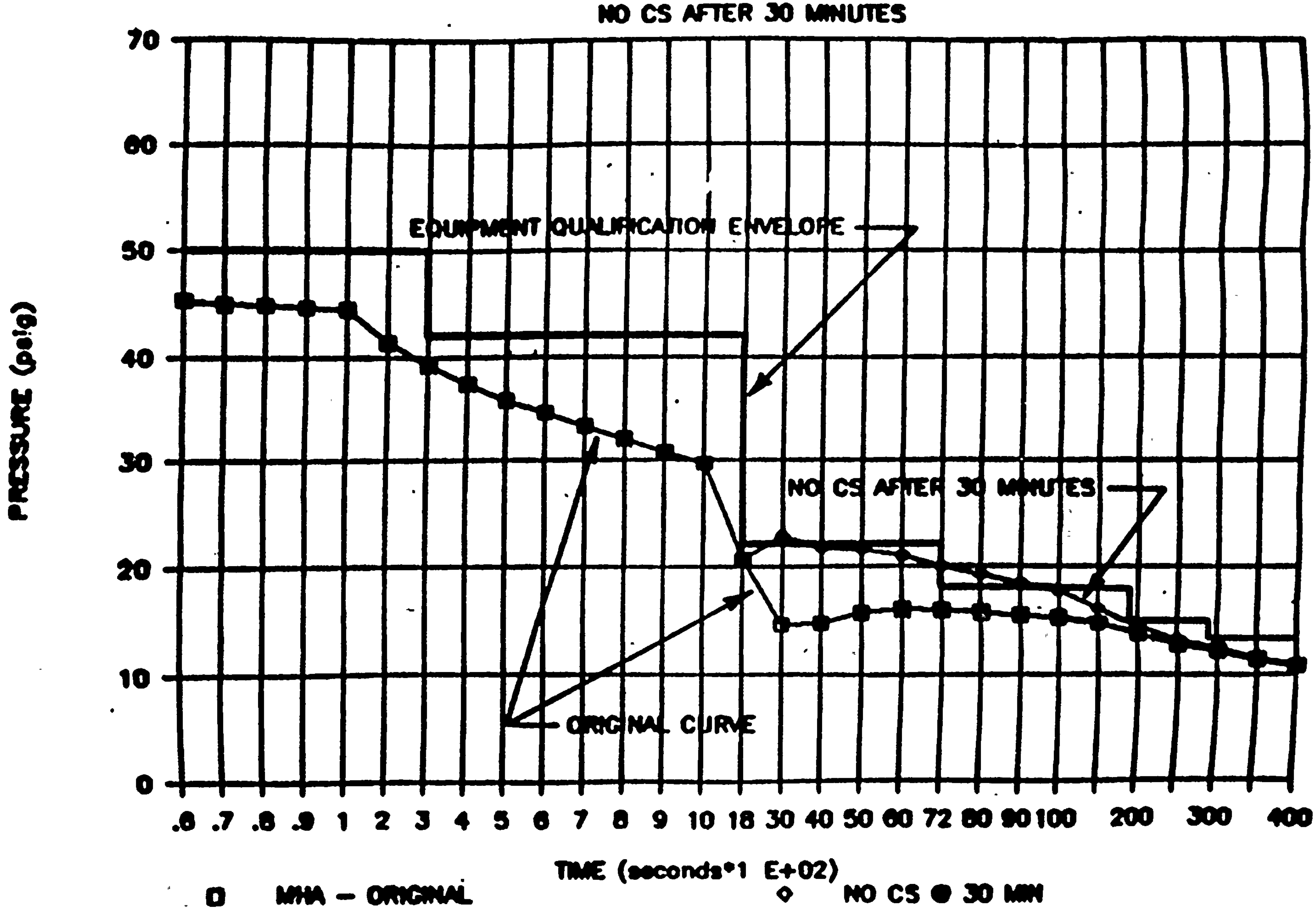

FIGURE RAI-2

for the subject interval and the original curve corrected per this factor. Each subsequent interval builds upon those preceding it to assess the total correction factor. The entire analysis is based upon additional transferred or untransferred heat load in the containment.

Containment pressure in psig, as shown on Figure RAI-2, represents the total of the air and steam partial pressures in the steam/air mixture. Temperature of the mixture is the saturation temperature at the steam partial pressure and is provided as Figure 3 of the EDG Load Evaluation.

RAI-4

Confirm in writing that a single failure in the 4A battery does not result in the loss of 4A 4160V Bus. Explain the four batteries systems and how they provided redundancy to the Class 1E buses.

Response to RAI-4

A failure of the 4A battery will result in loss of the single 4A 4160V bus due to failure of the 4A emergency load sequencer. A brief description of the load sequencing operation follows:

The loading of the 4 kV bus onto the EDGs is controlled by bus clearing relays and emergency load sequencers. Each bus has an associated bus clearing scheme and emergency load sequencer independent of the others. Upon loss of bus voltage, the emergency load sequencer acts to open all breakers on the bus. Once the bus clearing relays sense all breakers are open on the bus, the emergency load sequencer closes the EDG breaker to energize the bus. The sequencer then closes the necessary breakers in order to load the EDG with the required emergency equipment.

Each emergency load sequencer and associated bus clearing relay scheme is powered independently from one of the four station batteries (i.e., Battery 3A powers Sequencer 3A, Battery 3B powers Sequencer 3B, Battery 4A powers Sequencer 4A, and Battery 4B powers Sequencer 4B). Each 4 kV bus is powered from two batteries via an automatic transfer scheme such that upon loss of normal DC power, the alternate battery will supply control power to the bus. This is provided to assure control power is available to trip breakers.

Therefore, although the 4 kV busses are not directly affected by single failure of a battery, the ability to automatically clear and load the 4 kV bus is lost due to loss of power to the emergency load sequencer. This results in the associated 4 kV bus remaining de-energized until manual action can be taken to clear the bus and close the EDG breaker. The redundant 4 kV bus for that unit would not be affected and the redundant safety related equipment would be available.

RAI-5

Confirm that a single failure in 4A load sequences results in a failure of 4A 4160V Bus. Explain the load sequence and the loading of the 4160V Bus.

Response to RAI-5

As stated in the response to RAI-4, the failure of load sequencer 4A (or power to it) in conjunction with a LOOP will result in de-energization of the 4A 4kV bus. However, the redundant 4B kV bus will remain energized to provide power to required safety-related loads and manual action can be taken to re-energize the 4A 4 kV bus. Load sequencing and bus loading is explained in the response to RAI-4.

RAI-6

Provide information on the EDG "B" auxiliaries powered from MCC 4A including the self-contained cooling of DG(s).

Response to RAI-6

Loss of MCC-4A results in the deenergization of the below listed EDG B auxiliaries:

EDG B Starting Air System Compressors
EDG B Fuel Oil Transfer Pump
EDG B Auxiliary Equipment (i.e., lube oil immersion heaters, fuel oil solenoid valve (SV-3522) and the soakback lube oil pump).

A description of these loads follows:

EDG Starting Air System Compressors

The EDG Starting Air System provides a ready supply of air for a set of air motors which start the diesel engine. The air for each EDG is supplied by an air compressor and is stored in four air receivers (A, B, C and D). The normal valve alignment utilizes air receivers C and D to start the air motors. The outlet valve of air receivers A and B is locked-closed. This is done to maintain a reserve supply. The air from two receivers is sufficient for a minimum of five starts.

The normal power supply for air compressor A is MCC 3A; for air compressor B, the normal power supply is MCC 4A. However, should one EDG fail to start, the buses swing to those powered by the operating EDG. There is a cross-tie on the discharge of each air compressor to enable the compressor of one EDG Starting Air System to replenish the air receivers of the other EDG Starting Air System. Two locked-closed valves are provided in the cross-tie piping.
Under the current design, if one EDG failed to start, both air compressors would automatically load onto the operating EDG. This arrangement results in an automatic load of 10 kW on the operating EDG (i.e., 5 kW per Starting Air System compressor). Thus, the depleted air receivers for each EDG would be resupplied with air. As previously stated, air receivers C and D are aligned to provide a sufficient amount of air for the initial five start attempts. In addition, the operators could utilize air receivers A and B to start a failed EDG, since these receivers provided an additional five start capability without starting the air compressors. Therefore, the air compressors are not required for an emergency restart attempt.

Diesel Generator Fuel Oil Transfer Pump

The Diesel Generator Fuel Oil Transfer Pump transfers fuel oil from the 64,000 gallon Diesel Oil Storage Tank to the 4,000 gallon day tank. Failure to repower this pump will lead to an eventual shutdown of EDG B after the fuel oil in the day tank and the 275 gallon skid tank is expended. (Note that the engine-mounted skid tank contains sufficient fuel to power the EDG in excess of 50 minutes and is filled via gravity feed from the day tank). Once power is restored to these pumps, a normal transfer of fuel will be established. Plant Change/Modification (PC/M) 86-101 is being developed to power this pump from a load center and 4 kV bus which is supplied by EDG B.

EDG B Auxiliary Equipment

This load consists of the EDG lube oil immersion heaters, fuel oil solenoid valve SV-3522, and the soakback lube oil pump. These are loads that keep the engine lube oil system warm, provide circulation throughout the engine and gravity feed fuel oil between the day tank and the skid tank. PC/M 86-101 is being developed to power these loads from a load center and 4 kV bus supplied by EDG B.

It should be noted that the EDGs are cooled by a shaft driven fan assembly, engine drive water pump and radiator which does not depend upon the availability of electric power. The EDG B vent fan, which was powered from MCC 4A, is being modified to be powered from MCC 4B via Plant Change/Modification (PC/M) 86-94. MCC 4B is powered from a load center and 4 kV bus which is supplied by EDG B.

RAI-7

Describe any operator actions which are implemented to restore 4160V bus 4A after positive indication that the 4A load sequencer has failed. This question relates to restoration of power to MCC 4A to supply EDG "B" auxiliaries.

Response to RAI-7

As stated in the EDG load evaluation, the effects of the EDG "B" auxiliaries being powered from MCC 4A were being evaluated independently of the EDG load evaluation and appropriate design changes would be developed as required. As described in the response to RAI-6, it has been determined that the EDG B auxiliaries required for operation of the EDG B will be relocated to MCC 4B (powered by EDG B) or their unavailability can be accommodated in the short-term.

However, in answer to the question concerning operator action required to restore power to MCC 4A subsequent to a 4A load sequencer failure, action can be taken as follows:

(a) MCC 4A can be manually transferred to its alternate source of power by local manual operation of the transfer relay.

(b) The 4A 4160 V bus can be manually aligned and powered from EDG A thereby re-energizing MCC 4A. This can be accomplished by manually opening all 4A 4160 V bus breakers, then closing the 4A EDG A breaker and then closing the 4A 4160 V breaker to re-energize MCC 4A. All of these actions can be implemented by the operators within the Control Room.

RAI-8

What provisions and/or design modifications are being implemented to preclude auto-start of non-safety loads after SI reset.

Response to RAI-8

As stated in the EDG load evaluation, upon SIS reset, the Instrument Air Compressor (IAC) and certain turbine-related loads would be re-enabled and would, therefore, load on the EDGs. This design is being modified such that these loads will be blocked from loading on the EDGs subsequent to a LOOP and thereby be unaffected by SIS reset.

RAI-9

Table 2 on page 15 of the June 12, 1986, letter specifies the following manufacturer ratings for the EMD-GM Diesel Generator: 2567 kW for 8,000 hrs/yr; 2821 kW for 2,000 hrs/yr; 2930 kW for 200 hrs/yr; 2,966 kW for 4 hrs/yr; and 3,020 kW for ½ hr/yr. A plot of the above kW verses allowable continuous operating hours/year results in a fairly smooth curve. The rating of 2,950 kW for 168 hrs/yr does not fall on the curve or within reasonable distance of the curve (10% tolerance). Justify the 2,950 kW for 168 hrs/yr and/or provide manufacturer concurrence for that rating.

Response to RAI-9

The diesel generators installed at Turkey Point were manufactured by the Electro-Motive Division of General Motors Corporation (GM-EMD) and supplied to FPL by the A. G. Schoonmaker Company, Inc. The engine ratings established by Schoonmaker are as follows:

Basic Continuous Rating	2500 kW
Basic Overload Rating	2750 kW
2000 Hr Peaking Rating	2850 kW
168 Hr Emergency Rating	2950 kW
1/2 Hr Exceptional Rating	3050 kW

It should be noted that the Schoonmaker ratings have been reviewed in the past with Schoonmaker and more recently with GM-EMD and the Morrison-Knudsen Company, Inc. The ratings provided on Table 2 on Page 15 of the June 12, 1986 letter are based on EMD engine horsepower ratings, engine cooling fan power requirements, and generator efficiency. The kW ratings provided by Schoonmaker (i.e., the FSAR column of Table 2 of the EDG Load Evaluation) are either less than the calculated kW values or are very close (i.e., within approximately 1%) to those calculated using EMD engine horsepower ratings. FPL considers the ratings essentially identical, thus, in the absence of specific engine data at 168 hours, 2950 kW is considered to be a valid rating. It should be noted that even if it was conservatively assumed that the 168 hour rating was identical to the 200 hour rating, the variance would be no more than 0.7%.

RAI-10

The corrective action on page 4 of the June 12, 1986, letter states that the computer room/cable spreading room AC will not be loaded on to the D/G for one (1) hour. The reason is that "the function will not be required for one hour." Insufficient information is provided in the submittal for the staff to concur with this conclusion. Provide an analysis which shows that with the outside and room air temperatures at their maximum (design conditions) that the room air temperature will not exceed 90°F during that one hour time period.

Response to RAI-10

A series of plant tests and analyses were conducted to determine temperature rise in the Computer Room and the Cable Spreading Room. This data was then used to determine the allowable time span for loading the Computer Room/Cable Spreading Room Air Conditioning (CR/CSR AC) to the EDG as well as the maximum initial temperature for these rooms.

The testing consisted of securing all air conditioning to the Computer Room and the Cable Spreading Room for over one (1) hour. Temperatures were plotted at various locations in each room (including inside cabinets). Outside temperature was also recorded. Additional testing was conducted to determine the actual heat load in the Computer Room by determining the load on each chiller serving the rooms. A calculation was then performed which adjusted the output for the design conditions for outdoor temperature. The results were that, under design conditions, the Computer Room temperature will not exceed 90°F if the chillers are secured for one hour provided that the initial Computer Room temperature does not exceed 77°F during normal operation.

(It should be noted that the 77°F normal temperature limitation represents information unavailable at the time the EDG Load Evaluation was prepared. The 67°F cited in the EDG Load Evaluation represented the then current analysis and reflected the temperature normally maintained in the Computer Room. As a result of the latest analysis, the Computer Room temperature will be permitted to exceed 67°F during normal operation but plant procedure will require that the Computer Room temperature not exceed 77°F.)

RAI-11

On page 11 of the June 12, 1986 letter, the loadings on the D/G's assuming a MCC tie breaker failure is discussed. The loadings range from 2,805 kW to 2,901 kW depending on which MCC tie breaker fails. The conclusion is that "this scenario approaches current NRC requirements embodied in the STS." The current STS requirements limit the D/G load to the 2,000 hour rating which in this case is 2,850 kW. The maximum load as a result of a MCC tie breaker failure exceeds this value by more than 10%. Justify your conclusion for this scenario.

Response to RAI-11

The statements in question were intended to demonstrate that the worst-case (i.e., MCC D Tie Breaker fails to open) auto-connected load of 2975 kW will, in all likelihood, not be experencied. The pump kW correction factor reduces the load by 74 kW to 2901 kW, while an additional 96 kW reduction could be experienced if certain cyclic loads (i.e. Battery Room AC (22 kW), two Control Room AC units (54 kW) and boric acid heat tracing (20 kW)) were not energized at the time of the transient. The simultaneous, auto-connected loading of all these components is highly unlikely.

As stated, the Standard Technical Specification (i.e., 4.8.1.1.2(f)(8)) require auto-connected loads not to exceed the 2000 hour rating, which for Turkey Point in 2850 kW. Consequently, the worst-case loading could only exceed the STS limit by 51 kW (or approximately 2%). However, the anticipated load would be between 2901 and 2805 kW (i.e., approaching 2850 kW).