FLORIDA POWER & LIGHT COMPANY

TURKEY POINT UNITS 3 AND 4

EMERGENCY POWER SYSTEM ENHANCEMENT REPORT

SUPPLEMENT NO. 2
SAFETY ANALYSIS
REVISION 0

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1.0 INTRODUCTION

Florida Power and Light Company (FPL) is installing two new emergency diesel generators (EDGs) and associated electrical and mechanical equipment at the Turkey Point Nuclear site, as documented in the Emergency Power System (EPS) Enhancement Report enclosed with FPL letter L-88-269 dated June 23, 1988. Supplement 1 to the EPS Enhancement Report was submitted via FPL letter L-89-124 dated April 3, 1989 and provided information regarding the testing to be performed on the various components and systems during turnover and startup, during preoperational testing, and prior to returning the enhanced EPS to service.

This Supplement 2 to the EPS Enhancement Report provides FPL's Safety Analysis for the enhanced EPS configuration. As discussed herein, the enhanced EPS configuration provides an improved response to the existing FSAR limiting Design Basis Accident (DBA) by providing enhanced equipment availability on the accident unit with increased EDG loading margin. From an EDG loading standpoint, the existing FSAR limiting DBA is defined as both Units at 100% power, a LOOP on both Units, a LOCA on one Unit, and a single active failure of an EDG.

In the existing design, one EDG must provide the capacity to mitigate the LOOP/LOCA in one Unit and attain safe (hot) shutdown in the other Unit. The enhanced design alleviates this dual-Unit reliance on one EDG in the following ways:

1. As indicated in Reportable Event 85-42 (Revision 1), documented in FPL's letter to the NRC L-86-256, a potential existed prior to November 1985 for exceeding the limits for EDG loading during the DBA. The resolution of this issue provides a transient, and short-term continuous, load limit philosophy of 2950/2850 kW, loaded on one existing EDG for the Design Basis Accident described above. Operator actions and load management are required for the existing design to ensure that the EDG is not overloaded. The enhanced configuration improves the plant response during this DBA since:

    a) The auto-connect loads on each Unit's EDG(s) for a LOOP, or LOOP and LOCA, are within the continuous rating of each EDG (2500 kW for the existing EDGs, 2874 kW for the new EDGs); and

    b) The load limit philosophy for the new design stays below the continuous rating of each EDG during a DBA even with auto-connect and concurrent manual loads considered.

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2. The enhanced EPS configuration ensures that a minimum of three EDGs are operable in response to the DBA, versus only one EDG in the existing configuration. Since in the enhanced design each EDG powers one 4.16 kV bus, and its associated equipment, three 4.16 kV buses and equipment are available for the DBA (as discussed below), versus only two 4.16 kV buses and the minimum ESF in the existing design (due to EDG loading limits). The enhanced EPS thus provides additional equipment to either mitigate the accident or to shut down the non-accident Unit (depending on which Unit the failure of an EDG is postulated) as follows:

   a) If the EDG failure is on the non-accident Unit, the operators have more flexibility to manage the accident using the two EDGs and associated equipment available on the accident Unit, plus an additional High-Head Safety Injection (HHSI) Pump available from the non-accident Unit's OPERABLE EDG (assuming that an OPERABLE HHSI pump was aligned to the remaining EDG). The operators on the accident Unit can utilize at least two HHSI pumps, both CS pumps, two RHR pumps, two CCW pumps, two ICW pumps, all three ECCs, all three ECFs, all three CRAC units, plus plant investment loads (e.g., the turbine-generator loads) as desired. In this scenario, none of the EDGs assumed available exceed their continuous rating. This allows more ESF equipment available than was assumed in the FSAR.

   b) If the EDG failure is on the accident Unit, the operators have more than the minimum equipment available than was assumed in the FSAR, plus an additional HHSI Pump. That is, the operators on the accident Unit can utilize at least two HHSI pumps, two ECCs, two ECFs, all three CRACs, plus plant investment loads. The FSAR DBA analysis remains the bounding accident due to the minimum equipment assumed available.

This Safety Analysis was developed in accordance with the requirements of the NRC's Standard Review Plan (NUREG-0800, Section 8.3.1), which states that for shared electrical configurations, sufficient analyses shall be provided which substantiate the adequacy of the design to withstand the consequences of electrical faults and failures in one Unit with respect to the other Unit(s). Therefore in accordance with Standard Review Plan requirements, this Safety Analysis demonstrates the following:

1. The enhanced EPS configuration improves overall plant safety by essentially doubling the available capacity of Turkey Point on-site EPS. Under design basis conditions (which include single

failure considerations), EDG loading is maintained within each EDG's continuous rating.

2. Required Engineered Safety Feature loads and desired plant investment loads are accommodated with the enhanced EPS configuration, while retaining the shared systems as originally designed.

In addition to the above, this Safety Analysis provides a discussion of the quantitative probabilistic evaluations performed for both the existing and the enhanced EPS 4.16 kV bus configurations. These evaluations (considering the AC power recovery capability of both the existing system capability and the inter-Unit crosstie provided by the enhanced design, and considering a conservative probability of operator error for either design), show that the 4.16 kV bus state failure frequency is reduced with the enhanced design. Hence overall plant safety as measured by the availability of emergency power to the plant's safety buses is improved under the enhanced EPS configuration.

Evaluations of the enhanced EPS will verify that the current design basis accident analyses as presented in the FSAR are not adversely impacted and remain valid under the enhanced EPS configuration.

This Safety Analysis is divided into eight sections. Following this introduction, Section 2.0 presents an overview of the enhanced EPS design and identifies any significant changes which have occurred since issuance of the June 23, 1988 EPS Enhancement Report. Section 3.0 provides analyses to show that the availability of power to required Engineered Safety Feature loads and desired plant investment loads is assured under the enhanced EPS configuration without exceeding the continuous rating of any EDG. Section 4.0 describes the enhanced sequencer design. Section 5.0 provides the results of Failure Modes and Effects Analyses (FMEAs) for postulated DBA single failures to show that under design basis conditions, the enhanced EPS will accomplish its required safety function. Section 6.0 provides the results of a quantitative probabilistic evaluation which compares the enhanced EPS to the existing EPS with respect to their ability to successfully provide power to the 4.16 kV buses. Section 7.0 then provides a summary and conclusion. References used in the Safety Analyses are listed in Section 8.0.

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2.0 DESCRIPTION OF ENHANCED EMERGENCY POWER SYSTEM

2.1 OVERVIEW

The enhanced EPS includes the installation of two new EDGs with all support systems (fuel oil, starting air, ventilation, etc.), a new emergency diesel generator building, diesel oil storage tanks and transfer pumps in an associated building, new 4.16 kV switchgears, new 480V load centers, new 480V motor control centers, new 125V DC transfer/distribution panels, new sequencers, breakers, battery chargers, etc., plus lighting distribution panels, transformers, cabling and numerous components necessary for modifying the existing equipment.

The design of the enhanced EPS also meets the Station Blackout Rule, 10CFR50.63, by adding an intertie between each Unit's new "D" (3D and 4D) 4.16 kV switchgear. This feature provides an alternate AC power supply to the blackout Unit through the use of an operable EDG on the non-blackout unit. This Turkey Point Plant conformance to 10CFR50.63 is the subject of a separate submittal to NRC. (Refer to FPL letter L-89-144, dated April 17, 1989).

See Figures 1 and 2 for a one-line electrical diagram of the AC and DC systems, respectively. Note these figures are essentially the same as those included in the June 1988 EPS Enhancement Report, but have been redrawn for clarity and to reflect several changes pertaining to the proposed AC and DC system modifications.

The new seismic Category I diesel building is located northeast of the Unit 3 containment. The building is two stories high with the diesel generators located on the lower elevation and the auxiliaries such as air start skids, control panels, motor control centers, distribution panels, etc., located on the upper level. Also located on the upper level are the two new 4.16 kV swing buses, one for each Unit.

As part of the EPS Enhancement Project, existing EDG #3 (EDG "A"), presently supplying power to the A system of both Units, is reassigned to the Unit 3A power system, and relabeled EDG 3A. Similarly, existing EDG #4 (EDG "B") is relabeled EDG 3B and assigned to supply power to the Unit 3B power system. Thus, the two existing EDGs are aligned as the emergency AC power supplies for Unit 3 and certain common or shared systems.

The two new EDGs are aligned as the emergency AC power supplies for Unit 4 and certain common or shared systems. EDG 4A supplies the Unit 4A power system and EDG 4B supplies the Unit 4B power system.

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The four existing sequencers are replaced with four new solid-state sequencers.

The new swing 4.16 kV Switchgear 3D supplies power to the Intake Cooling Water (ICW) Pump 3C, Component Cooling Water (CCW) Pump 3C and the intertie breaker for station blackout; likewise, the new swing Switchgear 4D supplies power to ICW Pump 4C, CCW Pump 4C and the intertie breaker for station blackout. Refer to Figure 1. During normal operation, the swing 4.16 kV switchgear power supply breakers can be manually aligned to either the A or B switchgear.

Each Unit has a new 480V load center swing bus both located in the Auxiliary Building. The new swing 480V Load Center 3H supplies power to MCC 3D and to Charging Pump (CP) 3C; likewise, the new swing Load Center 4H supplies power to MCC 4D and to Charging Pump 4C. Refer to Figure 1. Each swing load center can be aligned to Train A or Train B of its associated Unit. However, during power operation, the alignment of these swing load centers will normally be to the B Train of each Unit. The EDG loading is acceptable with either Train alignment. For each 480V swing load center, if the bus to which it is aligned loses power, automatic circuit breaker operation connects the bus to the alternate power source.

A new Motor Control Center (MCC) 3K is added to supply EDG 3B auxiliaries (presently supplied from Unit 4 MCC 4B). Existing MCC D, (which presently supplies power to Unit 3 and 4 third service loads and plant common loads), is relabeled MCC 3D, and supplies power to Unit 3 loads and existing plant common loads. New MCC 4D is added to supply vital loads associated with Unit 4 that are presently fed from MCC D. New MCCs 4J and 4K are added to power the auxiliary loads for the new EDGs. Refer to Figure 1. The existing EDG #3 (renamed EDG 3A) auxiliaries are powered from MCC 3A and are not affected.

The existing MCCs 3A and 4A have Telemand transfer systems which presently allow them to be powered from either existing Train A or Train B. These existing Telemand operators will be removed as the safety loads connected to these MCCs have redundant counterparts. With the enhanced design, MCC 3A and 4A are powered from the Train A of each respective Unit and the redundant safety loads are powered from Train B and/or the new swing LCs/MCCs.

The existing MCC D provides power to common, shared and third service loads. This MCC has a Telemand Transfer System which allows it to be powered from either Unit 3 (Train B) or Unit 4 (Train A). This existing Telemand operator will be removed. The enhanced design thus eliminates the Telemand logic and replaces it with a power-seeking transfer design at the (new) Load Center H level. Loads which previously could be powered from either Unit 3 or Unit 4 are relocated as shown on Figure 1, and now can be powered from either the "A" or "B" Train of each Unit including the swing loads.

The six existing battery chargers are being replaced with six new battery chargers, and are being relabeled as indicated on Figures 1 and 2. Two additional battery chargers, 3A2 and 3B2, are added as new equipment, and the two existing spare battery chargers 3S and 4S are being realigned and relabeled, whereby 3S becomes 4B2 and 4S becomes 4A2. These modifications provide the capability of two independently powered battery chargers aligned to each DC bus, as shown in Figures 1 and 2. The battery chargers 3A2 and 3B2 are powered from the new MCC 4D, and the relabeled battery chargers 4A2 and 4B2 are powered from MCC 3D (relabeled). With two battery chargers able to be aligned to each DC bus, a single failure of a battery charger or its MCC still assures that the redundant battery charger can be made available for its associated DC bus. Refer to Figures 1 and 2; also see the discussions in Section 5.0, Failure Modes and Effects Analyses (FMEA).

As a result of these additions and modifications, Turkey Point Units 3 and 4 have a safer, more reliable system with the capability of having one train out of service without significantly affecting the other Unit. The use of swing bus arrangements, to power the third ESF loads of the two out of three ESF equipment, provides the capability to power those loads from either Train on a Unit. Components are more available for maintenance since the new plant alignments allow items to be taken out of service with lessened Technical Specification impact on the other Unit. The increase in emergency generation capacity and the addition of switchgears, motor control centers and distribution panels allows future load growth when required and the ability to add plant investment protection loads upon completion of the modifications.

2.2 ELECTRICAL/INSTRUMENTATION AND CONTROL MODIFICATIONS

The June 1988 EPS Enhancement Report (L-88-269), describes the electrical and instrumentation/controls modifications being performed under the EPS Enhancement Project. Please refer to the Emergency Power System Enhancement Report (EPSER) for information relating to the modifications being made.

In addition to the June 1988 EPSER, additional information is provided (under separate cover) by the FPL responses to NRC's RAIs (see 2.4 below), by Supplement 1: Testing, and by this Supplement 2: Safety Analysis.

Since issuance of the above documents, two additional changes have been made with respect to the planned DC system modifications. The changes have been incorporated into Figure 2 and include the following:

1. The two new battery chargers being installed under the EPS Enhancement Project (labeled 3A2 and 3B2) are assigned to DC buses 3D01 and 3D23 respectively. The two existing swing chargers (relabeled 4A2 and 4B2) are assigned to DC buses 4D23 and 4D01 respectively.

2. The tie-line between DC buses 3D23 and 4D23 and the existing tie-line between DC buses 3D01 and 4D01 will be used with a new safety-related spare battery. With a safety-related spare battery, it will be possible to test each of the existing station batteries while its affected DC bus is aligned to the spare battery.

2.3 MECHANICAL AND STRUCTURAL ADDITIONS

Details of the mechanical and structural additions are provided in the June 1988 EPSER, and in the FPL responses to NRC's RAIs (see 2.4 below). Please refer to that information as necessary.

In addition, since issuance of the above documents, the following change has occurred to the design of the new EDG building:

1. The June 1988 EPS Enhancement Report, Section 5.1, states that missile protection for structures is provided by reinforced concrete walls, heavy steel grating, and exterior steel missile doors.. However, in lieu of the missile doors, the new EDG building configuration has been revised to include the installation of reinforced concrete labyrinths which serve to protect exterior doors from impact by postulated missiles. The use of such concrete labyrinths provides missile protection capability equivalent to that achieved through the use of the previously specified steel doors.

2.4 RESPONSES TO NRC REQUEST FOR ADDITIONAL INFORMATION

Following submittal of the June 1988 EPSER, the April 1989 Testing Submittal (Supplement 1) and additional letter information from FPL, in January 1989 and in March 1990 the NRC transmitted Requests for Additional Information (RAIs) regarding the EPSER, pre-op testing, and FPL's position concerning waiver of the 300-start and load qualification testing of the new EDGs.

FPL's responses to the RAIs were forwarded under separate cover and provide additional information related to the June 1988 EPSER, the Supplement 1, and to this Supplement 2. Please refer to all of the above documents, in addition to this Supplement 2, for further information regarding the enhanced EPS.

3.0 EDG LOADING UNDER DESIGN BASIS ACCIDENT CONDITIONS

3.1 EXISTING EPS

For the existing emergency power system, the most limiting Design Basis Accident (DBA) with respect to EDG loading is a large break LOCA (LBLOCA), coincident with a loss of offsite power (LOOP) and a single failure of one of the two EDGs to start. The highest EDG loads were shown to occur in the initial short-term phases of the accident, i.e., in the first 0-30 minutes. Both units are assumed initially at full power in a normal operating condition (i.e., no equipment is out of service or undergoing test).

Specifically, the most limiting DBA for the existing EPS is a LBLOCA on Unit 3 with failure of the #3 (or "A") EDG to start. This scenario imposes the maximum loads on the remaining EDG, which must provide power to the accident Unit loads to mitigate the accident (using the maximum amount of Engineered Safety Features available), and must also provide power to the non-accident Unit loads to achieve Hot Standby conditions.

It should be noted that the ability of the existing EPS to meet this design basis was the subject of an April 2, 1986 NRC Confirmation of Action Letter (CAL) which limited total loads on the EDGs to no more than 2845 kW per EDG. FPL submitted a Safety Evaluation for dual-Unit operation via letter L-86-243 dated June 12, 1986 and responded to NRC's July 8 Request for Additional Information (RAI) via letter L-86-295 dated July 16. As a result, the NRC issued a Safety Evaluation (SE) on December 15, 1986. The NRC concluded that the loads for the various conditions were in conformance with Regulatory Guide 1.9, Position C.2 and that the actions identified in the CAL were completed. A transient/short-term continuous load limit philosophy of 2950/2850 kW was found acceptable in the NRC SE.

3.2 ENHANCED EPS WITH NORMAL (TRAIN B) ALIGNMENT

3.2.1 LOCA on Unit 3

The enhanced EPS design, with four EDGs each powering a 4.16 kV bus, ensures that for the same design basis accident described above (i.e., LOOP on both Units, LOCA on one Unit, and failure of one EDG) there are 3 out of 4 EDGs available, with one 4.16 kV bus powered on one Unit, and two 4.16 kV buses powered on the other Unit. Both Units are assumed initially at full power in a normal operating condition (i.e., no equipment is out of service or undergoing test). Only one 4.16 kV bus on each Unit is required for successful mitigation of an accident on the Unit suffering the LOOP and LOCA, and for successful safe (hot) shutdown for the Unit undergoing a LOOP.

This Subsection and the next discuss various accident scenarios and illustrate that accident mitigation and safe shutdown are accomplished without exceeding any one EDG's continuous rating. Since provision of a swing Load Center "H" (i.e., Load Centers 3H and 4H) on each Unit allows alignment of the vital MCCs "D" (i.e., MCCs 3D and 4D) to either Train A or Train B of each Unit, this

Subsection discusses the accident scenarios (dual Unit LOOP, single Unit LOCA) with the load centers in their "normal" alignment to the B Train. Subsection 3.3 then discusses the LOOP/LOCA accident scenarios for the case where the swing load centers are assumed to be aligned to the A Train of each Unit. Demonstration that the required safe shutdown and accident mitigation loads are always available in the short-term of the accident (i.e., the first hour) is provided in this and the next Subsection and summarized in Subsection 3.4. Subsection 3.5 demonstrates that the required safe shutdown and accident mitigation loads are available in the long-term (i.e. about eight hours) after the accident. Subsection 3.6 provides overall conclusions.

As indicated in the previous Subsection, the most limiting DBA for the existing EPS is a LBLOCA on Unit 3 with failure of the existing "A" EDG to start. Table 3-1 shows the enhanced EPS EDG short-term loads for all four EDGs, for a LOCA on Unit 3. (No single failure of an EDG is shown in Table 3-1, but is discussed later). Table 3-1 identifies the continuous load rating for the existing and the new EDGs, and illustrates the additional EDG capacity which is now provided by the enhanced EPS. Some discussion of the information provided in Table 3-1, and the other Tables in this Section 3.0, is required:

The existing component kW loads were reanalyzed in 1985-1986 during the evaluation of the potential EDG loading concern, and these kW values are reflected in the updated FSAR (Reference 1). To ensure that there is no EDG loading concern with the enhanced EPS, the component kW values shown in the Section 3.0 Tables are equal to, or greater than, the component kW values presented in the updated FSAR. The kW values used in Section 3.0 are equal to, or greater than, the highest power requirements of a motor (such as a Containment Spray Pump motor, or an RHR Pump motor) assuming maximum head and flow conditions, and running singly. In addition to this conservatism, the loading tables in this Section also depict various manual loads (shown in parentheses in the tables) also added onto each EDG along with the auto-connect loads. In addition, a conservative estimate of miscellaneous loads (35 kW) was added to each EDG, and a conservative estimate of plant investment loads was added to each EDG (i.e., 175 kW on each Train A EDG, and 100 kW on each Train B EDG). Finally, the loading tables show a total EDG load as if all the loads shown are run concurrently, when in reality the loads are not all powered at the same time.

By inspection of Table 3-1, it can be seen that the loading on each EDG is within its continuous rating, even with the assumption of concurrent manual loads imposed. Therefore, with one EDG powering each 4.16 kV bus, the enhanced design alleviates existing EDG load management scenarios by providing additional load capacity. Also by inspection of Table 3-1, it can be seen that the failure of one EDG on the accident Unit (Unit 3) does not result in the loss of the minimum required Engineered Safety Features, due to the automatic swing of LC 3H/MCC 3D if power is lost. Also see Figure 1: if

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power is lost to LC 3D (by failure of the 3B EDG, or some other single failure), the loads shown on MCC 3D are still available since LC 3H/MCC 3D automatically swing to the alternate power source, LC 3C. Similarly, a loss of an EDG on the LOOP Unit (Unit 4) does not result in the loss of the minimum equipment required for hot shutdown.

3.2.2 LOCA on Unit 4

For a LBLOCA on Unit 4, with offsite power not available and with the same normal alignment (B Train) loadings assumed for Table 3-1, the EDG short-term loads were calculated and result in the following (with no single failure assumed):

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2016	2204	1927	2210

Thus, if a LBLOCA occurs on Unit 4 instead of Unit 3, the above totals again indicate, even for the concurrent loads assumed, that each EDG kW load is still well below its continuous rating. The failure of any one EDG still results in sufficient equipment for accident mitigation on Unit 4 and Hot Standby on Unit 3.

3.3 ENHANCED EPS WITH ALTERNATE (TRAIN A) ALIGNMENT

3.3.1 LOCA on Unit 3

As discussed in Subsection 3.2.1, loss of the normal power source to a swing load center on either Unit results in automatic transfer of equipment powered from the 3H/4H Load Center(s) from the normal B Train alignment to an A Train alignment. This alignment can also be used during normal operation, and is administratively controlled and interlocked to preclude paralleling load centers. For the purpose of this analysis, this realignment of loads, and the resultant EDG kW loadings were evaluated for a LBLOCA on Unit 3, where the results are shown assuming both Units were operating with the "A" Train alignment. For this condition, Table 3-2 shows the EDG short-term loads which could result in approximately the first hour without the assumption of any single failure.

By inspection of Table 3-2, it can be seen that, even with the assumption of concurrent manual loads imposed, each EDG kW load is still well below its continuous rating. Note also that, as in Table 3-1, component kW load values generally have been increased from the values presently assumed in the FSAR.

In addition, by inspection of Tables 3-1 and Table 3-2, it can be seen that the required short-term loads are still available even if EDG 3A (or EDG 3B) is assumed to fail. The requirement for an additional High Head Safety Injection Pump (since one is lost by failure of a Unit 3 EDG) is met by EDG 4A, with yet another HHSI Pump available if desired from EDG 4B (or vice-versa). The loss of the other short-term components needed is accommodated by their

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redundant counterparts on the EDG 3B (or EDG 3A). Moreover, the minimum safeguards are supplemented with additional desired loads (manually loaded) such as plant investment loads as shown in Tables 3-1 and 3-2, and there is no EDG load concern. The enhanced EPS thus meets its short-term safety function for a design basis LBLOCA accident on Unit 3. Similarly, Tables 3-1 and 3-2 indicate that if a Unit 4 EDG is lost, equipment required for safe shutdown is still available.

3.3.2 LOCA on Unit 4

If the LBLOCA were on Unit 4, instead of Unit 3, the short-term kW loadings similar to those given in Table 3-2 (for the same Load Center alignments to each Unit's Train A) were calculated and result in the following:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2344	1856	2285	1852

Thus if a LBLOCA occurs on Unit 4 instead of Unit 3, the above totals again indicate, even for the concurrent loads assumed, that each EDG kW load is still well below its continuous rating. In addition, the required short-term loads are still available even if EDG 4A (or EDG 4B) is assumed to fail. The requirement for an additional High Head Safety Injection Pump (since one is lost by failure of a Unit 4 EDG) is met by EDG 3A, with yet another HHSI Pump available if desired from EDG 3B (or vice-versa). The loss of the other short-term components needed is accommodated by their redundant counterparts on the EDG 4B (or 4A). Moreover, the minimum safeguards are supplemented with additional desired loads (manually loaded) such as plant investment loads as shown in the Table 3-1 and 3-2 scenarios, and there is no EDG load concern. The enhanced EPS thus meets its short-term safety function for a design basis LBLOCA accident on Unit 4 and safe shutdown of Unit 3.

3.4 ENHANCED EPS - RESULTS

The above discussions are summarized as follows, to determine the worse case loading on an EDG with the enhanced EPS configuration:

<u>CASE 1: SIS ON UNIT 3</u>

LBLOCA plus LOOP on Unit 3, LOOP on Unit 4; no single failures; normal (Train B) alignment; concurrent manual loads assumed:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
1846	2159	2062	2285

CASE 2: SIS ON UNIT 4

LBLOCA plus LOOP on Unit 4, LOOP on Unit 3; no single failures; normal (Train B) alignments; same concurrent manual loads assumed:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2016	2204	1927	2210

CASE 3: SIS ON UNIT 3, LOADS ALIGNED TO TRAIN A

LBLOCA plus LOOP on Unit 3, LOOP on Unit 4; Load Center 3H and Load Center 4H aligned to Train A; concurrent manual loads assumed:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2204	1801	2425	1922

CASE 4: SIS ON UNIT 4, LOADS ALIGNED TO TRAIN A

LBLOCA plus LOOP on Unit 4, LOOP on Unit 3; Load Center 3H and Load Center 4H aligned to Train A; same concurrent manual loads assumed:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2344	1856	2285	1852

Therefore, EDG 3A is most heavily loaded for Case 4 (LOOP plus Train A alignment of swing loads); EDG 3B is most heavily loaded for Case 2 (LOOP with normal Train B alignment); EDG 4A is most heavily loaded for Case 3 (LOOP plus Train A alignment of swing loads); and EDG 4B is most heavily loaded for Case 1 (LOOP with normal alignment). In other words, since the normal alignment LOOP loads are higher than the LOOP plus LOCA loads, the new EPS configuration more evenly distributes the loads on each EDG such that the normal Train B alignment of the loads for LOOP are around 2200 kW on each EDG, and if a Load Center is lost such that the loads swing onto the other EDG, the LOOP, or LOOP and LOCA, loads remain at about that level for the 3A or 4A EDG.

3.5 LONG TERM EDG LOADING

3.5.1 LOCA on Unit 3, Both Units Aligned to Train B

Tables 3-1 and 3-2 indicate that for a LBLOCA on Unit 3 the required short-term equipment is available with the enhanced EPS design, with no EDG loading problems. Inspection of Tables 3-1 and 3-2 indicates that, even if one EDG on the accident Unit is assumed to fail, the required short-term equipment is still available. At least one HHSI pump is available from the 4A or 4B EDG. No equipment needs to be secured from an EDG loading standpoint.

Even though the DBA licensing basis for PTP is attainment of safe (hot) shutdown, the following discussions analyze the EDG loadings for achieving long-term cold shutdown, post-DBA. The equipment

required long-term can be loaded on the accident Unit EDGs even with all short-term-required safeguards equipment still running (if required), and still maintain the EDG loads to below the EDG continuous rating. This is demonstrated on Table 3-3 and in the following discussions. Normal Train B alignment is discussed first for a LOCA on Unit 3, then a LOCA On Unit 4. The Train A alignment is briefly reviewed for resultant EDG loadings for a LOCA on Unit 3, then a LOCA on Unit 4. As per the previous Subsections, a tabulation is given for both Train alignments for the LOCA on Unit 3.

The requirement for a stable sump pH requires the following equipment to be operated within 8 hours after the onset of the accident:

- 1 out of 3 Charging Pumps
- 1 out of 4 (2 per Unit) Boric Acid Transfer Pumps

It is assumed that when boric acid injection is needed, the following equipment is also required to assure boric acid solubility:

- 1 out of 3 (Shared) Boric Acid Tank Heaters
- 1 out of 2 (Shared) Circuits for Boric Acid Heat Tracing

The Boric Acid Heat Trace transformers are auto-connected in the short-term. The other above loads on the accident Unit (Unit 3) for the long term, without securing any equipment already assumed running in the loadings obtained previously, are depicted in Table 3-3. The loads required for shutdown and cooldown of the non-accident Unit (Unit 4) have already been assumed loaded onto the Unit 4 EDGs, and are also depicted in Table 3-3; a Spent Fuel Pit Pump is also loaded onto each Unit. The loads are as follows:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2091	2299	2152	2285

These loads are obtained by assuming (refer to Figure 1) that a Charging Pump (125 kW each) is powered from Load Center 3A (on EDG 3A) and Load Center 3B (on EDG 3B); the Boric Acid Tank Heater "A" (15 kW) is powered from MCC 3C (on EDG 3A); the Boric Acid Transfer Pump "3A" (15 kW) is powered from MCC 3C; and the Boric Acid Transfer Pump "3B" (15 kW) is powered from MCC 3B (on EDG 3B). A Boric Acid Heat Trace circuit transformer (25 kW) is already assumed powered from MCC 3D (on EDG 3B). In addition, it is assumed that a Spent Fuel Pit Pump (90 kW) is loaded onto each Unit's "A" EDG (EDG 3A/4A) via LC 3C/4C. Thus an additional 245 kW is added to the pre-existing EDG 3A kW loadings (Table 3-1), and an additional 140 kW is added to the pre-existing EDG 3B kW loadings without securing any already-running equipment, and without exceeding the continuous rating of the accident Unit's EDGs (2500 kW). An additional 90 kW is added to the non-accident Unit's Train A diesel (EDG 4A).

Tables 3-1 and 3-3 demonstrate that the most-heavily loaded EDG on the accident Unit remains below its continuous rating (2500 kW), and the enhanced EPS fulfills its safety functions in both the short and long term, even assuming the concurrent loading of engineered safety features and manual loads such as plant investment loads.

For the long-term loads needed on the accident Unit, if an EDG fails on that Unit, the loads which would have been provided by the now-failed EDG are provided by the redundant components available from the swing LC on the accident Unit, or by the redundant components on the non-accident Unit's EDGs.

For example, if EDG 3A is postulated to fail, the Boric Acid Transfer Pump "3B" is still powered from EDG 3B, as is a Charging Pump. The long-term load of the Boric Acid Tank (BAT) Heater (a shared component) is provided by using one or both of the BAT heaters normally aligned to EDG 4B, and the Boric Acid Heat Trace circuit transformer and the other ESF loads are powered by MCC 3D, which is still aligned to EDG 3B. If EDG 3B is postulated to fail, a Charging Pump, Boric Acid Tank Heater, and Boric Acid Transfer Pump "3A" remain powered from EDG 3A, while the Boric Acid Heat Trace circuit transformer (and ESF loads) on MCC 3D will swing to EDG 3A when the normal alignment Load Center 3D loses power and Load Center 3H automatically aligns itself to Load Center 3C.

Therefore, a single failure of EDG 3A or 3B would not affect the long-term loads needed for Unit 3, as shown on Table 3-3. The enhanced EPS thus meets its long-term safety function for a design basis LBLOCA accident on Unit 3. Equivalent conclusions are obtained for the Train A alignment (see Subsection 3.5.3 and Table 3-4), since the accident Unit EDGs are less heavily loaded, and since the same equipment discussed above can be shown to be available.

3.5.2 LOCA on Unit 4, Both Units Aligned to Train B

As noted in Subsection 3.2.2, the resultant short-term EDG kW loads for a LBLOCA on Unit 4 (plus LOOP, no single failures, normal B Train alignment) are the following:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2016	2204	1927	2210

The loads required long-term for the non-accident Unit (Unit 3) have already been assumed loaded onto the Unit 3 EDGs, and are repeated below, with the addition of a SFP Pump on EDG 3A.

The resulting EDG loads on the accident Unit (Unit 4) in the long-term, without securing any equipment already assumed running in the loadings obtained above, have been evaluated as per the discussions in Subsection 3.5.1 above and are as follows:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2106	2204	2157	2380

These loads are obtained by assuming (refer to Figure 1) that a Charging Pump (125 kW each) is powered from Load Center 4A (on EDG 4A) and Load Center 4B (on EDG 4B); the Boric Acid Tank Heater "C" (15 kW) is powered from MCC 4B (on EDG 4B) and the Boric Acid Tank Heater "B" is powered from MCC 4B (on EDG 4B); the Boric Acid Transfer Pump "4A" (15 kW) is powered from MCC 4C (on EDG 4A) and the Boric Acid Transfer Pump "4B" is powered from MCC 4D (on EDG 4B). A Boric Acid Heat Trace circuit transformer (25 kW) is already powered from MCC 4D (on EDG 4B). In addition, it is assumed that a Spent Fuel Pit Pump (90 kW) is loaded onto each Unit's "A" EDG (EDG 3A/4A) via LC 3C/4C. Thus an additional 230 kW is added to the pre-existing EDG 4A kW loadings, and an additional 170 kW is added to the pre-existing EDG 4B kW loadings without securing any already-running equipment, and without exceeding the continuous rating of the accident Unit's EDGs (2874 kW).

For the long-term loads needed on the accident Unit (Unit 4), if an EDG fails on that Unit, the loads which would have been provided by the now-failed EDG are provided by the redundant components available from the swing LC on the accident Unit, or by the redundant components on the non-accident Unit's EDGs. In this case, the reassignment of loads for the enhanced EPS has provided most of the long-term loads from the swing LC, as discussed below.

For example, if EDG 4A is postulated to fail, the Boric Acid Transfer Pump "4B" is still powered from EDG 4B, as is a Charging Pump, both Boric Acid Tank Heaters, and the Boric Acid Heat Trace circuit transformer. If EDG 4B is postulated to fail, a Charging Pump and Boric Acid Transfer Pump "4A" remain powered from EDG 4A, and the Boric Acid Tank Heater "B", and the Boric Acid Heat tracing circuit transformer (and ESF loads) will all swing to EDG 4A when their normal Load Center 4D loses power and Load Center 4H automatically aligns itself to Load Center 4C.

Therefore, a single failure of EDG 4A or 4B would not affect the long-term loads needed for Unit 4. The enhanced EPS thus meets its long-term safety function for a design basis LBLOCA accident on Unit 4. Similar to the discussions above, the enhanced EPS also meets its long-term safety functions for safe shutdown on the non-accident Unit (Unit 3).

3.5.3 LOCA on Unit 3, Both Units Aligned to Train A.

For illustrative purposes, the Train A alignment of loads on both units, and the resultant long-term EDG kW loadings, are shown in Table 3-4 for a LBLOCA on Unit 3. By the same logic used in the Train B alignment discussions, there is sufficient EDG capacity to mitigate the accident in the long term on Unit 3, and to safely cool down and shut down the non-accident Unit 4, without any EDG loading concerns. Single failure is accommodated with the enhanced EPS design.

3.5.4 LOCA on Unit 4, Both Units Aligned to Train A

If the LBLOCA were on Unit 4, and the swing LCs on both Units were aligned to the "A" Train then the long-term kW loadings similar to those given in Table 3-4 (for the same Load Center 3H/4H Train A alignments) would be:

EDG 3A kW	EDG 3B kW	EDG 4A kW	EDG 4B kW
2434	1856	2530	2007

By the same logic previously detailed, sufficient equipment is available to mitigate the accident and safely shut down the non-accident Unit, without EDG load concerns. Single failure is accommodated with the enhanced EPS design.

3.6 CONCLUSIONS

Tables 3-1 through 3-4, and the kW loads shown above, demonstrate that even with the engineered safety features, desired manual loads, and the required long-term loads on both Units, plus the failure of a Load Center 3D or 4D (or alternate alignment of LC 3H/4H), there is no EDG loading problem associated with the enhanced EPS design, and the enhanced EPS can fulfill its safety function for a design basis LBLOCA on either Unit. The required equipment is available assuming a single failure of any one EDG.

After implementation of the enhanced EPS project, the emergency diesel generator (EDG) ratings (gross) will be as follows:

	Unit 3 EDG's	Unit 4 EDG's
Continuous Rating (Nominal)	2500 kW *	2874 kW
Short Term (2/24 Hr) Rating	2750 kW *	3162 kW

The above ratings are the kW values prior to subtraction of the EDG-run auxiliaries; i.e., before subtracting the related EDG's vent fan, air compressor, and other auxiliaries.

The enhanced EPS provides mitigation of a Design Basis Accident on one Unit and safe (hot) shutdown of the other Unit, with concurrent LOOP on both Units, for either the normal (Train B) alignment of the swing LCs or for the Train A alignment. Failure of an EDG during this DBA scenario does not affect this safety function and none of the EDGs exceeds its continuous rating.

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*Per NRC's Emergency Diesel Generator Load Safety Evaluation for Turkey Point Nuclear Units 3 & 4, dated December 15, 1986, the existing EDGs can be loaded to 2750 kW with a short term continuous load limit of 2850 kW. Based upon the above manufacturer's ratings, these load limits are consistent with Regulatory Guideline 1.9, Position C.2.

TABLE 3-1

SHORT-TERM EDG kW LOADS FOR UNIT 3 LOOP PLUS LOCA,

TWO-UNIT OPERATION WITH SWING LOADS ALIGNED TO B TRAIN

(NOTE: COMPONENT kW LOADS INCREASED FOR CONSERVATISM)

NO SINGLE FAILURE; REFER TO SECTION 3.0 DISCUSSIONS

	U3: LOOP + SIS		U4: LOOP ONLY		
COMPONENTS (1) (2)	EDG 3A	EDG 3B	EDG 4A	EDG 4B	REMARKS
HHSI	305	305	305	305	Only two HHSI pumps required for accident Unit
RHR	225	225	(225)	(225)	Only one RHR pump per Unit required
CS	225	225	N/A	N/A	Only one CS pump required on accident Unit
CCW	380	380	380	380	Only one CCW pump required per Unit
ICW	270	270	270	270	Only one ICW pump required per Unit
Normal Containment Coolers	N/A	N/A	(160)	(160)	Loss of power to LC 4D swings NCC 4B (MCC 4D)
Emergency Containment Coolers	25	50	N/A	N/A	Loss of power to LC 3D swings ECC 3B (MCC 3D)
Emergency Containment Filters	65	130	N/A	N/A	Loss of power to LC 3D swings ECF 3B (MCC 3D)
Battery Chargers	25	75	25	75	MCCs 3B, 3C, 3D, 4B, 4C, 4D power 8 battery chargers (1 per DC bus req'd)
Charging Pump	N/A	N/A	(125)	(125)	Manually loaded for hot shutdown RCS inventory control.
Pressurizer Heaters	N/A	N/A	(150)	(150)	Manually loaded for hot shutdown RCS pressure control.
Turbine Loads	see "plant investment"		see "plant investment"		Manually loaded.
Emergency Lighting XFMR	0	20	0	20	Loss of LC 3D or 4D swings Emrg Ltg XFMR 312 (MCC 3D) or 412 (MCC 4D)
Control Room AC	0	60	0	30	Loss of LC 3D or 4D swings CRAC C (MCC 3D) or CRAC B (MCC 4D)
BA Heat Tracing XFMR	0	25	0	25	Loss of LC 3D or 4D swings XFMR 3X313 (MCC 3D) or 4X416 (MCC 4D)
EDG Auxiliaries	30	30	115	115	MCCs 3A (EDG 3A), 3K (EDG 3B), 4J (EDG 4A), 4K (EDG 4B)
Miscellaneous Loads	35	35	35	35	Estimated
Load Center Transformer Losses	30	30	30	30	Varies depending on load; full load value used
Battery Room AC E16D & E16F	(0)	(25)	(0)	(25)	Loss of LC 3D or 4D swings Batt Rm AC E16D (MCC 3D) or E16F (MCC4D)
H_2 Analyzer Related	10	10	10	10	One Train on accident Unit required
Computer Rm/Cable Sprdg Room AC	(0)	(50)	(0)	(50)	Manually loaded; one req'd. Loss of LC 3C or 4C swings AC B or AC A
Boric Acid Transfer Pump	N/A	N/A	(15)	(15)	Manually loaded; one req'd.
Boric Acid Tank Htr	N/A	N/A	(0)	(30)	Not required short-term; loss of LC 4D swings BAT Htr B (MCC 4D)
Aux Bldg/EER HVAC	0	68	0	68	Process Load; Loss of LC 3D or 4D swings HVAC (MCC 3D/4D)
4.16 kV Swgr/EDG Rm HV	46	46	42	42	Process Load for Swgr and EDG rooms
Plant Investment Loads (est.)	(175)	(100)	(175)	(100)	Plant investment loads incl turbine loads, both manual & process-auto.
TOTAL KW LOADING:	1846	2159	2062	2285	
EDG Continuous Rating (nom.)	2500	2500	2874	2874	

NOTES:
1) Security Building Transformer load not shown due to Security Upgrade Project.
2) Parentheses denote manual load kW values.

TA[illegible]-2

SHORT-TERM EDG kW LOADS FOR UNIT 3 LOOP PLUS LOCA,

TWO-UNIT OPERATION WITH SWING LOADS ALIGNED TO A TRAIN

(NOTE: COMPONENT kW LOADS INCREASED FOR CONSERVATISM)

NO SINGLE FAILURE; REFER TO SECTION 3.0 DISCUSSIONS

	U3: LOOP + SIS		U4: LOOP ONLY		
COMPONENTS (1) (2)	EDG 3A	EDG 3B	EDG 4A	EDG 4B	REMARKS
HHSI	305	305	305	305	Only two HHSI pumps required for accident Unit
RHR	225	225	(225)	(225)	Only one RHR pump per Unit required
CS	225	225	N/A	N/A	Only one CS pump required on accident Unit
CCW	380	380	380	380	Only one CCW pump required per Unit
ICW	270	270	270	270	Only one ICW pump required per Unit
Normal Containment Coolers	N/A	N/A	(240)	(80)	Loss of LC 4C swings NCC 4B (MCC 4D)
Emergency Containment Coolers	50	25	N/A	N/A	Loss of LC 3C swings ECC 3B (MCC 3D)
Emergency Containment Filters	130	65	N/A	N/A	Loss of LC 3C swings ECF 3B (MCC 3D)
Battery Chargers	75	25	75	25	MCCs 3B, 3C, 3D, 4B, 4C, 4D power 8 battery chargers (1 per DC bus req'd)
Charging Pump	N/A	N/A	(125)	(125)	Manually loaded for hot shutdown RCS inventory control.
Pressurizer Heaters	N/A	N/A	(150)	(150)	Manually loaded for hot shutdown RCS pressure control.
Turbine Loads	see "plant investment"		see "plant investment"		Manually loaded.
Emergency Lighting XFMR	20	0	20	0	Loss of LC 3C or 4C swings Emrg Ltg XFMR 312 (MCC 3D) or 412 (MCC 4D)
Control Room AC	30	30	30	0	Loss of LC 3C or 4C swings CRAC C (MCC 3D) or CRAC B (MCC 4D)
BA Heat Tracing XFMR	25	0	25	0	Loss of LC 3C or 4C swings XFMR 3X313 (MCC 3D) or 4X416 (MCC 4D)
EDG Auxiliaries	30	30	115	115	MCCs 3A (EDG 3A), 3K (EDG 3B), 4J (EDG 4A), 4K (EDG 4B)
Miscellaneous Loads	35	35	35	35	Estimated
Load Center Transformer Losses	30	30	30	30	Varies depending on load; full load value used
Battery Room AC E16D & E16F	(25)	(0)	(25)	(0)	Loss of LC 3C or 4C swings Batt Rm AC E16D (MCC 3D) or E16F (MCC 4D)
H_2 Analyzer Related	10	10	10	10	One Train on accident Unit required
Computer Rm/Cable Sprdg Room AC	(50)	(0)	(50)	(0)	Manually loaded; one req'd. Loss of LC 3C or 4C swings AC A or AC B.
Boric Acid Transfer Pump	N/A	N/A	(15)	(15)	Manually loaded; one req'd.
Boric Acid Tank Htr	N/A	N/A	(15)	(15)	Not required short-term; loss of LC 4C swings BAT Htr B (MCC 4D)
Aux Bldg/EER HVAC	68	0	68	0	Process Load; Loss of LC 3D or 4D swings HVAC (MCC 3D/4D)
4.16 kV Swgr/EDG Rm HV	46	46	42	42	Process Load for Swgr and EDG rooms
Plant Investment Loads (est.)	(175)	(100)	(175)	(100)	Plant invstmnt loads incl turbine loads, both manual & process-auto.
TOTAL KW LOADING:	2204	1801	2425	1922	
EDG Continuous Rating (nom.)	2500	2500	2874	2874	

NOTES: 1) Security Building Transformers load not shown due to Security Upgrade Project.

2) Parentheses denote manual load kW values.

TABL[illegible]-3

LONG-TERM EDG kW LOADS FOR UNIT 3 LOOP PLUS LOCA,

TWO-UNIT OPERATION WITH SWING LOADS ALIGNED TO B TRAIN

(NOTE: COMPONENT kW LOADS INCREASED FOR CONSERVATISM)

NO SINGLE FAILURE; REFER TO SECTION 3.0 DISCUSSIONS

	U3: LOOP + SIS		U4: LOOP ONLY		
COMPONENTS (1)	EDG 3A	EDG 3B	EDG 4A	EDG 4B	REMARKS
HHSI	305	305	305	305	Only two HHSI pumps required for accident Unit
RHR	225	225	(225)	(225)	Only one RHR pump per Unit required
CS	225	225	N/A	N/A	Only one CS pump required on accident Unit
CCW	380	380	380	380	Only one CCW pump required per Unit
ICW	270	270	270	270	Only one ICW pump required per Unit
Normal Containment Coolers	N/A	N/A	(160)	(160)	Loss of LC 4D swings NCC 4B (MCC 4D)
Emergency Containment Coolers	25	50	N/A	N/A	Loss of LC 3D swings ECC 3B (MCC 3D)
Emergency Containment Filters	65	130	N/A	N/A	Loss of LC 3D swings ECF 3B (MCC 3D)
Battery Chargers	25	75	25	75	MCCs 3B, 3C, 3D, 4B, 4C, 4D power 8 battery chargers (1 per DC bus req'd)
Charging Pump	(125)	(125)	(125)	(125)	Manually loaded for HSD and boration; one per unit required
Pressurizer Heaters	N/A	N/A	(150)	(150)	Manually loaded for hot shutdown RCS pressure control.
Turbine Load	see "plant investment"		see "plant investment"		Manually loaded.
Emergency Lighting XFMR	0	20	0	20	Loss of LC 3D or 4D swngs Emrg Ltg XFMR 312 (MCC 3D) or 412 (MCC 4D)
Control Room AC	0	60	0	30	Loss of LC 3D or 4D swings CRAC C (MCC 3D) or CRAC B (MCC 4D)
BA Heat Tracing XFMR	0	25	0	25	Loss of LC 3D or 4D swings BA Ht Tr XFMR 3X313 (MCC 3D) or 4X416 (MCC 4D)
EDG Auxiliaries	30	30	115	115	MCCs 3A (EDG 3A), 3K (EDG 3B), 4J (EDG 4A), 4K (EDG 4B)
Miscellaneous Loads	35	35	35	35	Estimated
Load Center Transformer Losses	30	30	30	30	Varies depending on load; full load value used
Battery Room AC E16D & E16F	(0)	(25)	(0)	(25)	Loss of LC 3D or 4D swings Batt Rm AC E16D (MCC 3D) or E16F (MCC 4D)
H_2 Analyzer Related	10	10	10	10	One Train on accident Unit required
Spent Fuel Pit Pp	(90)	--	(90)	--	Spent fuel cooling may be needed within about 6 hours
Computer Rm/Cable Sprdg Room AC	(0)	(50)	(0)	(50)	Manually loaded; one req'd. Loss of LC 3C or 4C swings or AC A or AC B
Boric Acid Transfer Pump	(15)	(15)	(15)	(15)	Manually loaded; one req'd.
Boric Acid Tank Htr	(15)	--	(0)	(30)	Not required short-term; loss of LC 4D swings BAT Htr B (MCC 4D)
Aux Bldg/EER HVAC	0	68	0	68	Process Load; Loss of LC 3D or 4D swings HVAC (MCC 3D/4D)
4.16 kV Swgr/EDG Rm HV	46	46	42	42	Process Load for Swgr and EDG rooms
Plant Investment Loads (est.)	(175)	(100)	(175)	(100)	Plant invstmnt loads incl turbine loads, both manual & process-auto.
TOTAL KW LOADING: (including manual loads)	2091	2299	2152	2285	
EDG Continuous Rating (nom.)	2500	2500	2874	2874	

NOTES: 1) Parentheses denote manual load kW values.

2) Loads conservatively shown for attainment of cold shutdown.

TABLE

LONG-TERM EDG kW LOADS FOR UNIT 3 LOOP PLUS LOCA,

TWO-UNIT OPERATION WITH SWING LOADS ALIGNED TO A TRAIN

(NOTE: COMPONENT kW LOADS INCREASED FOR CONSERVATISM)

NO SINGLE FAILURE; REFER TO SECTION 3.0 DISCUSSIONS

	U3: LOOP + SIS		U4: LOOP ONLY		
COMPONENTS (1)	EDG 3A	EDG 3B	EDG 4A	EDG 4B	REMARKS
HHSI	305	305	305	305	Only two HHSI pumps required for accident Unit
RHR	225	225	(225)	(225)	Only one RHR pump per Unit required
CS	225	225	N/A	N/A	Only one CS pump required on accident Unit
CCW	380	380	380	380	Only one CCW pump required per Unit
ICW	270	270	270	270	Only one ICW pump required per Unit
Normal Containment Coolers	N/A	N/A	(240)	(80)	Loss of LC 4C swings NCC 4B (MCC 4D)
Emergency Containment Coolers	50	25	N/A	N/A	Loss of LC 3C swings ECC 3B (MCC 3D)
Emergency Containment Filters	130	65	N/A	N/A	Loss of LC 3C swings ECF 3B (MCC 3D)
Battery Chargers	75	25	75	25	MCCs 3B, 3C, 3D, 4B, 4C, 4D power 8 battery chargers (1 per DC bus req'd)
Charging Pump	(125)	(125)	(125)	(125)	Manually loaded for HSD and boration; one per unit required
Pressurizer Heaters	N/A	N/A	(150)	(150)	Manually loaded for hot shutdown RCS pressure control
Turbine Loads	see "plant investment"		see "plant investment"		Manually loaded
Emergency Lighting XFMR	20	0	20	0	Loss of LC 3C or 4C swngs Emrg Ltg XFMR 312 (MCC 3D) or 412 (MCC 4D)
Control Room AC	30	30	30	0	Loss of LC 3C or 4C swings CRAC C (MCC 3D) or CRAC B (MCC 4D)
BA Heat Tracing XFMR	25	0	25	0	Loss of LC 3C or 4C swings BA Ht Tr XFMR 3X313 (MCC 3D) or 4X416 (MCC 4D)
EDG Auxiliaries	30	30	115	115	MCCs 3A (EDG 3A), 3K (EDG 3B), 4J (EDG 4A), 4K (EDG 4B)
Miscellaneous Loads	35	35	35	35	Estimated
Load Center Transformer Losses	30	30	30	30	Varies depending on load; full load value used
Battery Room AC E16D & E16F	(25)	(0)	(25)	(0)	Loss of LC 3C or 4C swings Batt Rm AC E16D (MCC 3D) or E16F (MCC 4D)
H_2 Analyzer Related	10	10	10	10	One Train on accident Unit required
Spent Fuel Pit Pump	(90)	--	(90)	--	Spent fuel cooling may be needed within about 6 hours
Computer Rm/Cable Sprdg Room AC	(50)	(0)	(50)	(0)	Manually loaded; one req'd. Loss of LC 3C/4C swings AC A/B
Boric Acid Transfer Pump	(15)	(15)	(15)	(15)	Manually loaded; one req'd.
Boric Acid Tank Htr	(15)	--	(15)	(15)	Not required short-term; loss of LC 4C swings BAT Htr B (MCC 4D)
Aux Bldg/EER HVAC	68	0	68	0	Process Load; Loss of LC 3D or 4D swings HVAC (MCC 3D/4D)
4.16 kV Swgr/EDG Rm HV	46	46	42	42	Process Load for Swgr and EDG rooms
Plant Investment Loads (est.)	(175)	(100)	(175)	(100)	Plant invstmnt loads incl turbine loads, both manual & process-auto.
TOTAL KW LOADING:	2449	1941	2515	1922	
EDG Continuous Rating (nom.)	2500	2500	2874	2874	

NOTES: 1) Parentheses denote manual load kW values.

2) Loads conservatively shown for attainment of cold shutdown.

4.0 SEQUENCER ENHANCEMENTS

Voltage drop calculations performed during the design of the swing Load Centers 3H/4H and the repowering of equipment associated with the associated Motor Control Centers 3D/4D, indicated that the load sequencing could be enhanced by modifying the sequence of loads and adding additional load blocks during the one-minute duration when the auto-connect loads are placed on the EDGs. In addition, it was advantageous from voltage drop considerations to have the loads also sequence onto the buses for the scenario of an SI with offsite power available. Finally, certain single failure scenarios require the redundant swing loads to be loaded onto an EDG following the normal sequencing of the other ESF and hot shutdown loads. A description of these changes is provided below.

4.1 EXISTING LOAD BLOCKS

For a LOOP/LOCA on Unit 3, the Updated FSAR Table 8.2-3 (Revision 6, 7/88) is the basis for the following worst case Engineered Safeguards Features loading on an EDG with four load blocks in the existing sequencer design (see next page). In addition, for a LOOP on Unit 4, the required Unit 4 loads will sequence on after the Unit 3 ESF loads.

[illegible]

BLOCK	SECONDS AFTER ENGINE START SIGNAL	MAJOR EQUIPMENT	LOAD (kW)[1]
1	16	LC Transformer Losses	9
		Lighting	17
		Motor Operated Valves *	30
		Miscellaneous Loads	17
		Heat Tracing	20
		Control Room Air Conditioners	54
		Battery Chargers	69
		Battery Room Air Conditioner	22
		Step Load	238
2	18	High Head SI Pumps	604
		Residual Heat Removal Pump	201
		Step Load	805
3	26	Component Cooling Water Pump	365
		Emergency Containment Cooler	23
		Emergency Containment Filter	55
		Containment Spray Pump	219
		Step Load	662
4	33	Intake Cooling Water Pump	265
		Emergency Containment Cooler[2]	23
		Emergency Containment Filter[2]	55
		Step Load	343
--	--	(Sequencer Times Out)	
		TOTAL kW	2048

* Approximate total kW load for multiple short-term, small loads

(1) This represents the worst case loading scenarios for one EDG

(2) Assumes accident on Unit 3; loads only apply for this case. If an SIS on Unit 4, only one cooler and filter starts per EDG.

4.2 ENHANCED LOAD BLOCKS

For the enhanced design, the following ESF load blocks were designed, for an SI with LOOP scenario. (The kW loads shown here are higher than design for conservatism.) The loads are shown for EDG 3B, assuming the normal alignment of LC 3H/MCC 3D to the B Train:

BLOCK	SECONDS AFTER ENGINE START SIGNAL	MAJOR EQUIPMENT	LOAD (kW)[1]
1	15.5	LC Transformer Losses	30
		Lighting Transformer	20
		Motor Operated Valves*	30
		Miscellaneous Loads	35
		Battery Chargers	75
		Heat Tracing	20
		Step Load	210
2	18	High Head SI Pump	305
		Residual Heat Removal Pump	225
		Step Load	530
3	26	Emergency Containment Cooler	25
		Containment Spray Pump**	225
		Step Load	250
4	33	Intake Cooling Water Pump	270
		Emergency Containment Cooler***	25
		Step Load	295
5	40	Component Cooling Water Pump	380
		Step Load	380
6	47	Emergency Containment Filter	65
		Step Load	65
7	54	Emergency Containment Filter	65
		Step Load	65
--	59	(Sequencer Times Out)	
		TOTAL kW	1795

* Approximate total kW load for multiple short-term, small loads

** If Containment Spray Pump is not required to start by the 3rd load block, upon the receipt of a High-High Containment Pressure Signal it will start after sequencing is complete.

*** If single failure (discussed below) delays auto-transfer of LC/MCC, the ECCF will load onto the EDG at 72 seconds after the engine start signal.

NOTE: For LOOP only scenario, the above sequence times apply for non-ESF loads

The times shown in 4.1 and 4.2 are total elapsed times from receipt of a LOOP signal. Note that an additional one second is required for the undervoltage relay to initiate sequencing subsequent to detection of the LOOP.

The assignment of a High Head Safety Injection Pump to each EDG in the enhanced design deletes about 305 kW from the second load block in each EDG loading, and the assignment of seven load blocks instead of four load blocks more evenly distributes the loading, and thus allows the voltage to recover more readily.

4.3 SEQUENCING LOADS ONTO BUSES FOR SI WITH OFFSITE POWER AVAILABLE

If an SI occurs with offsite power available, the enhanced EPS design utilizes the sequencers to sequence the loads onto the buses, with the same load blocks shown in Subsection 4.2 above, but without the 15-second delay for the EDGs to come up to speed and voltage. That is, the load block times shown in 4.2 occur 15 seconds earlier than for the SI with LOOP scenario. Note that any equipment operating before the receipt of the SI signal will remain operating. Since the Engineered Safety Features are loaded onto the buses earlier than for the limiting case of LOOP plus SI, the FSAR accident analyses (DBA with LOOP) remain the bounding analyses for accident consequences because of the delay to initiate the ESF equipment.

4.4 ENHANCED SEQUENCER DESIGN TO MEET SINGLE FAILURE CRITERIA

The new sequencers logic and loading blocks were designed to meet single failure criteria. The design of the load blocks for the enhanced EPS consider accident response requirements to ensure plant safety, engine loading performance and single failure. The repowering of loads from the existing MCC D (relabeled MCC 3D) and timing of the load blocks have been considered. The design includes several features which ensure that the consequences of component failures do not impact plant safety:

1. The swing load centers/motor control centers are isolated and not powered if the charging pump breaker fails to strip upon command.

2. Loading of the swing load center is delayed until after the seventh load block to accommodate any failure, during sequencing, which causes loss of the train to which the LC was initially aligned.

The loading sequence of the enhanced EPS is designed to ensure it does not adversely affect the existing FSAR accident analyses. The addition of new load blocks and the delayed loading (compared to the existing loading design) of certain ESF equipment have been considered in the design. At a minimum, all of the equipment assumed in these analyses is available and loaded on the EDGs. With the EDG load margin available with the enhanced EPS, the capability exists to power additional loads. An evaluation is being finalized which will verify that the proposed changes to the EDG loading

scheme do not adversely impact the current design basis accident analyses for Turkey Point Units 3 and 4. A preliminary review (Reference 20), of the proposed changes, by Westinghouse indicates that there will be no adverse impact on the FSAR analyses of record.

[illegible]

5.0 FAILURE MODE AND EFFECTS ANALYSES (FMEA)

In addition to postulating various single failures during the accident scenarios described in the previous section, the design of the enhanced EPS system was subjected to a rigorous analysis of failure modes during system operation, to demonstrate that the system safety function can still be accomplished even with a single failure. The enhanced EPS was subjected to a comprehensive FMEA, the key elements of which are summarized below, from which it is concluded that the enhanced EPS can perform its safety functions for all modes of plant operation.

The detailed FMEA is approximately 500 pages long, and is not included in this Safety Analysis for the sake of brevity. The FMEA for the electrical system components and individual loads was used to identify potential failure modes from proposed relocation (repowering) of the shared, or common, loads which presently are located on MCCs 3A, 4A or D. Where the FMEA identified such problems, the loads were assigned to the proper MCC such that a DBA and single failure does not result in the loss of the minimum required equipment. Figure 1 depicts the design which evolved from the FMEA studies and shows selected repowered loads (indicated by an asterisk on Figure 1).

The FMEA also considered the scenario of one Unit at power and the other Unit in MODE 5 or 6 with one train out-of-service (OOS). An accident (LOCA) plus a single failure was assumed on the Unit at power. The FMEA was used to confirm that the proposed EPS Technical Specifications (NRC proof and review, dated 5/4/90) are appropriate for potential EPS configurations during plant operation, including equipment OOS conditions (e.g., for a Unit in MODES 5 or 6 with only one EDG required to be OPERABLE). The EPS Technical Specifications are being submitted to NRC, as a separate package, for NRC review.

5.1 FMEA OF THE ONSITE AC EMERGENCY POWER SYSTEM

Operation of the enhanced EPS and its components, including initiating signals, sequencers, breakers, etc. is described in the June 1988 submittal. A review of various failure modes and their effect on the EPS safety functions was performed assuming LOOP, and the accidents discussed in Section 3.0 above (i.e., assuming that both Units are at power, an accident occurs, and dual-Unit LOOP is concurrent with the accident). This scenario is the worst-case condition from an EDG loading standpoint. The FMEA shows that no single failure of the onsite EPS (i.e., sequencers, EDG and AC electrical distribution system components) will preclude meeting the enhanced EPS design bases for LOOP and LOCA, or LOOP only.

5.2 FMEA OF THE 125V DC ENHANCEMENTS

The operation of the enhanced 125V DC components, including initiating signals, breaker controls, etc. is described in the June 1988 submittal. A review of various failure modes and their effect on the enhanced 125V DC safety function was performed assuming LOOP, and then the accidents discussed above (i.e., assuming that both Units are at power, an accident occurs, and dual-Unit LOOP is concurrent with the accident). This scenario is the worst-case condition from an EDG loading standpoint. The FMEA shows that no single failure of the 125V DC enhancements will preclude meeting the enhanced EPS design bases for LOOP and LOCA, or LOOP only.

6.0 PROBABILISTIC EVALUATION

6.1 PURPOSE AND SCOPE

The purpose of this section is to provide a quantitative probabilistic evaluation of the enhanced emergency diesel generator configuration for Turkey Point Units 3 and 4. This evaluation was performed both for the existing EDG configuration and the enhanced EDG configuration to allow a comparison of the two configurations. (The terms 4-KV and 4.16 KV are used interchangeably in this evaluation).

Three different measures were used to evaluate and compare the two EDG configurations. These measures were

1. The probability of AC power availability on the 4.16-KV buses given that a loss of offsite power initiating event has occurred.

2. Total frequency of the failed 4KV-Bus states that results from the loss of offsite power initiating event. In this evaluation the following items were taken into consideration:

   A. Operational state of both units, e.g., power operation, shutdown, design basis accident with safety injection signal.

   B. Availability states of 4-KV buses, e.g., AC power available on all, some, or none of the four emergency buses.

3. Evaluations considered AC power recovery for both designs, Unit crosstie capability with the enhanced design, and considered a conservative probability of operator error for either design.

6.2 QUANTITATIVE EVALUATION METHODOLOGY

A quantitative evaluation of a system can be done in many different ways, particularly when the system mission success criteria depends upon the operating status of the two nuclear units, as well as the nature of the initiating event challenging the system. For this evaluation, two different measures were used to evaluate and compare the two EDG configurations.

The first measure is the probability of being in a particular 4-KV bus state, where a bus state is defined in terms of the availability of AC power on given combinations of the 4.16-KV buses following a loss of offsite power (LOOP) event.

The second measure is the total frequency of failed 4KV-bus states following a LOOP event, considering the different status of each of the two units (e.g., in power operation, shutdown, or DBA with SI).

The methodology for quantification of each of the two measures is described in the following sections.

6.2.1 4-KV Bus State Probabilities

The EDGs and their associated support and distribution systems are designed to respond to a loss of offsite power event which affects both nuclear power units. The EDGs supply onsite emergency AC power to the four (4) emergency buses, switchgear 3A, 3B, 4A, and 4B. The availability of AC power on these buses is a quantity which provides for an evaluation and comparison of the different EDG configurations.

After a LOOP event, the four emergency buses may be in one of sixteen 4-KV Bus states, as displayed in Table 6-1. A 4-KV Bus state is any combination of the four (4) emergency buses having and/or not having AC power after the LOOP event. For example, the first 4-KV Bus state has AC power on all four 4-KV emergency buses, whereas the 16th state has no AC power on any of the four 4-KV buses.

The conditional probabilities of these states (P_i) after a LOOP event add up to 1.0. The four emergency buses at the two units have to be in one of these 16 states. Also, these states are mutually exclusive; they can not exist at the same time.

It is desirable that P_1 be close to 1.0 and the probability of being in bus states 6, 7, and 12 through 16 be low. The 4KV-bus states 6, 7, and 12 through 15 correspond to single unit blackout, and state 16 is the station blackout at both units. The probabilities for the 16 states can be calculated by using fault tree modeling techniques, for each EDG configuration. Then the calculated probabilities can be compared for each bus state for the two configurations (e.g., compare P_i (existing configuration) with P_i (enhanced configuration), etc.).

6.2.1.1 Procedure for 4-KV Bus State Evaluation

The following procedure was utilized to evaluate EDG configurations using 4-KV Bus state probabilities as the measure of evaluation:

1. Fault tree models for the 4-KV Bus states, for the existing EDG configuration were constructed. Included in the models were random failures, common cause failures, operator action failures (if any), unavailability due to test and maintenance of the EDG's, failure of the distribution and support systems, etc.

2. A data bank using generic and plant specific data to quantify failures modeled in the fault trees was prepared.

3. Fault trees were quantified to obtain the failure probabilities of each bus state.

4. The dominant failure combinations and importances of components were identified and listed.

5. Results from the analysis are documented.

6. Steps 1, 3 and 4 were repeated for the enhanced EDG configuration. (The data bank of Step 2 was assumed to be applicable to both configurations.) Document the analyses and results.

7. Conclusions as to the acceptability of the bus state probabilities for each configuration were determined.

8. A comparison of the two EDG configurations from the bus state probability point of view was then performed

6.2.2 Estimation of the Total Frequency of Failed 4KV-Bus States

The total frequency of failed 4KV-bus states was the second measure used to quantitatively evaluate and compare the two EDG configurations. To quantify this frequency due to the LOOP event for each EDG configuration, the following multistate model was used:

The frequency f can be formally written as a product of three terms:

$$f = (f_{LOOP})\ (P_{plant\ state})\ (P_{bus\ state})$$

The first term refers to the plant specific initiating event frequency for the LOOP event, expressed as the number of LOOP events affecting both units per calendar year.

The second term refers to the probability of the two units being in a given plant state. A plant state is defined as the status of a unit during the LOOP event. The following three possibilities have been chosen as limiting conditions for the plant status:

1. A unit is in power operation (PO) (with probability P_{PO}).

2. A unit is in cold shutdown (SD) (with probability P_{SD}).

3. A unit is in DBA with SI (SI) (with probability P_{SI}).

The probabilities of these plant states for each unit are calculated. Note that these plant states are assumed to make up all of the possible states that a unit can be in. Thus these probabilities sum up to 1.0 for each unit. Any other conceivable intermediate state is to be classified as one of these three states and its probability is to be added to that of the proper state.

Based on the above classification, a total of 9 two-unit plant states can be defined, as shown in Table 6-2.

The third term ($P_{bus\ state}$) refers to the probabilities of failed 4-KV bus states, as described in section 6.2.1. These probabilities are calculated by using fault tree analysis results. Success and failure for a bus state are determined for each plant state.

[illegible]

The details of the calculations and the determinations are provided in Westinghouse Report "Quantitative Evaluation of Enhanced Emergency Diesel Generator Configuration for Turkey Point Nuclear Power Units 3 and 4 - Quick-Look Assessment", and in the FPL Reliability and Risk Assessment Group's "PTN EPS Quick-Look Assessment". The overall results are presented below.

6.3 RESULTS

When the power recovery capability of both the enhanced EPS inter-Unit crosstie and the existing system capability are modeled, the following results are obtained for the failure frequency (per year) of the 4 kV buses to provide AC power:

	EXISTING	ENHANCED
Events With Safety Injection:	1.2 E-07	8.7 E-08
Events Without Safety Injection:	2.1 E-04	6.7 E-06

Independently of the above calculations (i.e., not taking credit for power recovery), when the operator error rate is conservatively assumed as a probability of 0.1 (due to load management and operator action requirements), the failure frequencies (per year) are calculated as:

	EXISTING	ENHANCED
Events With Safety Injection:	3.2 E-07	2.3 E-07
Events Without Safety Injection:	2.1 E-03	6.7 E-05

As expected, for both cases studied above, the events with safety injection are low-probability events and therefore the failure frequency is also low. The existing and the enhanced designs both provide a low frequency for failed bus states for events with SI, with the enhanced design resulting in relatively "better" values (considering the already low frequencies calculated).

From a plant safety standpoint, the events without safety injection (i.e., the loss of offsite power events, with various bus failure states calculated) are a better indicator of how the enhanced design compares to the existing design, since events without an accompanying SI are more probable. As indicated above, the enhanced design provides a more reliable design in either of the two cases considered.

If the more-likely events without SI are considered, even without allowing for AC power recovery and without a conservative value attributed to operator error, the failure frequencies (per year) of the 4-KV buses to provide AC power are as follows:

	EXISTING	ENHANCED
Events Without Safety Injection:	2.1 E-03	6.7 E-05

Clearly, the enhanced EPS design provides a more reliable system which is better able to cope with various loss of offsite power scenarios. An enhanced capability is thus provided to mitigate relatively high-probability events.

TABLE 6-1

DEFINITION OF 4-KV BUS STATES

After a LOOP event, the site may be in various 4-KV Bus states. Each bus state refers to availability of AC power on a different combination of 4-KV buses. The following bus states may exist:

	AC Power On Emergency Bus					
State #	3A	3B	4A	4B	Probability	Comments
1.	Y	Y	Y	Y	P1	
2.	Y	Y	Y	N	P2	
3.	Y	Y	N	Y	P3	
4.	Y	N	Y	Y	P4	
5.	N	Y	Y	Y	P5	
6.	Y	Y	N	N	P6	Single Unit Blackout
7.	N	N	Y	Y	P7	Single Unit Blackout
8.	Y	N	Y	N	P8	
9.	Y	N	N	Y	P9	
10.	N	Y	Y	N	P10	
11.	N	Y	N	Y	P11	
12.	Y	N	N	N	P12	Single Unit Blackout
13.	N	Y	N	N	P13	Single Unit Blackout
14.	N	N	Y	N	P14	Single Unit Blackout
15.	N	N	N	Y	P15	Single Unit Blackout
16.	N	N	N	N	P16	Station Blackout

Sum of probabilities = 1.0

Y = Yes; there is AC power on the emergency bus.
N = No; there is No AC power on the emergency bus.

TABLE 6-2

DEFINITION OF PLANT STATES

Plant State #	Unit 3 Condition	Unit 4 Condition	Probability	Comments
1	PO	PO	PS1	States 1-4 refer to both units being in operation
2	SI	PO	PS2	
3	PO	SI	PS3	
4	SI	SI	PS4	
5	PO	SD	PS5	States 5-8 refer to one unit being in operation; the other in standby
6	SD	PO	PS6	
7	SI	SD	PS7	
8	SD	SI	PS8	
9	SD	SD	PS9	State 9 refers to both units being in standby

Sum of probabilities = 1.0

PO = Power Operation
SD = Cold Shutdown
SI = DBA with SI

7.0 CONCLUSIONS

The information presented in this Safety Analysis demonstrates that the enhanced EPS provides additional installed capacity at the Turkey Point Plant such that the design basis accident of LOOP, plus a LOCA on one Unit, plus the single failure of an EDG, is mitigated with 3 EDGs available. The 3 EDGs can be automatically loaded and manually loaded with the required loads for accident mitigation on one Unit and the achievement of safe hot shutdown on the non-accident Unit. In addition, the EDG loading capacity available for the design basis accident affords sufficient capacity for manual loading of the loads desired in the long-term recirculation phases of the accident or in the transition to cold shutdown for the non-accident Unit.

The Failure Modes and Effects Analyses, performed for the enhanced design, demonstrate that the minimum equipment required to mitigate the design basis accidents described in the FSAR is readily available with the enhanced EPS configuration, even assuming a single failure of an EDG to start. (In fact, more than the FSAR minimum equipment is often available for most accident scenarios.) Thus, the accident analyses in the FSAR remain valid as bounding analyses and the accident analyses results are not affected (i.e., still meet applicable regulatory requirements) as a result of reconfiguring the EPS by this enhancement project.

From a probabilistic standpoint, the enhanced system provides a reduction in the overall failure frequency of the 4-KV buses to provide AC power in the case of the LOOP and LOOP with SI events, as compared to the existing configuration. Hence, overall plant safety as measured by the availability of emergency power to the plant safety buses is improved under the enhanced EPS configuration.

8.0 REFERENCES

1. Updated FSAR, Revision 7, 7/89

2. FPL Letter to NRC, L-88-269, dated June 23, 1988, "Emergency Power System (EPS) Enhancement Project," submitting EPSER

3. FPL Letter to NRC, L-88-454, dated October 19, 1988, outlining New EDG Testing and requesting Waiver of 300-Start and Load Tests

4. FPL Letter to NRC, L-88-510, dated December 14, 1988, outlining the 10CFR50.59 Licensing Approach

5. NRC Letter to FPL, dated January 6, 1989, "Turkey Point Units 3 & 4 -Request for Additional Information on Emergency Power System Enhancement Project"

6. FPL Letter to NRC, L-89-54, dated February 24, 1989, submittal of first set of FPL Responses to NRC's 1/16/89 RAIs

7. FPL Letter to NRC, L-89-107, dated March 20, 1989, submittal of remaining FPL Responses to NRC's 1/16/90 RAIs

8. FPL Letter to NRC, L-89-124, dated April 3, 1989, submitting EPSER Supplement No 1: Testing

9. FPL Letter to NRC, L-89-144, dated April 17, 1989, submitting 10CFR50.63 Information on PTP Station Blackout

10. NRC Letter to FPL, dated March 16, 1990, "Turkey Point Units 3 & 4 - Request for Additional Information on Emergency Power System Enhancement Project"

11. FPL Letter to NRC, L-90-140, dated April 16, 1990, first submittal of FPL Responses to NRC's 3/16/90 RAIs

12. FPL Letter to NRC, L-90-160, dated May 2, 1990, second submittal of FPL Responses to NRC's 3/16/90 RAIs

13. Westinghouse Letter to FPL, FPL-86-561 dated March 3, 1986, "Emergency Operating Procedures/Emergency Diesel Generator Loading"

14. JPN-PTN-SENJ-89-140, Revision 0, "PTN EPS Quick-Look Assessment", January 1990

15. Westinghouse Letter to FPL, NS-RMOI-PRRA-244 dated December 27, 1988

16. NUREG/CR-2728, "Interim Reliability Evaluation Program Procedures Guide" (IREP), January 1983.

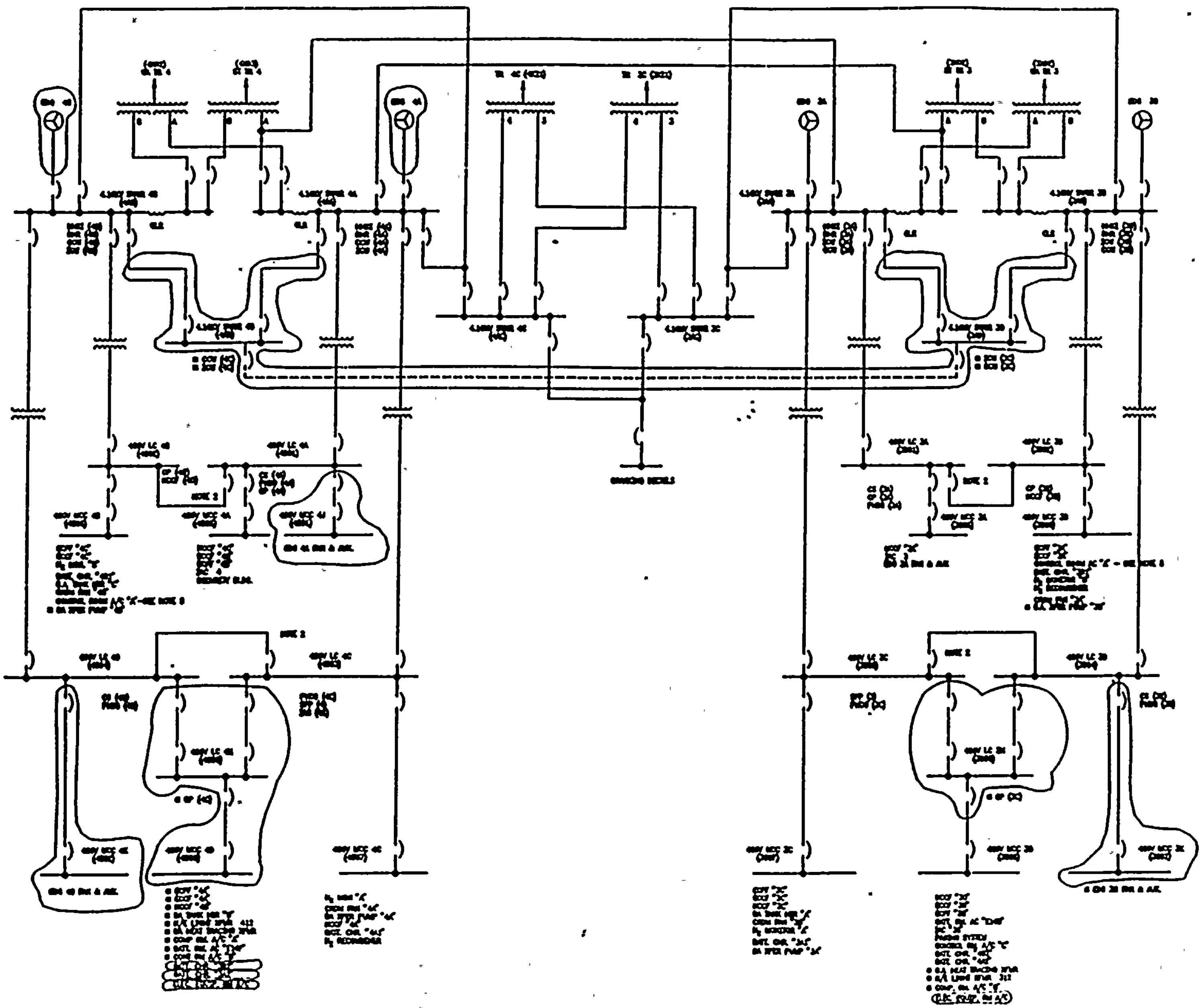
17. NUREG/CR-4550, Analysis of Core Damage Frequency from Internal Events: Methodology Guidelines, Volume 1, September 1987.

18. Westinghouse "Quantitative Evaluation of Enhanced Emergency Diesel Generator Configuration for Turkey Point Nuclear Power Units 3 & 4 - Quick Look Assessment", December 1988.

19. FPL Letter to NRC, L-86-256 dated June 16, 1988, "Reportable Event 85-42 (Revision 1), Turkey Point Unit 3, Date of Event: December 14, 1985 (original date), Emergency Diesel Generator Loading".

20. Westinghouse Letter to FPL, FPL-90-611 dated May 7, 1990, "Assessment for Proposed Diesel Loading Schemes"

21. Ebasco letter No. PTP-90-139 Transmittal of 4kVAC, 480VAC, and 125V dc FMEAs to FPL dated February 15, 1990.



SYMBOLS:

* RELOCATED EQUIPMENT (POWER SUPPLY) NOTE 1

--- SBO CROSSTIE

NOTES:

1. ONLY SELECTED SAFETY RELATED LOADS ARE SHOWN
2. BREAKER NORMALLY RACKED OUT
3. THE FOLLOWING NEW EQUIPMENT IS BEING ADDED UNDER EPS ENHANCEMENT PROJECT:
   - EDGs 4A & 4B
   - 4.16KV SWGR 3D & 4D
   - 480V LOAD CENTERS 3H & 4H
   - MCCs 3K, 4D, 4J & 4K
   - BATTERY CHARGERS 3A2 & 3B2
4. THE FOLLOWING EXISTING EQUIPMENT IS RELABELED UNDER EPS ENHANCEMENT PROJECT:

EXISTING	RELABELED
EDG A	EDG 3A
EDG B	EDG 3B
MCC D	MCC 3D
BATTERY CHARGER 3A	BATTERY CHARGER 3A1
BATTERY CHARGER 3B	BATTERY CHARGER 3B1
BATTERY CHARGER 3S	BATTERY CHARGER 4B2
BATTERY CHARGER 4A	BATTERY CHARGER 4A1
BATTERY CHARGER 4B	BATTERY CHARGER 4B1
BATTERY CHARGER 4S	BATTERY CHARGER 4A2

EXISTING BATTERY CHARGERS WILL BE REPLACED AND RELABELED AS SHOWN ABOVE.

5. CONTROL ROOM AC "A", FED FROM MCC 3B, CAN BE POWERED FROM MCC 4B VIA TRANSFER SWITCH.

INDICATES EQUIPMENT ADDED BY EPS ENHANCEMENT PROJECT

FLORIDA POWER & LIGHT COMPANY

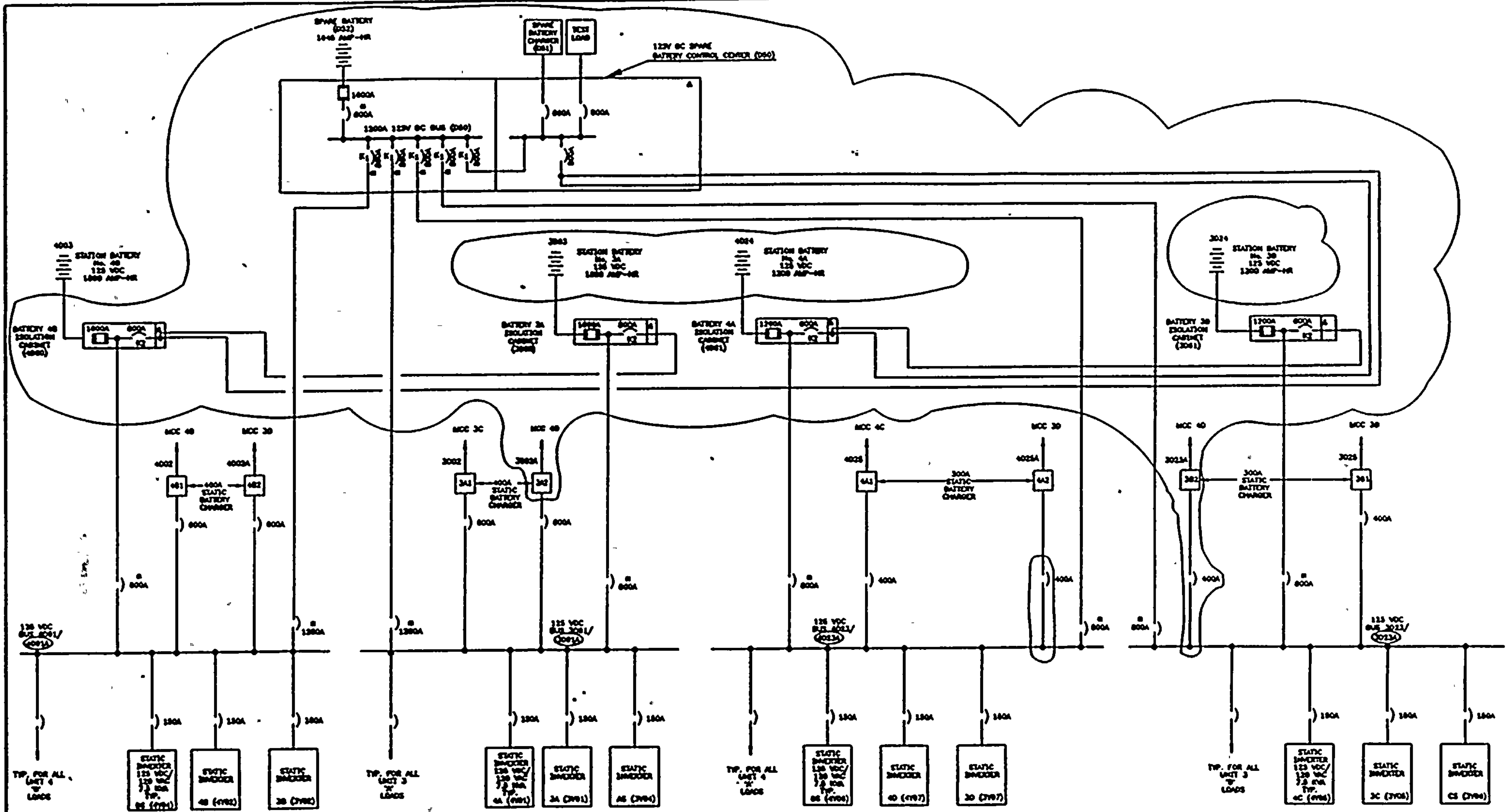
TURKEY POINT PLANT UNITS 3 & 4

EMERGENCY POWER SYSTEM ENHANCEMENT

AC ONE-LINE DIAGRAM

FIGURE 1

MAY 14 1990



NOTES:

1. K_1 AND K_2 ARE BREAKERS SUPPLIED WITH KIRK KEY LOCK (OR EQUIVALENT)
2. K_1 BREAKERS SHALL BE INTERLOCKED SO THAT ONLY ONE BREAKER MAY BE CLOSED AT ANY ONE TIME.
3. K_2 BREAKERS SHALL BE INTERLOCKED SO THAT ONLY ONE BREAKER MAY BE CLOSED AT ANY ONE TIME.
4. SYSTEM UTILIZES EXISTING BATTERIES.
5. EXISTING MCC D RELABELED MCC 3D.
6. EXISTING BATTERY CHARGERS REPLACED AND RELABELED AS FOLLOWS (3A2 AND 3B2 ARE NEW):

EXISTING	NEW
3A	3A1
3B	3B1
3S	4B2
4A	4A1
4B	4B1
4S	4A2

LEGEND

- ■ NON-AUTOMATIC BREAKERS
- K KEY INTERLOCKED BREAKERS
- ▲ NON-CLASS 1E SECTION

INDICATES EQUIPMENT ADDED BY EPS ENHANCEMENT PROJECT AND OTHER MODS

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT PLANT UNITS 3 & 4

EMERGENCY POWER SYSTEM ENHANCEMENT
DC ONE-LINE DIAGRAM

FIGURE 2