FLORIDA POWER & LIGHT COMPANY

TURKEY POINT UNITS 3 AND 4

EMERGENCY POWER SYSTEM ENHANCEMENT PROJECT DESIGN REPORT SUPPLEMENT NO. 0 REVISION 1

MAY 1990

TURKEY POINT UNITS 3 AND 4
EMERGENCY POWER SYSTEM ENHANCEMENT REPORT

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1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This Emergency Power System Enhancement Report serves a three-fold purpose: a) provide background information and descriptions of the existing Turkey Point Units 3 and 4 emergency power system; b) provide information regarding the enhancements Florida Power and Light Company (FPL) is implementing to upgrade the existing emergency power system; and c) provide information regarding the overall upgraded response to transients such as loss of offsite power (LOOP), and the Design Basis Accident - DBA, which is LOOP, plus LOCA on one Unit and a single active failure.

This introductory Section is structured to provide considerable background information which allows the reader to understand the sequence of events that led to the present Emergency Power System Enhancement Project, the details of which are given in Sections 2.0 through 7.0. Subsection 1.2 provides an overview of the contents of this Report. Subsection 1.3 provides a review of the earlier emergency diesel generator loading scenarios. Subsection 1.4 describes the series of studies Florida Power and Light Company conducted to reach an optimum solution to upgrade the Turkey Point emergency power system.

This Report is being provided to the NRC to support NRC staff approval of the enhanced Emergency Power System. A separate submittal containing the resultant proposed Technical Specification changes and No Significant Hazards evaluation will be docketed in 1990.

In addition, this report has been revised to reflect the current design, which has changed in certain areas since the initial issuance of this report. Also, this report has been updated by adding information on additional enhancements to the electrical system at Turkey Point. The major additional enhancements addressed in this revision are:

1. Sequencer Modifications
2. Addition of a Spare Battery
3. Modifications to the existing EDGs to achieve similarity between their operation and the new EDGs.

This information is being added at NRC's request. By reference 12, NRC requested that all major electrical system modifications, that could impact their review of the proposed Technical Specifications, be addressed in this report.

1.2 CONTENTS OF EMERGENCY POWER SYSTEM ENHANCEMENT REPORT

This Report contains the following major sections:

Section 1.0 provides an introduction and background for the proposed changes.

Section 2.0 provides an overview of the existing emergency power distribution system and an overview of the proposed modifications to the emergency power distribution system.

The Electrical/Instrumentation & Controls portion of the upgrade is presented in Section 3.0. The major topics within this Section are the discussions of the proposed modifications and the operation of the enhanced emergency power system.

Section 4.0 discusses operation of the enhanced Emergency Power System during transients and accidents, and demonstrates that the previous EDG loading restrictions are alleviated with the upgraded design.

Section 5.0 details the Mechanical/Structural aspects of the proposed modifications. The description of the new design for both structures and mechanical equipment are presented.

Section 6.0 discusses the plans for the sequence of installation of the new equipment and tie-ins to the existing emergency power system.

Section 7.0 describes the overall benefits of the resulting plant enhancement.

1.3 BACKGROUND REVIEW OF EMERGENCY DIESEL GENERATOR ELECTRICAL LOADS

INPO Significant Operating Experience Report (SOER) 81-10, "Event Sequences Not Considered in Design of Emergency Bus Control Logic," recommended that plants review their control logic schemes for Emergency Diesel Generator (EDG) breaker control, load shedding and load sequencing to ensure that the emergency power system would meet the design intent under all accident conditions involving loss of offsite power prior to or following the actuation of engineered safety features (ESF) equipment.

In response to the SOER, FPL initiated a review of Turkey Point Units 3 and 4 to determine if the plants were susceptible to the scenarios postulated in the SOER. The review, completed in March 1983, concluded that Turkey Point Units 3 and 4 appeared to be susceptible to one of the three scenarios postulated in the SOER. One of these scenarios involved a postulated loss of offsite power with no ESF actuation initially required. In this scenario, the shutdown loads would be carried by each EDG and would include loads which automatically load on the diesels and any manual loads added by the Control Room operators. If an accident requiring automatic ESF actuation was to subsequently occur, the addition of the ESF loads to the emergency buses could potentially lead to EDG overload since the existing nonessential loads would not have automatically shed.

In December 1983, the scope of the review was expanded to include a determination of those loads not automatically stripped on receipt of an ESF actuation signal while offsite power was unavailable.

Between September and October 1984, FPL's review raised questions regarding the accuracy and completeness of loading data tabulated in the Final Safety Analysis Report (FSAR). A review was begun of all EDG loads to establish the method of actuation of each load start signal (manual or automatic, instantaneous or delayed, etc.). The review included the reevaluation of design logic drawings and requirements specified in Emergency Operating Procedures (EOPs). In May 1985,

the Nuclear Steam Supply System (NSSS) vendor was requested to review the FSAR loading table with respect to the safety analysis to determine if the appropriate equipment, loading times, and operating times were shown. This review was completed in September 1985, and was made available for incorporation into the EDG loading evaluations previously implemented.

In December 1985, a preliminary report showed EDG loading higher than expected with actual loading values different from those recorded in the FSAR. An engineering evaluation of the situation in the format of a Justification for Continued Operation (JCO) was issued on December 15, 1985 (Reference 1).

The NRC was informed of the problem and FPL's proposed corrective actions. The administrative controls specified in the JCO were implemented.

On January 8, 1986, FPL met with the NRC Region II staff to discuss EDG loading. The December 1985 JCO was discussed as well as long-term plans for corrective actions.

Administrative controls were developed along with changes made in the EOP to control the loads on the EDG buses. With the changes made, the JCO for Unit 3 was revised, with Unit 4 to remain in cold shutdown, in January 1986. Various other changes were instituted to provide for electrical load management for the EDGs in emergency situations.

In February 1986, the final report (as opposed to the December 1985 preliminary report) on EDG loading was completed. This report provided more accurate estimates of the kilowatt (kW) loads placed on the EDGs by equipment likely to be operated under accident conditions. Additionally, the final report utilized actual test data for the CCW and ICW pump kW load rating. The loading estimates for several components were increased over those used in the December 1985 JCO. The loading estimates for other loads decreased or remained unchanged.

On March 29, 1986, FPL completed a second JCO (Reference 2) which justified the operation of Unit 3 while requiring Unit 4 to remain in cold shutdown. This JCO was necessary because the final EDG loading report of February 1986 indicated pump kW loads in excess of those assumed to exist in the December 1985 JCO. FPL estimated that during the assumed accident, the 2750 kW auto-connected Technical Specification (TS) surveillance limit and the 2950 kW limit incorporated in the EOPs could be exceeded. Since Unit 4 was in a refueling shutdown condition,

the first phase of the March evaluation centered on a basis for continued operation of a single unit. Consequently, the results of the evaluation limited Unit 4 to the cold shutdown condition. Additionally, to provide the EDGs with the load capacity for Unit 3 operation, the flow configuration of the Unit 4 intake cooling water (ICW) and component cooling water (CCW) systems were restricted such that one ICW pump and one CCW pump together would place a 500 kW load on the EDG as opposed to the 639 kW the Unit 4 would normally draw. The Reference 2 JCO was revised to reflect this information.

Region II issued a Confirmation of Action Letter (CAL) on April 2, 1986, which documented actions to be taken by FPL. The CAL indicated (Reference 3) that FPL would perform the following prior to restart of Units 3 and 4:

"1. Total loads on emergency diesel generators will be reduced to no more than 2845 kilowatts per diesel generator and procedures will be changed, and operators trained on these changes prior to assuming duties, to assure operation within this limitation.

2. A written safety evaluation performed pursuant to 10 CFR 50.59 of the reduced diesel generator loading demonstrates that, with Unit 4 in a cold shutdown condition:

   Unit 3 can be operated safely, in accordance with Technical Specifications, and within the bounds of currently approved accident analysis for the full range of accident break spectra.

   Unit 4 can be safely maintained in cold shutdown.

   This evaluation will be formally submitted to the NRC prior to Unit 3 entering mode 2.

3. A safety evaluation of diesel generator loading for concurrent operation of Units 3 and 4 will be completed and approved by the NRC prior to restart of Unit 4."

FPL responded to the Reference 3 CAL with a JCO (Reference 4) which allowed Unit 3 to restart while Unit 4 remained in cold shutdown. Unit 3 was returned to power operation on April 9, 1986. Unit 4 remained in the cold shutdown condition while FPL evaluated acceptable methods of load reduction and management. FPL discussed long term corrective actions, which could lead to the operation of Unit 4 at power, with the NRC Region II staff on May 20, 1986.

In letters dated June 12, 1986 (Reference 5) and July 16, 1986 (Reference 6), FPL provided to NRC an EDG load evaluation and answers to NRC questions detailing the EDG loads, the EDG capabilities and ratings, and the effects and corrective actions to be taken during a loading sequence to accommodate the single failure of one EDG. The proposed corrective actions consist of manually applying or removing plant system loads to accommodate the defined loading requirements within the EDG ratings.

By letter dated June 26, 1986 the NRC allowed concurrent operation of Units 3 and 4, subject to completion of the corrective actions. At the same time, the staff reviewed the FPL EDG load evaluation submittals to assess the operational and accident conditions at the two Units, containment pressure and temperature conditions, diesel engine and diesel generator electrical capability and human factors considerations. These assessments were based on the information provided in FPL's submittals on EDG load evaluation and several telecon discussions with FPL.

The NRC provided a Safety Evaluation (SE) in a letter dated December 15, 1986 (Reference 7). The NRC's SE concludes that the loads for the various conditions are in conformance with Regulatory Guide 1.9, Position C.2; the operator actions described are acceptable and are consistent with FPL's accident analysis and emergency operating procedures; the containment pressure and temperature analysis is acceptable; an adequate human factors analysis was performed; and therefore, the proposed corrective actions relating to the emergency diesel generator loads are acceptable.

1.4 ENHANCEMENT OPTIONS

In parallel with the EDG loading evaluations being conducted in 1986 as discussed in Section 1.3 above, in January 1986 FPL management authorized what became a three-phased Contractor study to review viable alternatives to the existing Turkey Point EDG arrangement taking into account the previously identified EDG load constraints, reliance on operator actions, applicable Safety Evaluations/JCOs, etc. In late January 1986, as Phase I of the review, some twenty alternatives were presented against a matrix of seventeen considerations.

In early February 1986, as Phase II of the study, FPL chose six of those alternatives for further analysis. These alternatives, plus an alternative added later for consideration, were:

1) Obtain a larger engine that will fit the existing skid

2) Add one new Class 1E EDG (a "swing" EDG)

3) Add one new Class 1E EDG (a "slow-start" EDG)

4) "Separate" Turkey Point Units 3 and 4 AC system to the extent practicable and add two new Class 1E EDGs

5) Provide auto-start capability for the cranking ("black-start") EDGs

6) Upgrade the existing EDGs by testing

7) "Separate" Turkey Point Units 3 & 4 AC system to the extent practicable and provide four new Class 1E EDGs

The Phase II letter report recommended further study of a four-EDG configuration (alternatives 4 or 7). In May 1986, FPL authorized Phase III of the study, to consider the following options: a) add one new Class 1E EDG or b) add two new Class 1E EDGs to the Turkey Point site (in various electrical configurations).

The final conceptual study on these two options was completed in August 1986. The options reviewed in this study (three EDGs or four EDGs) resulted in six proposed electrical arrangement schemes, which were critiqued as to how well each scheme met the following goals:

1) Increase EDG Capacity - Improve plant safety by providing a scheme which affords additional installed emergency AC capacity.

2) Reduce Operator Actions - Improve plant safety by reducing operator actions associated with load management activities.

3) Single Failure Accomodation - Improve plant safety by providing a design which is more impervious to single failure, (e.g., EDG failure to start, loss of 4.16kV bus, battery failure, etc.).

4) Minimize Maintenance/Testing Downtime - Improve plant safety by providing a design which requires the least amount of downtime and least limiting conditions for operation (LCOs) on the non-outage Unit when performing maintenance/periodic testing on the other Unit or redundant electrical trains.

5) Safeguards Testing - Provide a design which will minimize two-unit outage when performing safeguards testing on either Unit.

6) Accommodate Plant Needs - Provide a design which accommodates present and future system changes and load increases.

7) Minimize Implementation Downtime - Provide a scheme which affords the least amount of outage downtime (replacement power cost), on either or both Units to implement the given scheme.

In late 1986, FPL authorized a detailed design study, the Emergency Power System Enhancement Study, to provide a conceptual design for the option finally selected: "separating" the Turkey Point Units 3 and 4 AC power system to the extent practicable and adding two new Class 1E EDGs to the site. Note that complete separation of the Turkey Point Units is not possible due to the present common and shared systems (e.g., High Head Safety Injection pumps and DC System) which presently exist at the plant.

2.

A conceptual design was completed in May 1987, and FPL authorized the implementation of this four - EDG scheme.

The installation of two additional EDGs plus enhancements to the emergency power distribution system at Turkey Point is a complex, carefully evaluated process which encompasses engineering, design, procurement and construction/installation activities spanning a timeframe from 1987 to 1991. Actual plant electrical reconfigurations of Train A and Train B on each Unit are tied to a dual Unit outage scheduled to begin in 1990. The required modifications are divided into several Engineering Packages (EPs), with the earlier EPs involving construction, installation and checkout of equipment without modifying the current electrical distribution system. The later EPs involve electrical modifications requiring a dual Unit outage.

1.5 ADDITIONAL EPS ENHANCEMENTS

In addition to adding two EDGs as discussed above, other electrical system enhancements are also going to be provided during the dual unit outage at Turkey Point. These primarily consist of:

1. Emergency load sequencer replacement and sequencer timing modifications (load blocks)

2. Replacement of existing battery chargers and the addition of two new battery chargers

3. The addition of a spare safety-related battery

4. Modifications to the existing EDGs to achieve similarity between their operation and the new EDGs.

5. The addition of a Station Blackout cross-tie.

6. The addition of two new 4.16 kV switchgears, two new 480V load centers and four new 480V motor control centers.

7. Delaying the start of selected loads (primarily HVAC) to enhance the dynamic response of the EDGs during the loading cycle.

8. Repowering of selected loads and other modifications to address potential single failure vulnerabilities.

The background of each of these enhancements is discussed below and other details are addressed as appropriate in the body of this report.

1.5.1 Sequence Timing Modifications

The existing sequencers are being replaced with new solid-state type sequencers and the sequencer timing is being modified as an enhancement.

The results of this effort are as follows:

1. With offsite power available and an SI signal, the emergency loads required to mitigate consequences of the event are sequentially started by the bus loading sequencers.

2. The overall timing interval has been extended to 39 seconds for accidents with offsite power available and 55 seconds for accidents without offsite power. The number of load blocks has increased to seven auto-loading commands, with the possibility of two final auto-load commands at/after 44 or 60 (with LOOP or LOOP/LOCA) seconds. These last two loads consider a possible late start of the Containment Spray Pump (due to late receipt of the High High Containment Pressure safeguards signal arriving at the Sequencer after the initial window allocated for sequential loading of this equipment has expired), and a possible late start of an Emergency Containment Cooler at 57 or 73 seconds (due to EDG loading concerns during the sequencing time).

1.5.2 Replacement of Battery Chargers and Additions

The existing six battery chargers are being replaced due to difficulty in securing spare or replacement parts. Also the existing configuration of two shared swing charges is being modified such that each battery will have two dedicated chargers powered from independent sources. This new configuration required the addition of two new battery chargers. The replacement battery chargers, as well as the two new chargers, are designated Class 1E and are seismic Category I.

1.5.3 Addition of Spare Battery

This modification involves the addition of a permanently installed spare station battery, the associated switching system and a new battery room. This enhancement allows the substitution of any of the four existing vital station batteries for a period of time during maintenance and capacity testing. This modification enables the plant to perform the appropriate tests, (e.g., capacity and performance test) in accordance with IEEE Standard 450, on the vital station batteries without entering into a Limiting Condition of Operation. This modification also precludes the need to cross-tie the 125V DC busses when performing test or maintenance on a battery. For future battery test and maintenance the spare battery will be connected to the appropriate 125V DC bus when the battery to be tested is disconnected, such that the bus is always aligned to a safety-related battery and no DC train will be cross-connected. The spare battery is safety-related and is functionally equivalent to any of the existing station batteries under all design basis conditions.

1.5.4 Modifications to Achieve Similarity Between Existing and New EDGs

Special attention has been given to modify the existing EDG control room controls and instrumentation to be similar to those of the new EDGs. The major areas covered in the similarity modifications are listed below:

a. Control switches, pushbuttons, indicating lights, and instrumentation
b. Conditions to be alarmed and legends on annunciator windows
c. EDGs protection during emergency operation
d. Remote metering
e. EDG control philosophy
f. Addition of an idle start capability (pending final plant approval)

1.5.5 Station Blackout

In accordance with FPL's response to the Station Blackout (SBO) Rule (Reference 11), a cross connection between Units 3 and 4 is provided via SBO tie breakers on new 4.16 KV switchgears 3D and 4D.

The control circuitry includes permissives and interlocks to prevent inadvertent closure of the SBO tie breakers. When the required permissives are satisfied, the SBO tie breakers can be manually closed by operation of the administratively controlled key lock operated control switches (one for each unit) provided in the control room. SBO permissives satisfied and breaker position indicating lights are also provided in the control room.

1.5.6 New 4.16 kV Switchgears, 480 V Load Centers and 480 V Motor Control Centers

New 4.16 kV Switchgear 3D/4D is designed as a manual swing bus capable of being powered from existing 4.16 kV Switchgear 3A/4A

(Train A) or 3B/4B (Train B). The existing CCW 3C/4C and ICW 3C/4C pump motor feeders and controls will be relocated from Switchgear 3A/4A and 3B/4B, respectively to the new Switchgear 3D/4D. The breaker cubicles in Switchgear 3A/4A and 3B/4B previously servicing CCW 3C/4C and ICW 3C/4C pump motors will be reassigned as the power feeds to Switchgear 3D/4D.

The new 480 Volt Load Center 3H/4H is designed as a swing bus capable of being powered from either existing 480 Volt Load Center 3C/4C (Train A) or 3D/4D (Train B), and will be installed in the new Electrical Equipment Room (refurbished Hot Machine Shop). Two new circuit breakers (per unit) will be installed, one in Load Center 3C/4C and one in 3D/4D, to function as the power feed to Load Center 3H/4H, capable of providing power to Load Center 3H/4H from either Train A or Train B. Load Center 3H/4H has been designed to automatically transfer from the aligned source to the other train,

provided the other train has available power and other permissives are satisfied. The power feed can only be manually retransferred upon repowering of the normal source, unless the alternate source is lost and the normal source is available. The existing Charging Pump 3C/4C motor feeders and controls will be relocated from Load Center 3C/4C to new Load Center 3H/4H.

New 480 Volt MCC 4D will be installed in the new Electrical Room and is powered from Load Center 4H. Existing MCC D is relabelled as 3D and will be powered from Load Center 3H. New MCC 3K, 4J and 4K have been added to power the auxiliaries of EDGs 3B, 4A and 4B, respectively.

1.5.7 Delay of the Starting of Selected Critical Loads

In order to minimize the disturbances to the EDG dynamic response during the emergency loading cycle, the re-energization after a LOOP of a selected number of process loads will be delayed. In those cases where the process loads contain inherent time delays, no additional time delay was required.

1.5.8 Repowering of Selected Loads

Selected loads have been repowered based upon the results of the Failure Modes Effect Analysis performed for this project (see Figure 1). New raceways have also been added, as required, to insure that redundant loads within, and between, Units 3 and 4 have their power and control cables routed independently of each other such that a raceway failure will not cause loss of redundant loads. Other unique potential single failure vulnerabilities have also been identified during the design process and appropriately resolved. For example, DC transfer switches have been added to eliminate single failure concerns for DC control power on 4.16 kV Swing Switchgear 3D and 4D. Also, an AC transfer switch has been added for a Control Room AC unit to insure that 2 out of 3 units are available upon a single failure.

2.0 OVERVIEW: EXISTING DESIGN AND ENHANCED DESIGN

2.1 EXISTING EMERGENCY POWER SYSTEM

The existing Turkey Point Units 3 and 4 emergency diesel generators (EDGs) and emergency electrical distribution system provide for emergency power in the event of loss of offsite power in order to bring both Units to a safe (hot) shutdown condition. This is achieved using automatic initiations and actuations as well as operator actions (see Subsection 1.3).

The emergency diesel generator load ratings are 2500 kW for base continuous operation with a 1/2 hour exceptional rating of 3050 kW. The worst case plant loads placed on an emergency diesel generator during an accident (requiring safety injection on one plant and normal shut down on the other in conjunction with loss of offsite power to both Units plus a failure of one EDG) result in about 2750 kW of automatically connected loads, initially, and then approximately 2500 kW for the duration of the accident. The first half-hour of this postulated accident scenario requires short term loads in the 2000 hour rating of 2850 kW and load management for loads approaching 2950 kW. Refer to Subsection 1.3; Table 1 depicts the presently evaluated EDG B loads for the above scenario.

The existing emergency power generation system utilizes two diesel generator sets. Each diesel engine is a turbocharged, two cycle engine which is coupled to a generator. Each engine is started by two air motors which are automatically activated by respective signals representing either a loss of 4.16 kV voltage on either the A and/or B 4.16 kV buses, degraded voltage on 480V load centers or a safety injection signal on either Unit.

The existing EDGs are designed to attain operating speed (900 RPM) and voltage (4.16 kV) with the ability to assume load in 15 seconds or less. The loading is done automatically by electromechanical cam timers and relays in a predetermined sequential order. Either EDG is capable of supporting those loads associated with achieving and maintaining a safe (hot) shutdown condition in one plant while mitigating the postulated accident on the other.

The EDGs are located in separate rooms of a seismic Class I structure. Each diesel generator system is monitored to alert personnel of off-normal conditions. Monitoring instrumentation for each EDG is located on the main control board and on local control panels.

Each diesel engine uses No. 2 fuel oil from its own 4000 gallon day tank. This tank is an ASME Section VIII tank with Class I requirements and is separated from the other diesel day tank by a concrete wall. The tank feeds the engine through a solenoid valve by gravity feed to the associated diesel generator skid mounted 275 gallon fuel tank. The two day tanks are supplied by a common Diesel Oil Storage Tank (DOST).

Transfer of fuel oil from the storage tank to the day tank is accomplished automatically by one of two electric motor driven transfer pumps to maintain desired level in the day tank. Fill connections for filling from a mobile tank unit are provided should the normal supply via the diesel oil transfer pumps become unavailable.

The emergency power distribution system responds to undervoltage signals by tripping all feeder breakers and the main supply breakers of the affected 4.16 kV bus and by starting the diesel in the emergency mode of operation. After the diesel generator has come up to speed and voltage and all the bus breakers are tripped, the sequencer automatically closes the generator output breaker and energizes the affected 4.16 kV bus. The load sequencer then closes the circuit breakers to re-energize the load centers and Motor Control Centers. Intake Cooling Water pumps and Component Cooling Water pumps are automatically started. To continue the shutdown of each Unit on loss of offsite power, further operations are performed manually by the operator in accordance with Emergency Operating Procedures (EOPs).

If the diesel start involves safety injection with a loss of offsite power, the load sequencer starts the engineered safety features (ESF) equipment at preset intervals.

In the event of a safety injection signal with offsite power available, the necessary ESF. equipment is automatically connected to the power distribution buses by the action of the sequencer without any timing delay. The safety injection signal, in this case, starts the EDGs but they are not connected to the plant distribution system unless a loss of offsite power occurs also.

Under no circumstances are the EDGs operated in parallel with each other. If one diesel generator is not available, it is automatically locked out. The loading of the remaining diesel generator is accomplished to ensure safe shutdown of both Units.

2.2 ENHANCED EMERGENCY POWER SYSTEM

The enhanced emergency power system includes separation of existing EDGs, the construction and/or installation of two new emergency diesel generators 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, two new 4.16 kV switchgears, two new 480V load centers, four new 480V motor control centers, one new spare station battery and associated control center, two new 125V DC transfer switches, five new 125V DC distribution panels, four new sequencers, new battery chargers, etc, plus lighting distribution panels/transformers, cabling and numerous components necessary for modifying the existing equipment and repowering and/or relocating existing loads. See Figures 1 and 2 for a one-line electrical diagram of the AC and DC systems, respectively.

The two new diesel generators include the capability of manual air start and self-excitation which allows starting without depending on outside AC or DC power sources.

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 centers, etc., located on the upper level. Also located on the upper level are the two new 4.16 kV swing busses, one for each Unit. Figures 3 through 8 depict the new EDG Building layout. The new Diesel Oil Storage Building Layout is shown on Figures 3 through 5, 7 and 8.

As part of the Emergency Power System enhancement project, existing 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 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. The 4A EDG supplies power to the Unit 4A power system and the 4B EDG supplies the Unit 4B power system.

The four existing load sequencers are replaced with four new qualified solid-state type sequencers (one per train/EDG) which primarily perform two functions, "Bus Stripping/Cleared" and "Load Sequencing".

The bus stripping function trips and blocks starting of electrical loads on the 4.16 kV switchgear, 480V load centers or 480V motor control centers; the bus clearing function verifies that the 4.16 kV switchgear breakers have tripped. The bus sequencing initiates the necessary load activation to mitigate the consequences of a plant accident.

The load sequencing in the new sequencer is performed through seven blocks (eight blocks when considering a late High-High Containment Pressure input to start the Containment Spray Pumps) as compared to four load blocks in the existing load sequencers.

Modifications to the stripping and loading of safety related equipment are summarized below:

Stripping:

a. On loss of offsite power with a subsequent Safety Injection signal, the stripping signal will trip all the 4.16 kV, 480 V load centers, and 480 V MCCs that energize on LOOP except for the EDG breaker, which will remain closed.
b. With the EDG parallelled to the grid, the EDG breaker will receive a command to trip on Safety Injection with offsite power available.

Sequencing:

a. The sequencing logic reflects the addition of three new load sequencing blocks.
b. The start of the Containment Spray Pump is allowed at a selected load block or at the termination of the loading sequence, depending on time of receipt of the High-High Containment Pressure (HHCP) signal.
c. The start of the swing Emergency Containment Cooler is allowed at a selected load block or at a selected time after the termination of the loading sequence, by a timing circuit.
d. The sequence of engineered safeguards loads with offsite power available upon receipt of Safety Injection signal.

More specifically, the results of these modifications to the sequencers are as follows (note: times are given as times following the start of the sequencer):

a. On SI (as the initiating event) with an HHCP signal, the Containment Spray Pump (CSP) will start at 11 seconds after the sequencer timing starts. This load block also contains a 2 second window (i.e., 11 seconds through 13 seconds) during which the CSP will start if an HHCP signal is detected.

b. On SI with an HHCP signal detected after 13 seconds but before completion of the sequencing cycle, the CSP will start at completion of sequencing (i.e., CSP starts when EDG sequencer resets). If the HHCP signal occurs after sequencer reset, the CSP will start on receipt of HHCP.

c. If a single failure were to occur during the sequencing process, such that a swing load center (3H or 4H) would need to transfer, this transfer is permitted up to 5.5 seconds, or else delayed until 39 seconds. If delayed, then an ECC will load at 57 seconds.

d. The swing auto-loading HVAC systems have a timer relay installed in their control circuitry which delays starting of these systems by at least 70 seconds if a loss of offsite power condition exists.

The new swing 4.16 kV switchgear 3D supplies power to Intake Cooling Water (ICW) Pump 3C and Component Cooling Water (CCW) Pump 3C; likewise, the new swing switchgear 4D supplies power to ICW Pump 4C and CCW Pump 4C. These ICW and CCW Pumps are now available as installed spares for either A or B pumps. For example, if one of the normally running ICW Pumps on Unit 3, ICW Pump 3A (or ICW Pump 3B) is taken out of service for testing, maintenance or repair, the 3C ICW pump powered from the 3D switchgear may be put into service by aligning the 3D switchgear to the 3A (or 3B) switchgear. 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. A new tie feeder will be provided between the 4.16 kV busses 3D/4D which will make possible the interunit intertie to power a bus in the blackout unit by connecting it to the operating EDG in the opposite unit.

Each Unit has a new 480V load center swing bus located on the ground floor in the Auxiliary Building hot machine shop (which is being converted to an Electrical Equipment Room). See Figure 9.

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. These Charging Pumps are now available as installed spares for either A or B pumps. For example, if one of the normally running Charging Pumps on Unit 3, CP 3A, (or CP 3B) is taken out of service, the 3C CP powered from Load Center 3H may be put into service by aligning the 3H Load Center to the 3C (or 3D) Load Center. Refer to Figure 1. Each swing load center can be aligned to either Train A or Train B of its associated Unit. However, during normal operation, the alignment of these swing load centers is 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 other power source if power is available there. The control logic contains an interlock to prevent parallel operation of load centers 3C (4C) and 3D (4D).

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, existing plant common loads and other new loads. New MCC 4D is added to supply loads associated with Unit 4 that are presently fed from MCC D, as well as existing common loads and other new loads. New MCCs 4J and 4K are added to power the auxiliary loads for the new EDGs. Refer to Figure 1. The existing EDG A (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 there will be no safety loads without redundant counterparts connected to these MCCs. With the enhanced design, MCCs 3A and 4A are powered from the Train A of each Unit and the redundant safety loads are powered from Train B.

The existing MCC D provides power to the Plant's common, shared and third service loads. This MCC also 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 deleted. See the above discussions on the new swing 480V load centers, 3H and 4H, and the new MCCs for additional details on the transfer scheme.

The existing six battery chargers are being replaced with six new battery chargers, and are being relabeled as follows: Battery Charger 3A relabled as 3A1, 3B as 3B1, 2S as 4B2, 4A as 4A1, 4B as 4B1, and 4S as 4A2. These are being replaced due to increased maintenance requirements and difficulty in securing spare and/or replacement parts. Two additional battery chargers, 3A2 and 3B2, are added as new equipment. These modifications result in two battery chargers, powered from independent sources, aligned to each DC bus, as shown in Figure 2. The battery chargers 3A2 and 3B2 are to be powered from the new MCC 4D, and the relabeled battery chargers 4A2 and 4B2 are powered from (relabeled) MCC 3D. With two battery chargers aligned to each DC bus, a single failure of a battery charger or its MCC still assures that one battery charger is available per DC bus.

The addition of a permanently installed spare station battery, the associated switching system and a new battery room allow the substitution of the spare battery for any of the four existing vital station batteries for a period of time during maintenance and capacity testing. This modification enables the plant to perform the appropriate tests (e.g., capacity and performance tests) in accordance with IEEE Standard 450 on the vital station batteries without entering into a Limiting Condition of Operation for scheduled or unscheduled battery maintenance or testing. This modification also precludes the need to cross-tie the 125V DC busses as has been done in the past when performing tests or maintenance on a battery. For future battery tests and maintenance, the spare battery will replace the battery to be tested, such that the bus is always aligned to a safety-related battery and no DC train will be cross-connected. The spare battery is safety-related and is functionally equivalent to any of the existing station batteries under all design basis conditions.

The bus section of the 125V DC spare battery control center for the spare battery connection and the power feeds to the four vital busses are separated by a tie breaker from the bus section for the battery charger connection and the connection to the DC test load. The breakers are key interlocked to allow the closure of only one of these breakers at a time. The key locking ensures that only one of the vital busses may be connected to the spare bus at any time and ensures that during this time, the DC test load and spare battery charger are isolated from the spare bus.

The non-Class 1E spare battery charger is only used to keep the spare battery charged when not in use. When the spare battery is substituted for any of the existing vital batteries, the battery charger(s) associated with that battery's DC bus will be used to keep the spare battery charged.

The spare battery will be housed in a Battery Room within the new Electrical Equipment Room. Provisions for HVAC (both safety and non-safety related trains), exhaust ventilation for hydrogen removal, fire detection, communication and lighting are provided for this room.

As a result of these additions and modifications, Turkey Point Units 3 and 4 have a safer, more flexible system with the capability of having one train out of service without significantly affecting the other Unit and, by use of swing bus arrangements, have additional loads available. Components are more available for maintenance since the new plant alignments allow items to be taken out of service with lessened Technical Specification impact. The increase in emergency power generation capacity and the addition of switchgear, 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.

3.0 ELECTRICAL/INSTRUMENTATION AND CONTROL MODIFICATIONS

This Section describes the electrical and instrumentation/controls modifications being performed as part of the Emergency Power System Enhancement Project.

3.1 EMERGENCY DIESEL GENERATORS (EDGs)

The existing emergency power distribution system configuration consists of two diesel generators shared between the two Units. Under this configuration one diesel feeds the 'A' bus of each Unit and the other diesel feeds the 'B' bus of each Unit. With the enhanced configuration, there is one diesel generator assigned to each of the four safety busses (see Figure 1); specifically, the new diesel generators power 4.16 kV busses 4A and 4B and the existing diesels power 4.16 kV busses 3A and 3B. The connections between the existing (now Unit 3) diesel generators and the 4.16 kV buses on Unit 4 are removed under the Emergency Power System Enhancement Project. In accordance with FPL's response to the station blackout rule, a new electrical tie between the Unit 3 and 4 4.16 kV busses is being installed through the swing switchgears 3D and 4D. The station blackout tie breakers on buses 3D and 4D are provided with hardwired interlocks and are also administratively controlled.

3.1.1 Unit 3 Emergency Diesel Generators

The two existing EDGs are General Motors, Electro-Motive Division (EMD) Model 20 645E4 design coupled to a Model A20 EMD generator. Each set was supplied by A.G. Schoonmaker Company, Inc. The output of each EDG is nominally rated as follows:

Base continuous rating: 2500 kW
Basic overload rating: 2750 kW

The supplier has indicated that the EDG basic overload rating corresponds to the IEEE Standard 387-1977 "short time" rating.

The re-assignment of these EDGs to Unit 3 service requires modifications to the original EDG control schemes to delete the Unit 4-related control interlocks and their associated components and to achieve a similarity in operation between EDGs of Unit 3 and Unit 4. The most significant modifications that will be implemented to make the operation of the existing EDGs similar to the new EDGs are summarized below:

- Provision for idle start capability (final design approval pending)
- Provision for Isochronous/Droop operation
- Normal start/stop capability
- More accurate/reliable speed detection
- All protective signals automatically bypassed during emergency operation except generator differential and overspeed
- Improved control room indication
- Idle coast down (cooldown) capability
- Reflash Annunciation

3.1.2 Unit 4 Emergency Diesel Generators

The new Emergency Diesel Generators are supplied by Morrison-Knudsen, Inc. Each set consists of a General Motors Electro-Motive Division Model 20-645F4B design, turbo charged, two cycle engine which is coupled to a Model #140 Electric Products generator. The output of each diesel generator set is nominally rated as follows:

Base Continuous rating: 2874 kW
Basic Overload rating: 3162 kW

The new EDG auxiliaries and other support systems required to ensure safe and reliable operation of the new EDGs are discussed in Section 5.0.

Monitoring instrumentation is provided for each new EDG at the main control board and at the new local panels consistent with the existing diesels.

3.2 4.16 kV SWING SWITCHGEAR

Two new 4.16 kV switchgear, one (3D) used as a Unit 3 swing bus and one (4D) as a Unit 4 swing bus, are located in the new Diesel Generator Building. The swing switchgear of each Unit can be manually aligned to either 4.16 kV A or B train via a double ended tie system. Interlocks ensure that the swing switchgear can only be connected to one 4.16 kV bus at a time. The swing switchgear powers installed spare loads (i.e., the Component Cooling Water or Intake Cooling Water pumps) when they are required to replace an inoperable A or B Component Cooling Water pump or an Intake Cooling Water pump. Also, for a station blackout scenario and employing an "Alternate AC" coping strategy, new tie breakers will be provided on bus 3D on Unit 3 and bus 4D on Unit 4. The 4.16 kV swing switchgear (3D and 4D) along with the station blackout cross-tie will be utilized to provide power to the blacked-out unit from the non-blackout unit. In order to satisfy Regulatory Guide 1.155 on station blackout, an administratively controlled key operated control switches are installed for the two intertie breakers to preclude inadvertant energization of the station blackout intertie.

3.3 480V SWING LOAD CENTERS

Two new 480V swing load centers are being added, one (3H) for Unit 3 and one (4H) for Unit 4. These load centers are located on the ground floor in the Auxiliary Building new Electrical Equipment Room (formerly the hot machine shop). Swing busses 3H/4H contain loads that are essential for plant safe shutdown and are designed as voltage seeking, dead transfer swing busses. Load Centers 3H/4H busses automatically transfer in the event of the loss of power on the supply load centers to which they have been aligned, provided that the other supply load centers are powered.

[illegible]

3.4 480V MOTOR CONTROL CENTERS (MCCs)

Four new 480V MCCs are added to the AC system. MCC 4J and 4K are located in the new EDG building. MCC 4J is fed from Load Center 4A and is used to supply EDG 4A radiator fans and auxiliaries while MCC 4K is fed from Load Center 4D and supplies EDG 4B radiator fans and auxiliaries. New MCC 3K is located in the existing EDG building and supplies the EDG 3B auxiliaries which were originally powered from MCC 4B. This MCC is fed from Load Center 3D. New MCC 4D is located in the new Electrical Equipment Room in the Auxiliary Building and is used to power existing Unit 4 swing loads which are being reassigned. This MCC is fed from 480V swing load center 4H. MCC D, previously fed from swing Load Center 3D, is now powered from swing Load Center 3H and is relabeled as MCC 3D. As previously stated, all existing Telemand transfer mechanisms are no longer required (for existing MCCs 3A, 4A and D) are being disconnected and removed.

3.5 125V DC BUSES

The existing plant DC distribution systems consist of four 125 volt DC busses shared by both Units, fed from batteries of two different ampere-hour capacities (see Figure 2). Each bus has a dedicated battery charger. Two "swing" battery chargers are installed, common to both Units, each one shared between the A and B bus of each Unit. The modifications to the DC systems as part of the Emergency Power System Enhancement Project are as follows (see Figure 2):

a. The existing "swing" battery chargers are dedicated to a single 125 volt DC bus, and two new battery chargers are added, each dedicated to a single 125 volt DC bus. The reconfiguration of the "swing" battery chargers and the addition of two new battery chargers provides each 125 volt DC bus with two redundant (full capacity) battery chargers fed from diverse AC power supplies. This ensures charging capability should one AC power supply not be available. Figures 1 and 2 show the battery charger power supplies.

b. The existing cables to the swing charger provided a tie between the 3B and 4A batteries. This existing tie will be removed.

c. The power to the diesel generator sets are distributed such that each EDG is supplied DC power from the battery system of the same designation; i.e., EDG 3A is associated with Battery 3A, etc.

d. Four new DC breaker panels are provided (as extensions of buses 3A, 3B, 4A, and 4B) to accommodate new loads, to repower EDG 3B auxiliaries, and to relocate battery 3B and 4A feeders.

e. A spare station battery and associated DC breaker panel which can be used as a substitute for any of the existing station batteries. A non-safety related spare battery charger is also provided to maintain the spare battery at full capacity when it is not being used as a substitute.

Note that, below the main DC bus level, the DC distribution systems are not affected by this enhancement project.

3.6 LOAD SEQUENCERS

Four new sequencers are provided for EDGs 3A, 3B, 4A and 4B to ensure an orderly automatic loading of essential equipment under the emergency mode conditions. The new EDG load sequencers, which are physically located next to the existing load sequencer cabinets, duplicate the basic functions of the existing sequencers (bus stripping and load sequencing). However, modifications to the sequence timing for loading of safety equipment have been incorporated. Also, testing features (manual and automatic) have been incorporated to facilitate troubleshooting and testing. The EDG load sequencers utilize a programmable logic controller (PLC) to execute the control functions and provide continuous monitoring of the same. The PLC is located in a key locked cabinet and the key is administratively controlled from the control room. Any modifications to the load sequence timing will be controlled through the design change process to ensure appropriate design and safety evaluation of the change.

The EDG load sequencers consist primarily of two major functions, stripping/clearing logic and the sequencing logic. The design and logic of these two functions are independent and, as indicated above, perform the same basic functions and principles of the existing design.

The changes in sequencer function over the existing sequencer can be summarized as follows:

1) The accuracy of the new solid-state sequencers (± 0.1 sec) is at least a factor of 10 better than the existing electro-mechanical devices (± 1.0 sec.).

2) Sequencing of loads is also initiated upon SI actuation alone (no LOOP) for the new sequencer design.

3) Additional modifications as addressed in Section 2.2.

A description of sequencer operation under various emergency conditions in the plant is provided in Section 4.2.3.

3.7 PROTECTIVE RELAYING SYSTEMS

New 4.16 kV "swing" switchgear and 480 volt "swing" load centers are being added. They are provided with overcurrent protection circuits consistent with those provided with the existing equipment, thereby maintaining the integrity of the overall system.

Protective and alarm relays are provided for the new emergency diesel generators as follows:

a. Generator Differential
b. Generator Overcurrent
c. Loss of Excitation
d. Reverse Power
e. Voltage Balance (control and alarm only)
f. Underfrequency
g. Over/Undervoltage (alarm only)
h. Generator Temperature (alarm only)

All of the above protective relays, except the generator differential, are bypassed under emergency operation. In addition to the generator differential relay, the only other signal that will trip the EDG under emergency operation is engine overspeed. Refer to Section 5.0 for a discussion of mechanical protective devices.

3.8 FEEDER AND SUPPLY BREAKERS

This section addresses the operation of breakers that control the flow of power to the power distribution buses that are required to be energized during plant operation. The circuit breaker on the bus supplying power to another bus is the feeder breaker. The breaker on the bus receiving power is the supply breaker.

The Emergency Power System enhancement project adds supply and feeder circuit breakers as required to power new buses such as 4.16 kV switchgear 3D and 4D, 480V load centers 3H and 4H, and 480V MCCs 3K, 4D, 4J and 4K.

a. EDG to 4.16 kV Bus Supply Breaker

The automatic operation of this breaker is tied to the start-up and operation requirements of the Emergency Diesel Generator, bus stripping and bus clearing relays and permissives. During EDG load testing, this breaker is manually closed after synchronizing with the bus. However, on an SI signal with offsite power available, this breaker will automatically trip.

b. 4.16 kV Bus to 480V Load Center Transformer Feeder Breakers

Each breaker is automatically tripped by the Load Sequencer, through the stripping logic relays, and each breaker is automatically closed by the EDG loading sequencer, as per the present design. Each breaker is provided with overcurrent protection.

Each breaker can be closed/tripped with controls at the switchgear or with a control switch in the Control Room. Position indication is provided in the Control Room and locally at the switchgear.

c. 480V Load Center Supply Breakers

Each breaker can be closed/opened at the 480V Load Center. The breaker is maintained in the closed position. These breakers are opened only for maintenance purposes, under administrative controls. The function of these breakers remains unchanged from the present design.

d. 480V Load Center to 480V MCC Feeder Breakers

Each breaker can be closed/open with a pushbutton located at the Load Center and can be opened manually. Each breaker is provided with overcurrent protection. The function of these breakers remains unchanged from the present design.

e. 480V MCC Supply Breaker

Each breaker can be closed/opened at the 480V MCC. The breaker is maintained in closed position, and is opened only for maintenance purposes, under administrative controls. The function of these breakers remains unchanged from the present design.

f. 4.16 kV Swing Bus (3D/4D) Tie Breakers

Each new 4.16 kV Swing Bus (3D/4D) is provided with tie feeders to the 4.16 kV Busses A and B. Thus, a swing bus has capability to receive power from either the A or B power train of its associated unit. The tie breakers for each switchgear are interlocked so that the 4.16 kV Swing bus can be manually connected to only one source of power supply at any given time. Each breaker is provided with overcurrent protection. Each breaker can be closed/tripped with a local control switch or from the control room. Breaker position indication is provided in Control Room. The 4.16 kV busses 3D/4D are protected for bus faults by a lockout circuit so that the supply breakers, feeder breakers, or station blackout tie breaker will trip and cannot be re-closed, unless the lockout relay has been reset.

The Station Blackout intertie is a cross connection between Turkey Point Units 3 and 4, 4.16 kV busses 3D and 4D.

g. 480V Swing Load Center (3H/4H) Tie Breakers

Each 480V Swing Load Center (3H/4H) is provided with tie feeders to 480V Load Centers (3C/4C, 3D/4D) that are associated with the A and B power train. Thus, a Swing Load Center has a capability of receiving power from either power train. The tie breakers are interlocked so that the 480V Swing Load Center is connected to only one source of power at any given time.

Operation of the tie breakers is controlled through the use of a control switch in the Control Room. With the selector switch in the 'C' position, the tie breakers aligned with Load Center "D" receive a trip signal and the tie breakers aligned with Load Center "C" receive a close signal. Once a power source is selected the tie breakers are subject to an automatic transfer scheme as follows:

> If the voltage on the primary supply bus is not present, the auto-transfer circuit checks the voltage on the alternate supply bus. If the voltage on the alternate supply bus is available, the auto-transfer action to the alternate supply bus is initiated. The auto-transfer action issues a signal to trip the tie breakers to the primary supply bus and, once the primary supply breaker is in an open position, issues a signal to close the tie breakers to the alternate supply bus.
>
> Each breaker is closed/tripped as a result of any of the following actions: operation of a local control switch; operation of the transfer switch in the Control Room; automatic transfer action; or overcurrent conditions. Position indication is provided in the Main Control Room.

4.0 EMERGENCY POWER SYSTEM (EPS) OPERATION

4.1 EXISTING EMERGENCY POWER SYSTEM

Presently, either existing EDG is capable of supplying power, in the event of loss of off-site power (LOOP), to all the necessary safeguards equipment of one Unit in an accident condition, plus the auxiliary loads for a safe (hot) shutdown of the other Unit. The maximum auto-connect loading associated with these conditions is about 2750 kW, which occurs in the first minute of EDG operation. This entails short-term loads in the first 30 minutes in the 2000 hour rating of 2850 kW, and transient load management loads approaching 2950 kW. Table 1 (see Subsections 1.3 and 2.1) provides the worst-case EDG loading scenario for the existing arrangement.

4.2 ENHANCED EMERGENCY POWER SYSTEM

The operational requirements for the Enhanced Emergency Power System consist of the following:

a. Detection of loss of the normal power supply.

b. Clearing of power distribution buses that are required for the emergency power application.

c. Disconnection of non-safety related loads from the emergency power supply.

d. Start-up and loading of each Emergency Diesel Generator.

4.2.1 Detection of Loss of Normal Power Supply

The existing scheme, presently in service at the plant, is used for the purpose of detecting an undervoltage condition at the 4.16 kV switchgear or the associated 480V Load Centers with minor modifications (e.g., undervoltage detection on 480V Load Centers 3C/4C, 3D/4D for the transfer scheme). The existing scheme consists of voltage monitoring relays at the 4.16 kV switchgear and associated 480V Load Centers, and the undervoltage detection relays interrelated as follows:

Each existing 4.16 kV switchgear is provided with two voltage monitoring relays that monitor phase to phase voltage at the bus.

Each of the existing associated 480V Load Centers are also provided with two pairs of voltage monitoring relays that monitor phase to phase voltage at the 480V bus.

When there is a loss of voltage at the 4.16 kV switchgear A or B or a loss or deterioration of voltage at the 480V Load Centers, the voltage monitoring relays will actuate the undervoltage actuation system, or stripping function of the EDG bus loading sequencer.

4.2.2 Startup and Loading of Emergency Diesel Generator

The control logic of each new EDG provides for emergency and normal modes of operation of the EDG, with the emergency mode assigned as priority over the normal mode.

4.2.2.1 Emergency Mode of Operation on Loss of Normal Power Supply

A loss of normal power supply is detected by the undervoltage system, which initiates the bus stripping action on the affected 4.16 kV or associated 480V load center bus by energizing bus stripping relays. The bus stripping relays open all required bus supply and feeder breakers, energize the bus isolation relays, and start the associated diesel.

In the emergency mode of operation the diesel achieves its normal operating speed and voltage within 15 seconds and the trip functions of all protective devices, with exception of overspeed and generator differential, are bypassed. There is no automatic or manual reset provided for the bypass of trip functions of the normal EDG protective devices. These trip functions remain deactivated as long as the EDG remains in the emergency mode of operation.

When the frequency and voltage of the EDG are within the acceptable limits and the associated bus clear signal is present, an automatic closure signal is issued to close the EDG breaker within 16 seconds after the onset of the LOOP.

When the normal power supply is re-established, the EDG(s) can be synchronized to the offsite power by closing the startup transformer breakers. The synchronization of the EDG to the offsite power is performed from the main control board. As soon as the 4.16 kV bus supply from start-up transformer breaker is closed, the operating mode of the EDG is automatically changed from emergency to normal. Subsequently, the EDG may be gradually unloaded, disconnected from the 4.16 kV power bus and shut down.

4.2.2.2 Normal Mode (Testing) in Parallel With Normal Power Supply

During the normal mode of EDG operation, the point of control - local control panel or main control board - is determined by the position of a Master Selector Switch. However, the change in point of control during the operation has no effect on the emergency operation of the EDG.

[illegible]

In the normal (test) mode, the diesel is started manually by operating the normal (idle) start/stop selector switch or rapid start pushbutton or emergency start/stop selector switches locally or remotely from the control room. During the normal start-up period, the diesel idles at a predetermined speed (450 rpm) to allow an orderly warm up of the engine to minimize wear. After the warm up period is completed, the idle control is disengaged and the diesel accelerates to rated speed (900 rpm) in preparation for loading. An undervoltage signal or safety injection signal will take precedence over the normal (test) mode of operation (as discussed above), as long as the key-operated auto start bypass switch has not been activated at the local control panel with the master switch in the "local" position.

Once the diesel is at normal speed and normal voltage is established, the operator may proceed with synchronization of the generator with the 4.16 kV bus and manually close the generator breaker. Once the EDG is tied to the 4.16 kV bus, it is manually loaded.

To initiate the normal shutdown process, the load on the EDG is first reduced to a preset minimum value before the generator breaker is manually opened via the control switch. When the EDG is disconnected from the 4.16 kV bus, the normal start/stop selector switch is operated to initiate the normal diesel shutdown. During the shutdown period, the diesel will operate for a period of time (20 min.) at a predetermined idle speed to allow the engine heat to dissipate in a controlled manner. After this period of cooldown, idle operation is completed and the diesel will stop. EDG normal start/stop is overridden by an automatic (emergency) start signal, as long as the auto start bypass switch has not been activated as previously before mentioned.

A rapid start function is provided for a fast start test of the diesel. The period of engine warm up, at idle speed, is eliminated from the diesel start up process thus resulting in a fast start of the diesel; however, all machine electrical and mechanical protective features are enforced.

Locally provided idle start control will accelerate the EDG to idle speed (450 rpm) until the idle release control accelerates the EDG to rated speed, or the normal start/stop control is operated to coast the EDG to stop. The idle start control is also overridden on automatic (emergency) EDG start, as long as the auto start bypass switch has not been activated, as previously before mentioned.

4.2.2.3 EDG Response to Safety Injection Signal (SIS)

On actuation of SIS on either Unit, all diesels are started automatically in the emergency mode of operation. The diesels continue to operate in a no-load condition (breaker open) at normal operating speed unless an undervoltage signal is received or until they are stopped manually.

[illegible]

The EDG can be manually stopped from the control room or locally, depending on the position of the master switch, by actuating the normal stop. Normal stop requires a previous resetting of the Safety Injection signal or operation of the previously mentioned administratively controlled key locked auto start bypass switch.

Emergency stop, which can be actuated from the main control room or locally at the EDG control panel or at the engine control panel, does not require a previous resetting of the emergency signal, but will actuate the shutdown relay which requires local resetting.

In case a loss of normal power supply occurs subsequent to SIS actuation, the EDG continues its operation, from that point on, in accordance with the requirements of the emergency mode of operation as delineated in Section 4.2.2.1 and 4.2.3.2.

4.2.3 Load Sequencer Operation

The following Subsections describe operation of the load sequencing function of the EDG bus loading sequencers.

4.2.3.1 Loss of Normal Power Supply

Upon initiation of stripping after detection of a degraded voltage condition (see Subsection 4.2.1), the sequencer starts loading automatically 15.5 seconds later, provided the EDG breaker is closed. The timing contacts of the sequencer close the breakers or energize the contactors of the equipment required for the safe shutdown of the plant in a predetermined sequential order.

4.2.3.2 Loss of Normal Power Supply Followed by Actuation of SIS

Actuation of SIS subsequent to a loss of normal power will shed all loads from the EDGs, while keeping the EDG breaker closed and will reset the timing contacts of the emergency bus loading sequencers to the zero time condition regardless of the state of progress of the EDG loading operation.

4.2.3.3 Actuation of SIS With Normal Power Supply Available

The sequencer automatically starts equipment required for the mitigation of an accident in a predetermined sequential order. The only differences between this scenario and an SIS concurrent with a LOOP are that the sequencers would commence timing and initiate loading immediately following an SI signal with offsite power available, (i.e., no 15 second delay in loading would occur as in the case where diesels must start following a LOOP) and that the non-safety related loads are not stripped via the sequencer.

4.2.3.4 Actuation of High Head Safety Injection Pumps

The High Head Safety Injection (HHSI) Pumps are a shared system, which provide high-pressure safety injection following a LOCA on either Unit. On receipt of an SIS on either Unit, all four HHSI Pumps receive a start signal. This ensures the operation of at least two HHSI Pumps, which provide sufficient safety injection (along with the passive accumulators) to satisfy the design basis accident analyses.

4.2.4 4.16 KV Swing Switchgear

The power to the 4.16 kV swing switchgear is supplied from either the 4.16 kV Bus A or from the 4.16 kV Bus B. When the 4.16 kV swing switchgear is connected to either 4.16 kV supply bus, it is considered an extension of that power supply bus.

The control logic of the power supply bus, (utilized for the bus stripping of loads on loss of bus voltage and development of a bus cleared signal to permit application of emergency power to the bus), is extended to the swing switchgear through the interlocks with the 4.16 kV swing bus breakers.

4.2.5 480V Swing Load Center Including 480V MCC

The power to either of the 480V swing load centers (3H/4H) is supplied from either the 480V Load Center C (Train A) or from the 480V Load Center D (Train B). When the 480V swing load center is connected to either 480V supply bus, it is considered to be an extension of that 480V supply bus.

However, the control logic of the 480V supply bus is not extended to the 480V swing load center; instead, the 480V swing load center is provided with the automatic transfer capability which allows the swing bus to transfer from a de-energized bus to an energized bus. The automatic transfer takes place if the 480V supply bus fails to be energized, provided that power is available at the 480V alternate bus. A timing circuit is also provided to prevent initiation of transfer in the event of a spurious voltage drop. In the event of loss of offsite power, an interlock will prevent transfer. No transfer will be initiated, unless one is necessary upon voltage restoration. The 480V MCC is powered from the 480V swing load center and thus follows it as to supply bus alignment.

An alarm is provided in the control room to annunciate 480V swing load center undervoltage.

4.2.6 Monitoring of Emergency Diesel Generator Operability

The diesel generator is periodically started and loaded in parallel with the plant's normal power supply for the purpose of verifying its operational reliability. An alarm annunciator is provided on the local control panel to both monitor the operation of the EDG and to annunciate an alarm in case an off-normal condition is detected. Any alarm at the local annunciator will also alarm in the control room to indicate diesel generator trouble.

4.2.7 Applicable Codes and Standards

New structures, systems, and components (SSC) are being installed to interact with those existing, which were licensed in the early 1970s. Individual Engineering Packages (EPs) are developed for site preparation, SSC installation, pre-op testing etc. These individual EPs delineate the specific Codes and Standards utilized in each design package (as work progresses). To the extent practicable, the latest Codes and Standards are invoked for the design of the new SSC.

4.2.8 Human Factors Review

The enhancement project activities are being evaluated with respect to NUREG-0700 Human Factors requirements and guidelines via the controlled EP process. The new equipment maintains similarity, to the maximum extent possible, of the nomenclature and arrangement for existing systems and components. The control logic and the associated control components and monitoring instrumentation are designed as similarly as possible for the EDGs in both Units.

4.3 EDG LOADINGS WITH THE ENHANCED DESIGN

As discussed previously in Subsections 1.3 and 2.1, Table 1 represents the EDG loading, for the existing design, for a LOCA and LOOP plus the failure of an EDG.

For the enhanced design, Table 2 presents the possible EDG loading for a LOCA and LOOP on Unit 3 and a LOOP on Unit 4. Resultant loads on each EDG are shown for both automatically loaded components, such as engineered safety features (e.g. HHSI pumps, Containment Spray pumps, etc), manually loaded components such as plant investment loads (e.g., turbine loads), and desired loads such as pressurizer heater banks and charging pumps. The total loading shown reflects the maximum possible load, due to the listed loads, on each diesel individually. Totals do not occur simultaneously as shown.

In Table 2, components powered from the swing Load Centers 3H (and 4H) and from MCCs 3D and 4D are normally aligned to EDGs 3B (and 4B). If a single active failure (SAF) of the normal power source (Load Center 3D or 4D) occurs, the MCC 3D or MCC 4D loads will automatically swing to the alternate Load Center (3C or 4C) and then be powered from EDG 3A or 4A.

For EDG loading purposes, both the swing alignment and normal alignment loads on each EDG are shown on Table 2 in an (x/y) format, where x is the swing alignment (i.e., the Load Center 3D failure result or the Load Center 4D failure result) and y is the normal alignment. The total loading on EDGs 3A and 4A is shown as if MCC 3D and MCC 4D have swung to the A power train. The total loading on EDGs 3B and 4B is shown as if the loads were normally aligned to the B power train.

By inspection of Table 2, it can be seen that: a) no single EDG is overloaded, let alone loaded to its continuous rating, if all four EDGs function properly and as expected (even with a full complement of a swing Load Center); and b) the worst single train failure (e.g., failure of an EDG to start) still leaves at least the minimum number of Engineered Safety Features (ESF) operable, plus common/shared equipment, and additional investment loads such as turbine-related loads.

A comparison of the Table 2 EDG 3B loads with the Table 1 (existing) EDG B loads shows that potential EDG loading limitations have been alleviated with the enhanced design.

Table 2 presents the possible loads on each EDG for the case of an SIS on Unit 3 (with LOOP on both Units). For the case of SIS on Unit 4 (with LOOP on both Units), the same conclusions derived from Table 2 for the previous case hold true: a) no single EDG is overloaded, let alone loaded to its continuous rating (even with a full complement of a swing Load Center); and b) the worst single train failure (e.g., failure of an EDG to start) still leaves at least the minimum number of ESF equipment operable, plus common/shared equipment, and additional investment loads. The possible kW loading on each EDG, for this Unit 4 accident scenario, is as follows:

EDG 3A:	2314 kW	(assuming the loss of EDG 3B which results in the Unit 3 swing loads being loaded on EDG 3A)
EDG 3B:	2204 kW	(assuming Unit 3 swing loads aligned to EDG 3B)
EDG 4A:	2260 kW	(assuming the loss of EDG 4B which results in the Unit 4 swing loads being loaded on EDG 4A)
EDG 4B:	2185 kW	(assuming Unit 4 swing loads aligned to EDG 4B)

As in Table 2, these kW loads are derived by increasing each component kW load for conservatism. Finally, the loading table shows a total EDG load as if all loads were running concurrently, when in reality the plant would alternate some loads such as charging pumps, with other loads such as the pressurizer heater back-up groups, and not actually load these at the same time.

The modifications performed under the Emergency Power System Enhancement Project provide an emergency AC distribution system design associated with each Unit more independent of the other Unit's electrical system. The original design basis of the Turkey Point plant is unchanged, from the perspective of retaining at least one 4.16 kV bus energized on each Unit. With the enhanced arrangement, the postulation of a single active failure for the design basis accident scenario during two-Unit operation leaves at least three 4.16 kV buses energized between both Units (See Table 2).

As shown in Table 2, the design basis accident scenario (LOCA plus LOOP plus worst single active failure (SAF) during two-Unit operation) is more easily accommodated with the enhanced design, versus the original design, from an EDG loading standpoint. Additional margin exists on each EDG to power more than the minimum required loads for mitigating a design basis accident on one unit and safely shuting down the other unit. Note that from a load distributing standpoint for the worst SAFs postulated (e.g. loss of a battery, or failure of an EDG to start/load, or failure of an MCC to load, etc.), the enhanced configuration provides more buses/components available than presently provided with the existing design.

From an operational standpoint, it is expected that the provision of four EDGs each powering an associated 4.16 kV bus, and the re-assignment of various loads as shown in Figure 1, provides the capability to have equipment out of service (for maintenance, testing, etc.) on one Unit without affecting the operability of the other Unit and without affecting the other Unit's capability to meet the single failure criterion. This aspect is being factored into the final system design and will be addressed as applicable in the new Technical Specifications which will be a future submittal.

5.0 MECHANICAL AND STRUCTURAL ADDITIONS

This Section describes the new structures and the new mechanical equipment being installed in support of the Emergency Power System Enhancement project.

5.1 DESCRIPTION OF STRUCTURES

Various civil/structural modifications are being made to accommodate the new EDGs and their auxiliaries, including new electrical duct banks, installation of equipment on the Auxiliary Building elevations 18.0, 30.0 and 42.0 and installation of equipment in the existing EDG Building as well as the new EDG Building. See Figure 9. The major structures are discussed below. The electrical duct banks, the Diesel Generator Building and the Diesel Oil Storage Building are Seismic Category I structures, and are designed to withstand design basis natural phenomena, including earthquake, wind, tornado and flooding. Tornado design requirements include protection from tornado-generated missiles. Missile protection for structures is provided by reinforced concrete walls, heavy steel grating, and reinforced concrete labyrinths protecting outside doors.

5.1.1 Diesel Generator Building

The new Diesel Generator Building is a seismic Category I reinforced concrete structure, located northeast of the Unit 3 Containment and the Auxiliary Building, which contains the diesel generators and auxiliary equipment. The dimensions of the building are approximately 55 feet wide by 56 feet long by 51 feet high, with the top of roof at elevation 61.0'. See Figures 3 through 8.

The building is partitioned by a reinforced concrete wall, such that the redundant diesel generators and associated auxiliary equipment are separated by a three hour rated fire barrier. Each division of the building has two floors: the ground floor, approximately at elevation 18.00', contains the diesel generators, and the second floor, approximately at elevation 42.00', encloses the auxiliary equipment. The second floor is partly reinforced concrete and partly structural steel with steel grating.

5.1.2 Diesel Oil Storage Building

The Diesel Oil Storage Building is also a seismic Category I reinforced concrete structure, connected to the Diesel Generator Building and sharing the west wall of the Diesel Generator Building. The structures have a common foundation mat. The dimensions of the diesel oil storage building will be approximately 29 feet wide by 38 feet long by 39 feet high, with the top of roof at elevation 49.0'. See Figures 3 through 5, and Figures 7 and 8.

[illegible]

The Diesel Oil Storage Building is also partitioned by a reinforced concrete wall such that the two Diesel Oil Storage Tanks (DOST) and their associated oil transfer pumps are separated by a three hour rated fire barrier. Each division of the building houses a DOST, which is a steel lined concrete pool. In each half of the building, the oil transfer pump is installed in a room separate from the enclosure housing its associated tank.

5.1.3 Electrical Raceways

New electrical raceways such as, duct banks, cable trays, conduits, boxes, etc. are constructed, as needed, for the routing of new cables. Some new cables are also installed in existing raceways.

5.1.4 Materials and Quality Control

The structures are reinforced concrete and structural steel. The fundamental design for these structures is in accordance with ACI 349-85, "ACI Standard Code Requirements for Nuclear Safety Related Concrete Structures," and the Eighth Edition of the AISC Manual of Steel Construction.

Applicable industry standards and regulatory documents are also considered in the design of the building as delineated in each EP. All design work and procurement of materials for these buildings is performed according to and in strict compliance with Florida Power & Light's Quality Assurance Program.

5.2 DESCRIPTION OF MECHANICAL EQUIPMENT

The mechanical equipment discussed below will be procured and installed at Turkey Point for the Emergency Power System Enhancement Project. The Codes and Standard utilized in piping and component design, analysis and shop fabrication are delineated in the following system-specific descriptions. Field installation, erection, welding and any field fabrication will be performed in accordance with the Codes and Standards called for in the existing procedures presently used at the Turkey Point site. The existing procedures are part of FPL's Quality Assurance Program in compliance with 10 CFR 50, Appendix B.

5.2.1 Diesel Oil Storage and Transfer System

The Diesel Oil Storage and Transfer System transfers diesel fuel oil from the new onsite storage tanks to the day tanks which supply the new emergency diesel generators. Each EDG system consists of one diesel oil storage tank, one transfer pump, one day tank, interconnecting piping, valves and associated instrumentation and controls for each EDG.

[illegible]

a. Diesel Oil Storage Tanks

Each Diesel Oil Storage Tank (DOST) has a capacity of 42,000 gallons. The proposed Technical Specification minimum volume requirement is 34,700 gallons, which is sufficient to operate a diesel at continuous load rating for a minimum of seven days. The DOST systems for the two new diesels are designed to provide adequate capacity to receive a diesel oil load (8,000 gallons) from a transport vehicle when the DOSTs inventory approaches the minimum Technical Specification limits. The two tanks are equipped with a cross-connection line which can be used to "balance" the inventory between the two tanks for this purpose if desired.

The steel liners of the concrete steel lined DOSTs are shop fabricated in accordance with the requirements of the ASME Code Section VIII and meet seismic Category I requirements. Materials or coatings containing aluminum and/or zinc are not used for the construction or coating of any tank surface that may be in contact with the fuel oil. The tanks are enclosed in a Seismic Category I building designed for protecting the tanks against postulated missiles. The building is also designed for retaining the entire capacity of a tank in the unlikely event of tank failure.

b. Diesel Oil Transfer Pumps

One Diesel Oil Transfer Pump is provided for each diesel-generator. The Diesel Oil Transfer Pump is designed in accordance with the requirements of the ASME Code Section III for Class 3 components and meets seismic Category I requirements. The pumps can take suction from either or both of the diesel oil storage tanks and discharge into either or both diesel day tanks. The new (for Unit 4) and existing (for Unit 3) Diesel Oil Transfer Pump discharge lines are interconnected, which provides flexibility of operation. Each new pump has enough capacity (approximately 12 GPM) for supplying diesel oil to two diesels at continuous load rating.

Each Diesel Oil Transfer Pump is powered from its associated train. A pump starts and stops automatically on low and high level signals, respectively, from its associated day tank. A pump also can be manually started and stopped, if required.

c. Piping and Valves

The system piping external to the engine skid (which is classified as safety-related) is designed in accordance with the requirements of the ASME Code Section III for Class 3 components and meets Seismic Category I requirements.

The engine mounted piping, as a minimum, is designed and analyzed to meet the stresses specified by ANSI B31.1 Power Piping. The engine mounted piping is designed to accommodate mechanical, pressure, thermal and seismic loads.

d. Instrumentation and Control

The following instrumentation and controls are available during normal operation:

i. Local oil level and temperature indication for each diesel oil storage tank and storage tank oil level switches for providing diesel oil low and high level alarms in the Main Control Room.

ii. Oil level switches for low, low-low and high levels in the day tanks for providing local alarms and as inputs to a diesel trouble alarm in the Main Control Room. Two additional level switches are used to start and stop the Diesel Oil Transfer Pump and for the opening and closing of the solenoid valve at the inlet of each day tank.

iii. Oil pressure indication at the Diesel Oil Transfer Pump discharge.

5.2.2 Emergency Diesel Engine Starting System

The starting system for each diesel is comprised of redundant components (except the air dryer) which includes two air compressors (one diesel and one electric motor driven), a deliquescent type air dryer, four air receivers, four air motors for cranking the engine, piping, valves and the required instrumentation. The electric motor driven air compressors operate automatically to maintain the required pressure in the air receivers. The diesel driven compressor serves as back-up for the electric motor driven compressor. A filter is provided at the compressor suction for preventing dust and foreign matter from entering the system. A wye type strainer is also installed in the air start piping to further control the possibility of foreign matter entering the air start motors. The air receivers are sized to ensure that the system has enough capacity, at the design pressure setpoint, for cranking the cold diesel engine five times without the need for recharging. The air receivers are designed in accordance with the requirements of the ASME Code Section III for Class 3 components and meet Seismic Category I requirements.

The starting system piping external to the engine skid is designed in accordance with requirements of the ASME Code Section III for Class 3 components, and meets Seismic Category I requirements.

The engine mounted piping, as a minimum, is designed and analyzed to meet the allowable stresses permitted by ANSI B31.1 Power Piping. The analysis includes mechanical, pressure, thermal and seismic loads.

The material used for the fabrication of the air receivers and associated piping off the engine skid for the air starting system is stainless steel type 304 or 316.

Four air motors, two 100% sets, are provided for cranking the diesel engine. Each set of two motors is supplied with air from a separate set of air receivers. The following instrumentation is provided:

a. Pressure indication at the compressor discharge, on each set of two air receivers, and at the headers supplying the engine air motors.

b. A pressure switch for each set of two air receivers, providing a low pressure alarm.

5.2.3 Diesel Generator Combustion Air Intake and Exhaust System

The ventilation intake to the EDG building is located at approximately 32 feet above grade (see Figure 6). The ventilation intake is provided with multiple turns to prevent air entrained water from entering the building.

This ventilation intake is located on the side of the EDG building, opposite from the exhaust, to minimize the possibility for contamination of the intake air by the exhaust products.

The EDG air intake is located inside the building and below the EDG building ventilation intake.

The exhaust piping is designed in accordance with requirements of ANSI B31.1 and is seismically supported. The exhaust pipe is sized in accordance with the diesel engine manufacturer recommendations to avoid excessive back pressure. The silencer is being supplied by the EDG vendor and is Safety Related and meets seismic Category I requirements.

5.2.4 Diesel Generator Building Class 1E Ventilation

Two redundant fans are provided for supplying the required ventilation of each switchgear room in the Diesel Generator Building. The fans are provided with Class 1E motors and control power and are seismically qualified. Air filtration is provided with these ventilation systems.

A Class 1E fan is provided for the ventilation of each of the control panel/MCC rooms.

5.2.5 Service Water and Demineralized Water Systems

These systems are designed in accordance with ANSI B31.1 requirements. The service water piping is routed above ground outside the Diesel Generator Building and the demineralized water system is routed in trenches inside the building. The piping in the pipe trenches is designed to retain structural integrity following an earthquake.

5.2.6 Service Air

A service air ring header, to facilitate EDG maintenance, is provided in the Diesel Generator Building with a connection outside the building for receiving air from a portable compressor.

5.2.7 Diesel Engine Cooling Water System

The diesel engine cooling water system consists of an expansion tank, circulating pumps, three-way thermostatic control valve, water to air heat exchanger (radiator), three electric, direct-coupled, motor driven cooling fans, standby immersion heater, piping, valves and the required instrumentation. Two engine-driven centrifugal pumps circulate water through the closed loop system.

An electrical immersion heater is provided for recirculating hot water, by convection, through the oil cooler for standby heating. The temperature of the water in the oil cooler is controlled automatically by temperature switches during standby. An expansion tank is provided in the system to allow for expansion and contraction of the water due to changes in temperature and also for water makeup capability. The expansion tank is designed in accordance with the requirements of the ASME Code Section VIII and meets seismic Category I requirements.

The radiator is designed in accordance with requirements of the ASME Code Section VIII and meets seismic Category I requirements.

Piping external to the engine skid and radiator is designed in accordance with the requirements of the ASME Code Section III for Class 3 components and meets seismic Category I requirements.

The following instrumentation is provided for monitoring the engine cooling water system operation:

a. Temperature Indicators for engine discharge water, lube oil cooler inlet and outlet water, and radiator inlet and outlet water.

b. Temperature Switches for cooling water low temperature alarm, engine water outlet high temperature alarm, engine water outlet high temperature shutdown, and immersion heater control.

c. Pressure Switch for low engine water pressure alarm and shutdown.

d. Level Switches for expansion tank low level alarm.

e. Level Gauge for expansion tank level.

Instrumentation is provided with readouts on the EDG local control panel in the EDG Building. Abnormal conditions are alarmed in the Main Control Room via diesel trouble alarms, which will reflash upon subsequent actuations.

5.2.8 Diesel Engine Lubrication System

The engine lubrication system is a combination of three systems: the scavenging oil system, the main lubricating system and the piston cooling system. Each system has its own positive displacement pump, driven from the accessories gear train at the front of the engine. A soak back oil system is also provided, and each system is described below.

a. Scavenging Oil System

The scavenging oil system pump takes oil through the scavenging oil strainer from the oil sump. The pump then forces the oil through the oil filter and oil cooler. Oil then returns to the strainer housing to supply the main lube oil pump and piston cooling oil pump with cooled filtered oil. Excess oil spills over a dam in the strainer housing and returns to the oil sump.

b. Main Lube Oil System

The main lubricating system supplies oil under pressure to most of the moving parts of the engine. The main lube oil pump takes oil from its strainer in the strainer housing. Oil from the pump goes into the main oil manifold which is located above the crankshaft, and extends the length of the engine. The majority of the moving parts receive their oil from passages directly off the manifold. An oil pressure line to the engine protective device and pressure gauge located on the engine panel is connected to the top of the turbocharger oil manifold adjoining the filter. A Low Lube Oil pressure alarm sounds in the engine panel whenever pressure drops below approximately 40 psig.

c. Piston Cooling Oil System

The piston cooling oil system pump receives oil from its strainer and delivers oil to the two piston cooling oil manifolds extending the length of the engine, one on each side. A piston cooling oil pipe at each cylinder directs a stream of oil to cool the underside of the piston crown and the ring belt. Some of this oil enters the oil grooves in the piston pin bearing; the remainder drains out through holes in the carrier skirt to the sump.

d. Soak Back Oil System

In addition to the three lube oil systems discussed above, electric motor driven (AC and DC) external lube oil pumps (the soak back pumps) are provided. These run continuously to supply lube oil to the turbocharger bearings for proper lubrication during emergency starts and coasting down of the unit, and also to maintain flow through the main lube oil filter and cooler to pick up heat during standby condition. To prevent possible overheating of the turbocharger, oil is automatically supplied to the turbocharger after stopping the engine. The system design ensures continuous oil flow through each of the supply headers.

The following instrumentation is provided for monitoring the engine lubrication system operation:

a. Temperature Indicators for lube oil cooler inlet and outlet.

b. Temperature Switches for low lube oil temperature alarm and high lube oil temperature alarm and shutdown.

c. Pressure Indicators for Turbo Standby Lube Oil Pressure and Engine Oil Pressure.

d. Pressure Switches for backup dc pumps control, low engine lube oil pressure alarm, low lube oil pressure, piston cooling oil low pressure and crankcase high pressure shutdown and alarms.

e. Differential Pressure Switches for lube oil filter, lube oil strainer and lube oil cooler high differential pressure alarms.

f. Level Switch for lube oil sump low level alarm.

Indicators are provided on the EDG local control panel in the EDG Building. Abnormal conditions are alarmed in the Main Control Room via a diesel trouble indicator.

Engine lube oil piping is designed in accordance with the requirements of the ANSI B31.1, as well as being seismically designed and supported.

5.3 FIRE PROTECTION SYSTEM

The existing plant fire protection system is extended to include the new structures and systems. Thermal and ionization detectors are located at strategic points in the new buildings and in the new Electrical Equipment Room (in the Auxiliary Building) for fire detection. The fire water system for the Diesel Generator Building is a completely automatic pre-action system with capability for manual actuation. The sprinkler system is pressurized only upon a signal(s) from the detector(s). The system for the diesel oil transfer pump rooms is of the wet pipe type. The sprinkler systems are designed in accordance with NFPA 13 and designed to retain structural integrity following an earthquake.

The fire detection system and the fire detectors are in compliance with NFPA 72D and 72E, respectively, and give an audible and visual alarm and annunciation in the main control room.

The fire suppression system piping material, design, and installation are in accordance with NFPA 13 as well as being seismically designed and supported.

Fire extinguishers, in accordance with NFPA 10, are provided in areas that could present a fire exposure hazard to safety related equipment.

Redundant trains of safety related systems are separated from each other so both are not subject to damage from a single fire hazard. The diesel generators are separated from each other by a 3 hour rated fire barrier and the Diesel Generator Building is physically located remote from the other plant structures. The construction of the enclosures for the diesel oil transfer pumps provide a 3 hour fire rating.

The diesel generator day tanks are designed in accordance with the requirements of NFPA 37. The Diesel Oil Storage Tanks are equipped with a leak collection system draining to the associated diesel oil transfer pump room oil collection sump. The volume of each diesel oil transfer pump room is such that, combined with the associated main diesel oil storage tank residual volume, they can contain the contents of the main storage tank.

Personnel access and escape routes are provided for in each fire area and fire exit routes are clearly marked.

Fixed self-contained lighting consisting of sealed beam units with minimum 8 hour battery power are provided in accordance with 10 CFR 50 Appendix R Section III.J. The existing alternate shutdown communication system is extended to include the new building.

The enhanced electrical power system is designed and installed to ensure that the capability for safe and alternate shutdown (in accordance with 10CFR50 Appendix R, Sections III.G and III.L) is maintained. A re-review of the Appendix R Safe Shutdown Analysis, essential equipment list, cable routing/protection, etc., is conducted as the design progresses to ensure this capability is maintained. Any specific fire protection (Appendix R) requirements are delineated within each EP.

5.4 APPLICABLE CODES AND STANDARDS

Applicable Codes and Standards are discussed briefly in this report and details have been provided in FPL's response to the NRC's request for additional information (RAI) dated January 6, 1989, specifically RAIs #1 and #2. In addition, each Engineering Package (EP) will detail the applicable codes and standards used for the design, installation, testing and operation of the new mechanical systems and components.

5.5 HUMAN FACTORS REVIEW

The enhancement project activities are being evaluated with respect to NUREG-0700 Human Factors requirements and guidelines via the controlled EP process. The new equipment maintains similarity, to the maximum extent possible, to the nomenclature and arrangement for existing systems and components. The control logic and the associated control components and monitoring instrumentation are designed as similarly as possible for the EDGs in both Units.

6.0 IMPLEMENTATION PLAN AND OBJECTIVES

The implementation plan and objectives are as follows:

a) Install the two new EDGs with all support systems in the new EDG building without impacting operation of the Units;
b) Install all the new equipment and raceways to be located in existing buildings without impacting the operation of the Units;
c) Install new cable raceways as required which satisfy existing routing requirements.
d) Tie-in the new EDGs, modify the existing EDGs and modify the electrical trains during scheduled outages, thus minimizing the downtime of the Units, the impact on operations, training, start-up, and complexity for implementation.

In order to meet the objectives of the plan, the activities have been separated into pre-outage and outage activities. The pre-outage activities include site preparation, construction of the new EDG building and diesel oil storage tanks, installation of the new EDGs and their auxiliary systems, and installation of electrical equipment, etc.

The outage activities include the tie-in of the new EDGs, modification of the existing EDGs and the modification of the electrical trains, plus component/system testing and safeguard testing.

6.1 PRE-OUTAGE ACTIVITIES

The pre-outage work covers the site preparation for the construction of the new building, building construction, installation of diesel generators, diesel oil storage tanks, fuel transfer system and electrical auxiliary equipment to be located in the new building.

The construction of the building and installation of the equipment (EDGs, 4.16 kV Switchgears, MCCs, etc) can be accomplished independently and without affecting plant operations. Construction power, for powering loads during erection and testing, will be provided from non-vital buses or an outside source such that no new plant loads are added.

The pre-outage work also includes the installation of the new equipment that will be located in the existing buildings. This equipment includes new 480V Load Centers, Motor Control Centers, and 125 V DC distribution panels. Raceway installation, cable pulling and terminations for the above described equipment can also be implemented to a certain extent, in preparation for the outages.

The program for on-site testing of the new components including the Emergency Diesel Generators was provided in FPL letter L-89-124 dated April 3, 1989.

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6.2 OUTAGE ACTIVITIES

Both Units will be shut down in order to tie-in the new EDGs, modify the existing EDGs, separate and install the load sequencers, tie-in the new 4.16 kV switchgear, 480V LCs/MCCs, and repower various loads. The implementation of these modifications will be performed on a per-train basis for each unit to ensure the availability of equipment required for plant conditions.

The existing EDGs will be taken out-of-service and one train on each unit will be de-energized and modified. The opposite trains will remain energized from offsite power for powering necessary plant loads. When the modifications on the de-energized trains are completed, they will be energized to support necessary plant loads and the opposite trains will be de-energized and modified. During this time, the new EDGs will be installed and tested and the existing EDGs shall be modified and tested. Upon completion of these modifications and pre-operational testing of the EDGs, the EDGs will be aligned to their respective trains and testing will be performed to establish system operability.

The testing to be performed, which includes an integrated safeguards test, is the subject of FPL's letter L-89-124 to NRC dated April 3, 1989.

A Safety Evaluation is being performed to establish and justify the plant equipment operability requirements.

7.0 BENEFITS OF PLANT ENHANCEMENT

Section 1.4 of this report provided background information as to how FPL arrived at the decision to install two new additional EDGs at the Turkey Point site, and the goals envisioned for the enhanced electrical configuration. Based on the descriptions and discussions provided in Sections 2.0 through 6.0, this Section summarizes how the enhanced design meets the goals set for the project.

7.1 INCREASE EDG CAPACITY

As indicated in Section 4.3, and as depicted in Table 2, the addition of two new emergency diesel generators improves overall plant safety by essentially doubling the installed emergency power capacity for Units 3 and 4. This allows the addition of loads desired to be backed up by emergency power, such as plant investment loads, without approaching the established load limits for the EDG's. The automatic swing bus arrangement allows the loading of specified Engineered Safety Features equipment even with the failure of one emergency diesel.

As indicated in Section 4.3, and as depicted in Table 2, each required safeguards load remains on its existing train or has been moved to a swing bus, and each train is now supplied from a dedicated emergency diesel generator. Failure of one emergency diesel generator leaves the remaining diesel generators providing power to those loads on the unaffected trains and the swing busses. Therefore, with the enhanced design, more EDG capacity is available for the operation of engineered safety features. Thus, overall plant safety is improved.

7.2 REDUCE OPERATOR ACTIONS

As noted in Section 1.3, the existing Safety Evaluation for EDG loading (Reference 7) includes, among other items, several operator actions for the manual control of specified plant system loads to accommodate defined loading limitations (e.g., securing an RHR pump on the accident Unit at 30 minutes etc.). In addition, the Safety Evaluation takes credit for several plant modifications which ensure that previous auto-connected loads would be disabled (e.g., the Instrument Air Compressors, the turbine-related loads, etc.). Some of these disabled loads require operator action to restore them onto the EDG(s) when the EDG loading scenario allows such additional loads.

The enhanced design provides more capacity, as depicted in Table 2, to allow automatic loading of equipment onto the EDGs without approaching the established load limit. In addition, the enhanced design allows the operator to manually load equipment on the EDGs without an undue concern of exceeding the established load limit. The extra capacity provided will enable fewer operator actions if selected manual loads are modified to become automatic loads (which FPL is reviewing as the design progresses). By reducing operator action associated with load management activities, overall plant safety is enhanced.

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7.3 ACCOMMODATE SINGLE FAILURE

By inspection of the AC and DC one-lines (Figures 1 and 2) in conjunction with a review of the four-EDG loading results given in Table 2, and based on the discussions provided in Section 4.3, it can be seen that a single failure is more easily accommodated with the new EDG configuration. With the enhanced configuration, a postulated single active failure under design basis accident conditions during two-Unit operation would leave at least three 4.16kV busses energized between the two Units. Because of this capability, overall plant safety is enhanced.

A Failure Modes and Effects Analysis for equipment out-of-service (OOS), plus a single failure, during a postulated accident has been prepared which confirms that the EPS Technical Specifications (NRC Proof and Review, dated May 4, 1990), and associated Limiting Conditions for Operation/Action Statements, are appropriate for the enhanced EPS configuration during operation under such equipment OOS conditions (e.g., for a Unit in MODES 5 or 6 with only one EDG required to be OPERABLE). Also, a circuit analysis for the EDG breaker and associated control circuits has been performed to ensure that the design of the new EDG breaker control logic and its implementation meet the single failure criteria and do not propagate a failure into other associated circuits. The EPS Technical Specifications are being submitted to NRC as a separate package, for NRC review and issuance of a License Amendment prior to the planned dual-Unit outage to implement the tie-in of the EPS Enhancement modifications.

7.4 MINIMIZE MAINTENANCE/TESTING DOWNTIME

From a review of the AC and DC one-line diagrams (Figures 1 and 2), it can be seen that the enhanced electrical configuration provides the capability to remove a component from service for maintenance or testing without affecting the availability of redundant counterparts. The new design will thereby minimize the potential for forced plant outages, which are necessary with the existing electrical system configuration. By reducing the impact on redundant counterparts and increasing the potential for periods of stable plant operation, overall plant safety is enhanced.

As indicated in Section 1.5, the addition of a spare station battery allows the substitution of any of the four existing vital station batteries for a period of time for maintenance or testing, and enables the plant to perform these activities on the vital station batteries without entering into a Limiting Condition of Operation. This modification also precludes the need to cross-tie the 125V DC busses when performing tests or maintenance on a battery. For future battery tests and maintenance, the spare battery will be connected to the appropriate 125V DC bus when the battery to be tested is disconnected, such that the bus is always aligned to a safety-related battery and no DC train will be cross-connected. Therefore, this enhancement provides increased availability of the 125V DC busses. In addition, more extensive testing (e.g. capacity testing), to provide added assurance of the batteries' capabilities, can now be performed during normal plant operation.

7.5 SAFEGUARDS TESTING

At present, both Units are shut down to perform an integrated Safeguards test on either unit since the availability of loads required for normal plant operation may be affected by testing.

With the enhanced design, safeguards testing is more easily accommodated. The enhanced EPS, with its increased capacity and load distribution diversity, provides for taking one train of a shut down unit OOS without impacting the opposite unit. The non-test unit will have sufficient equipment available for both normal operation and accident mitigation while one train on the other unit is undergoing testing.

7.6 ACCOMMODATE PLANT NEEDS

Table 2 and the discussions in Section 4.3 indicate that the enhanced design allows manual or automatic loads to be imposed on each EDG without approaching even the short time rating (110% of the continuous rating). For example, up to 175 kW of plant investment loads, both ICW pumps, both RHR pumps, etc. are assumed loaded onto the EDGs with margin still available to reach the continuous rating kW loading.. Since Table 2 was generated to show potentially heavy loads on each EDG, and since it can be seen that additional margin exists even with the loadings postulated, it is apparent that present and future plant needs for EDG-supported loads can be accommodated.

7.7 MINIMIZE IMPLEMENTATION DOWNTIME

As can be seen from the discussions in the previous Section 6.0, the Unit and/or plant downtime required to install and to implement the modifications is being minimized to the extent practical; refer to Section 6.0.

7.8 CONCLUSIONS

Based on the information presented in this report, it can be concluded that the EPS Enhancement Project will further serve to ensure the safe and reliable operation of Turkey Point Units 3 & 4. Additionally, its implementation can be performed in a manner whereby safety of the units is assured at all times.

A Safety Analysis Report is being submitted under separate cover which demonstrates that plant operation under the enhanced EPS is bounded by current FSAR accident analyses or updated analyses are performed to ensure the plant design basis is not altered. The detailed evaluation supporting this conclusion together with revised plant Technical Specifications will be the subject of future submittals.

8.0 REFERENCES

1) JPE-L-85-47 Revision 1, Justification for Continued Operation with Administrative Control of Diesel Generator Loads; Issue Date: December, 1985.

2) JPE-L-86-59 Revision 0, Justification for Continued Operation with One Unit at Power and One Unit in Cold Shutdown, Relating to Emergency Diesel Generator Loads; Issue Date: March, 1986.

3) Dr. J. Nelson Grace (NRC) to C. O. Woody (FPL), Confirmation of Action - Docket Nos. 50-250 and 50-251; dated April 2, 1986.

4) C. O. Woody (FPL) to Dr. J. Nelson Grace (NRC), Emergency Diesel Generators, L-86-147 dated April 3, 1986; with Attachment: JPE-L-86-59 Revision 1, Justification for Continued Operation with One Unit at Power & One Unit in Cold Shutdown, Relating to Emergency Diesel Generator Loads; Issue Date: April, 1986.

5) C. O. Woody (FPL) to Dr. J. Nelson Grace (NRC), Emergency Diesel Generator Load Evaluation, L-86-243 dated June 12, 1986; with Attachment: [JPE-L-86-74 Revision 0] Safety Evaluation, Turkey Point Units 3 & 4 (PTPN) Emergency Diesel Generator Load Evaluation.

6) C. O. Woody (FPL) to Dr. J. Nelson Grace (NRC), Request for Additional Information, Emergency Diesel Generator Load Evaluation, NRC TAC Nos. 61211 and 61212, L-86-295 dated July 16, 1983; with Attachment: FPL responses to NRC's July 8, 1986 Requests for Additional Information (RAIs), RAI-1 through RAI-11.

7) D. G. McDonald (NRC) to C. O. Woody (FPL), Emergency Diesel Generator Load Safety Evaluation - Turkey Point Units 3 and 4, dated December 15, 1986; with Enclosure: SAFETY EVALUATION REPORT, TURKEY POINT PLANT, UNITS 3 AND 4, DOCKET NOS. 50-250 AND 50-251, (TAC NOS. 61211 AND 61212).

8) G. E. Edison (NRC) to W. F. Conway (FPL), Turkey Point Units 3 and 4 - Request for Additional Information on Emergency Power System Enhancement Project (TAC Nos. 69023 and 69024), dated January 6, 1989; with Enclosure: Request for Additional Information Emergency Power System Enhancement Turkey Point, Units 3 and 4.

9) W. F. Conway (FPL) to NRC, Request for Additional Information on Emergency Power System Enhancement Project, NRC TAC Nos. 69023 and 69024, L-89-54 dated February 24, 1989; with Attachment: Response to Request for Additional Information Emergency Power System Enhancement Project (responses only to selected items).

10) W. F. Conway (FPL) to NRC, Request for Additional Information on Emergency Power System Enhancement Project, NRC TAC Nos. 69023 and 69024, L-89-107 March 20, 1989; with Attachment: Response to Request for Additional Information (responses to balance of items).

11) W. F. Conway (FPL) to NRC, Turkey Point Units 3 and 4 Docket Nos. 50-250 and 50-251, Information to Resolve Station Blackout, L-89-144, dated April 17, 1989.

12) Meeting between NRC (G. Edison, et al.) and FPL (J. Arias, et al.) on proposed Section 8 Technical Specifications for Turkey Point Nuclear held April 9-11, 1990 in Rockville, MD.

TABLE 1

LOOP PLUS LOCA PLUS EDG FAILURE
ONE EDG AVAILABLE
0 - 30 MINUTES
(EXISTING DESIGN)

	EDG LOAD* EVALUATION
HHSI	604
RHR	224
CS	223
CCW (Accident Unit)	380
CCW (Hot Shutdown Unit)	380
ICW (Accident Unit)	265
ICW (Hot Shutdown Unit)	265
Normal Containment Coolers	0
Emergency Containment Coolers	44
Emergency Containment Filters	104
Battery Chargers	0
Charging Pump	114
Pressurizer Heaters	0
Turbine Loads	0
Emergency Lighting	31
Control Room AC	54
BA Heat Tracing	40
EDG Auxiliaries	17
Miscellaneous Loads	8
Load Center Transformer Losses	14
Battery Room AC	22
H_2 Analyzer Related	14
Security Building Transformer	8
Computer Room/Cable Sprdg. Room AC	0
Boric Acid Pump	0
	2811

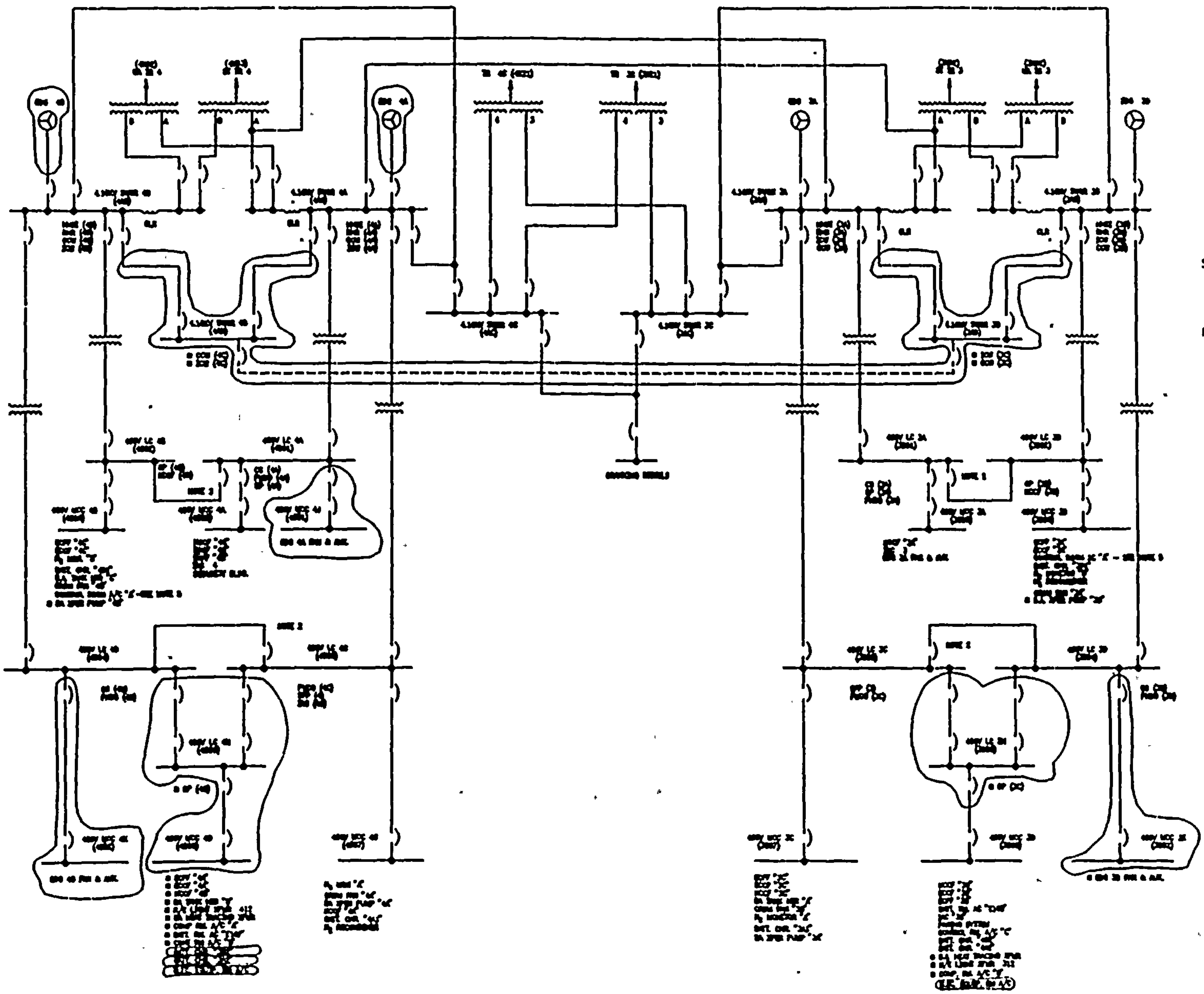
* PTPN 3 & 4 at Power, SIS on PTPN 3, EDG A fails; see Subsections 1.3 and 2.1

TABLE 2

EDG kW LOADS FOR LOOP PLUS LOCA, TWO-UNIT OPERATION: 0-30 MINUTES
(NOTE: COMPONENT kW LOADS INCREASED FOR CONSERVATISM; REFER TO SECTION 4.3 DISCUSSIONS)

COMPONENTS	U3: LOOP + SIS EDG 3A	 EDG 3B	U4: LOOP ONLY 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 (Accident Unit)	380	380	N/A	N/A	Only one CCW pump required
CCW (Hot Shutdown Unit)	N/A	N/A	380	380	Only one CCW pump required
ICW (Accident Unit)	270	270	N/A	N/A	Only one ICW pump required
ICW (Hot Shutdown Unit)	N/A	N/A	270	270	Only one ICW pump required
Normal Containment Coolers	N/A	N/A	(240/160)	(80/160)	Loss of power to LC 4D swings NCC 4B (MCC 4D)
Emergency Containment Coolers	50/25	25/50	N/A	N/A	Loss of power to LC 3D swings ECC 3C (MCC 3D)
Emergency Containment Filters	130/65	65/130	N/A	N/A	Loss of power to LC 3D swings ECF 3C (MCC 3D)
Battery Chargers	75/25	25/75	75/25	25/75	MCCs 3B, 3C, 3D, 4B, 4C, 4D power 8 bat chgr (1 per bat 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	0/20	20/0	0/20	Loss of power to LC 3D or 4D swings Emerg Ltg XFMR 312 (MCC 3D) or 412 (MCC 4D)
Control Room AC	30/0	30/60	30/0	0/30	Loss of LC 3C or 4C swings CRAC C (MCC 3D) or CRAC B (MCC 4D)
BA Heat Tracing XFMR	25/0	0/25	25/0	0/25	Loss of LC 3D or 4D swings XFMR 3X316 (MCC 3D) or 4X416 (MCC 4D)
Auxiliaries	30	30	115	115	MCC, 3A (EDG3A), 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	(25/0)	(0/25)	(25/0)	(0/25)	Loss of power to 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
Computer Rm/Cable Sprdg Room AC	(50/0)	(0/50)	(50/0)	(0/50)	One Train manually loaded, loss of LC 3C or 4C swngs AC A or AC B
Boric Acid Transfer Pump	N/A	N/A	(15)	(15)	Manually loaded; loss of LC 4D swings BA XFER pump 4B (MCC 4D)
Aux Bld and Elec Eqpt Room HVAC	68/0	0/68	68/0	0/68	Manually loaded or auto-process loaded after time delay
SWGR/LC Rms and EDG Rms HVAC	46	46	42	42	Manually loaded or auto-process loaded after time delay
Plant Investment Loads (est.)	(175)	(100)	(175)	(100)	Plant Invstment loads incl turbine loads, both manual & process-auto
LARGEST TOTAL KW LOADING: (including manual loads) shown	2204 (Loss of LC 3D)	2159 (Train B align.)	2410 (Loss of LC 4D)	2255 (Train B align.)	
EDG Continuous Rating (nom.)	2500	2500	2874	2874	

GENERAL NOTES: 1) Total kW loading reflects maximum possible load on each diesel, individually. Totals to not occur simultaneously as shown. 2) Security Bldg. XFMR load not shown due to Sec. Upgrade Project. 3) Parenthesis denotes manual load kW values. 4) For X/Y format: X is the swing alignment and Y is the normal alignment.



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

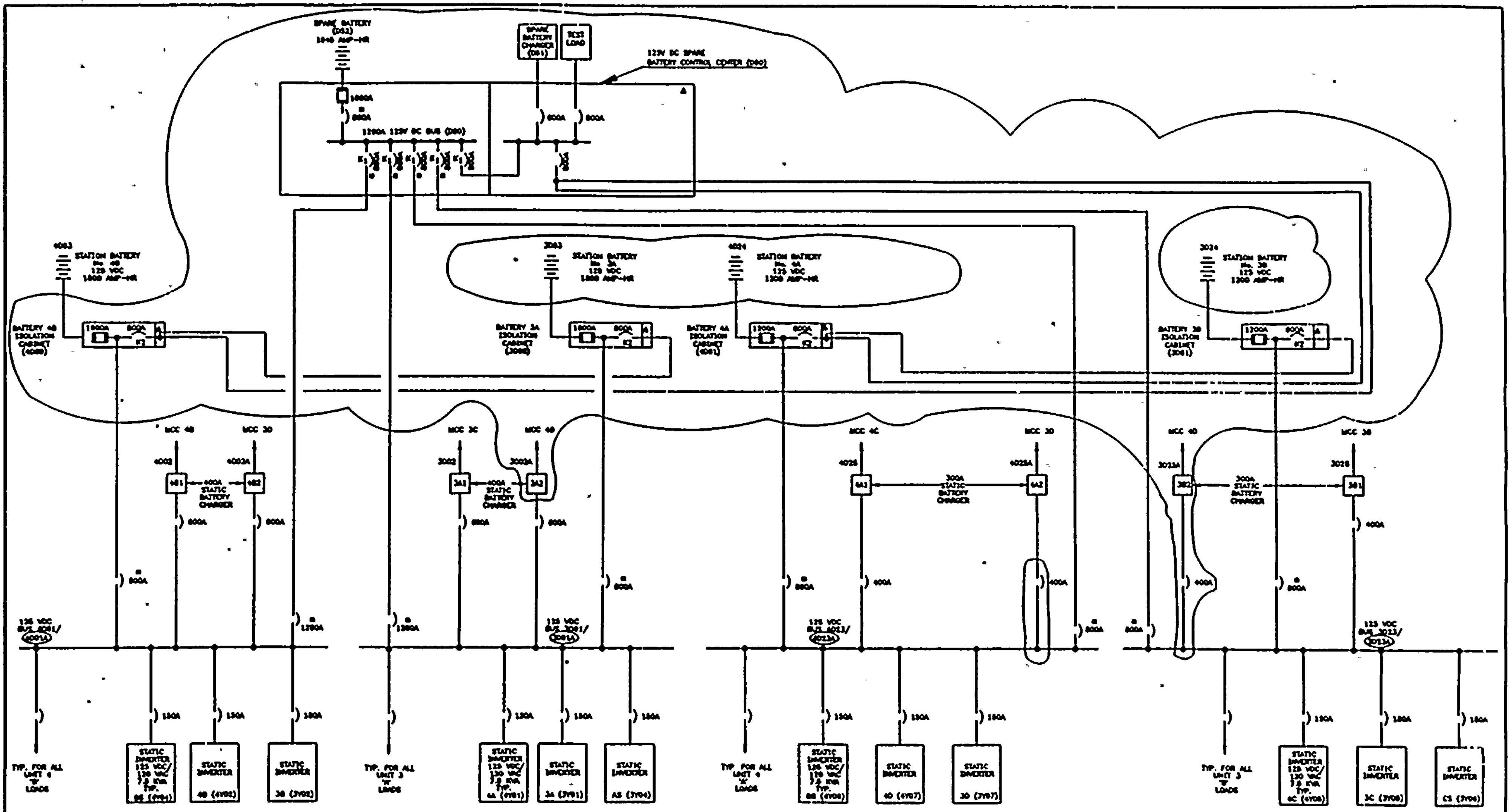
FLORIDA POWER & LIGHT COMPANY

TURKEY POINT PLANT UNITS 3 & 4

EMERGENCY POWER SYSTEM ENHANCEMENT

AC ONE-LINE DIAGRAM

FIGURE 1



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

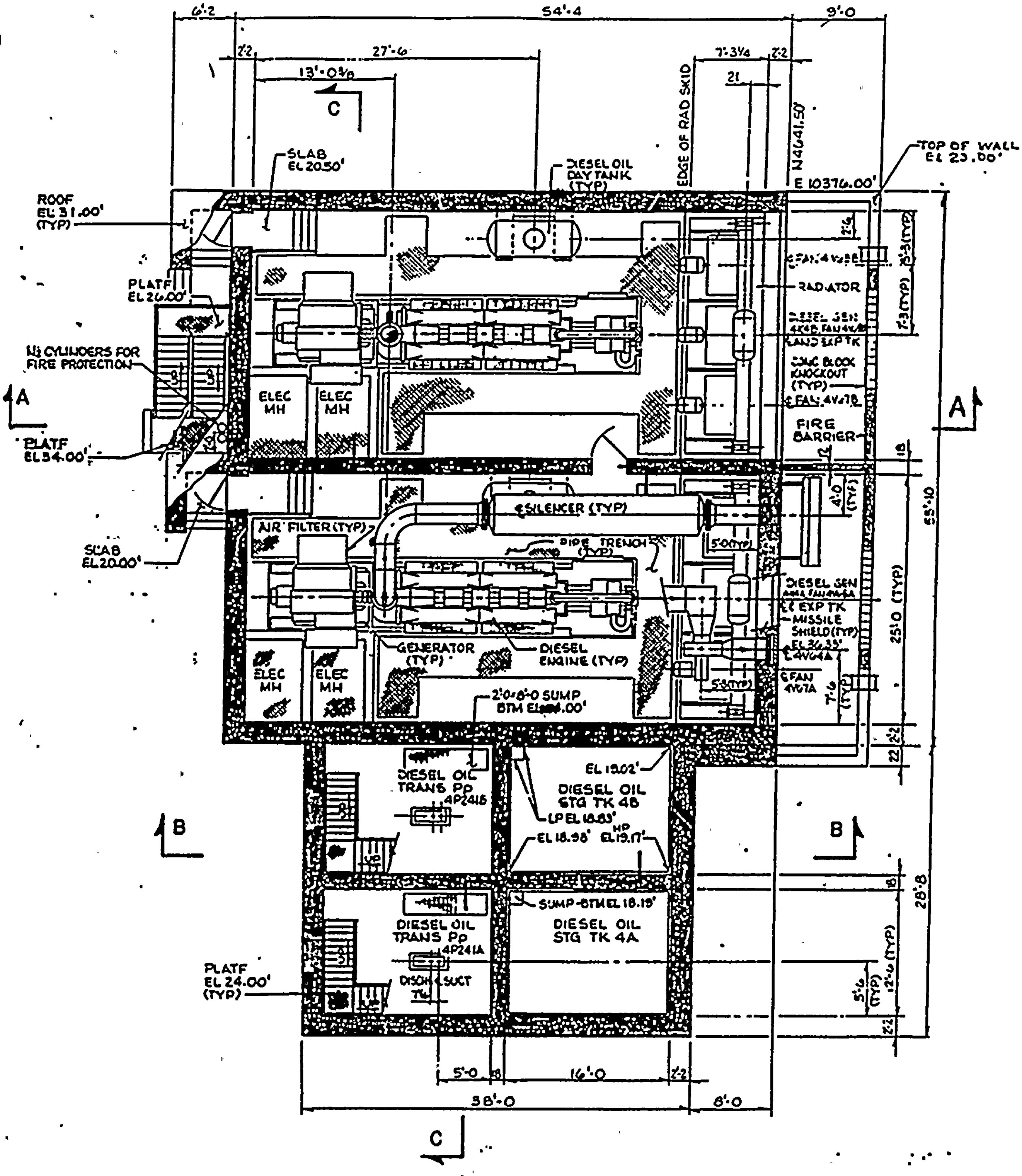
INDICATES EQUIPMENT ADDED BY EPS ENHANCEMENT PROJECT AND OTHER MODS

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

EMERGENCY POWER SYSTEM ENHANCEMENT
DC ONE-LINE DIAGRAM

FIGURE 2

[illegible]

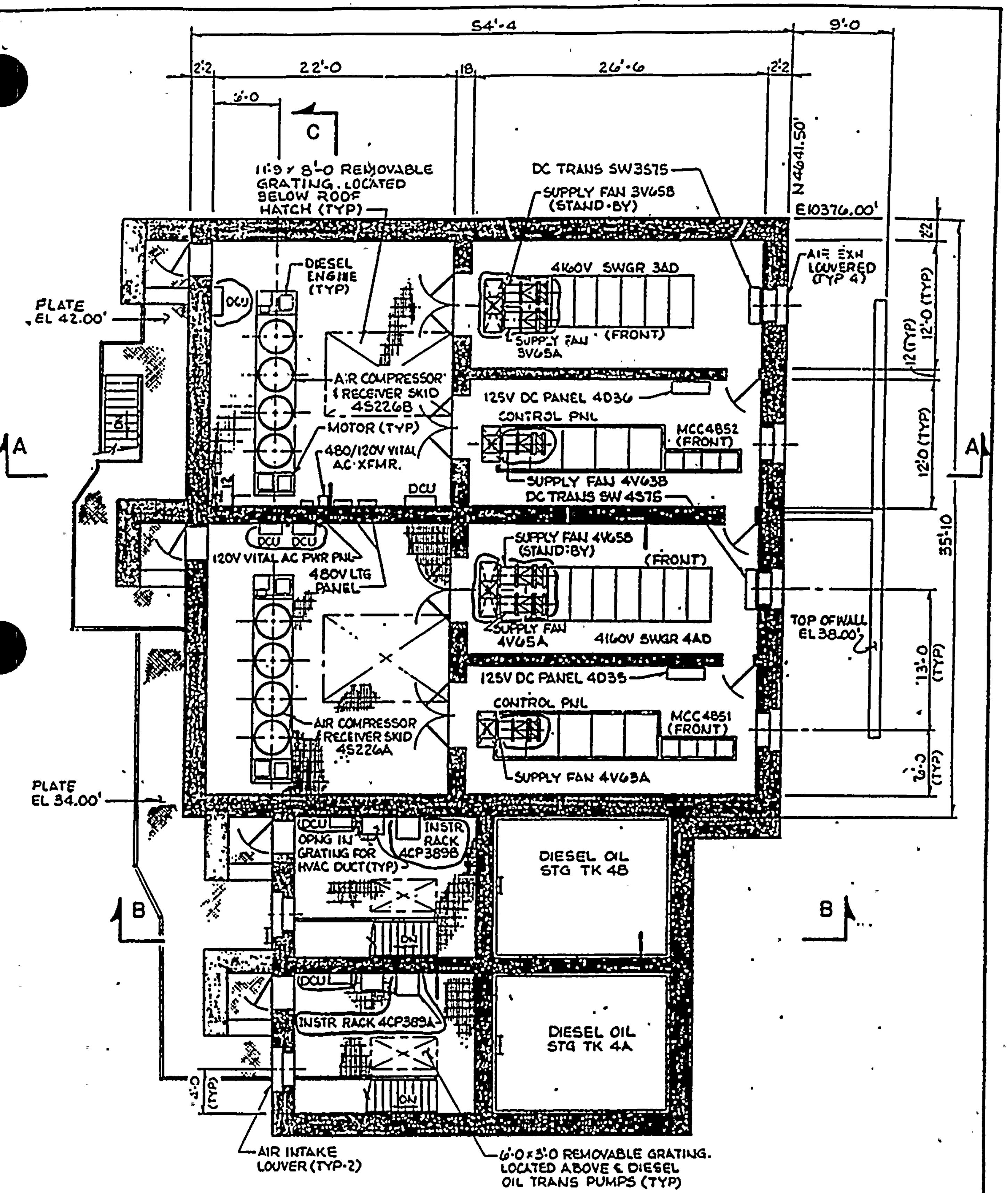


GROUND FLOOR PLAN

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

EMERGENCY POWER SYSTEM ENHANCEMENT
NEW EDG & DOST BUILDINGS
-GROUND FLOOR PLAN
FIGURE 3

[illegible]

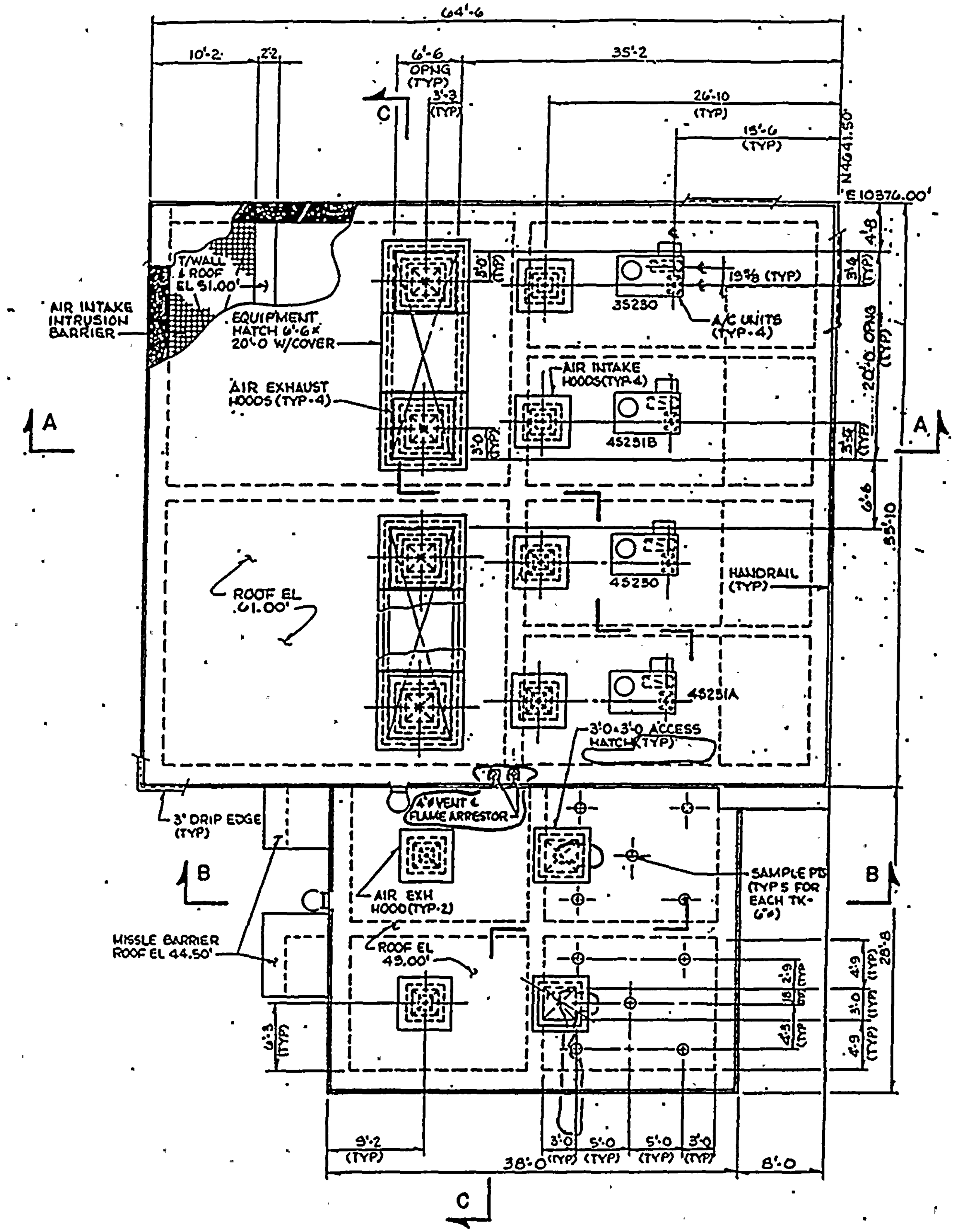


SECOND FLOOR PLAN

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

EMERGENCY POWER SYSTEM ENHANCEMENT
NEW EDG & DOST BUILDINGS
-SECOND FLOOR PLAN

FIGURE 4

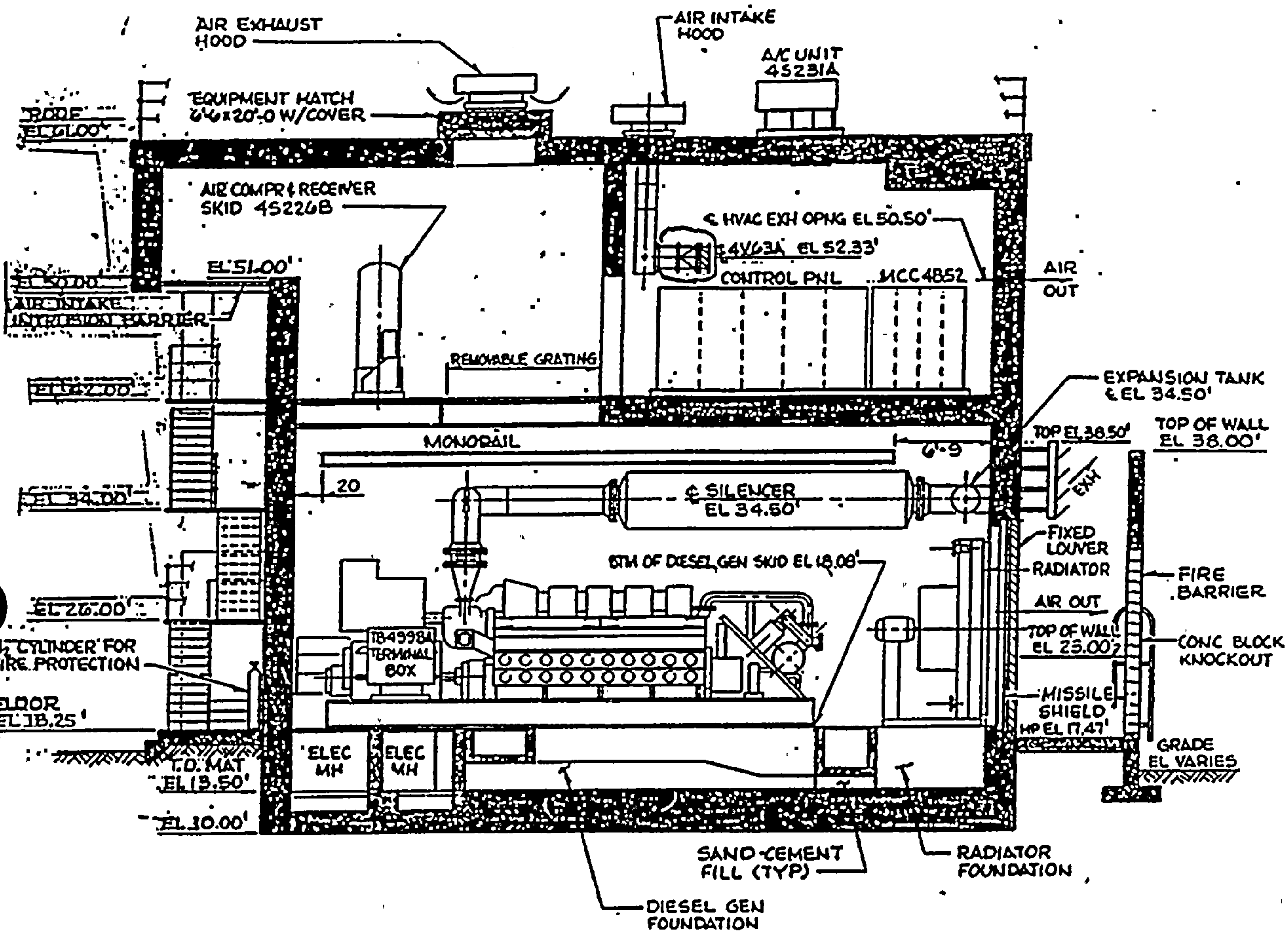


ROOF PLAN

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

EMERGENCY POWER SYSTEM ENHANCEMENT
NEW EDG & DOST BUILDINGS
-ROOF PLAN

FIGURE 5

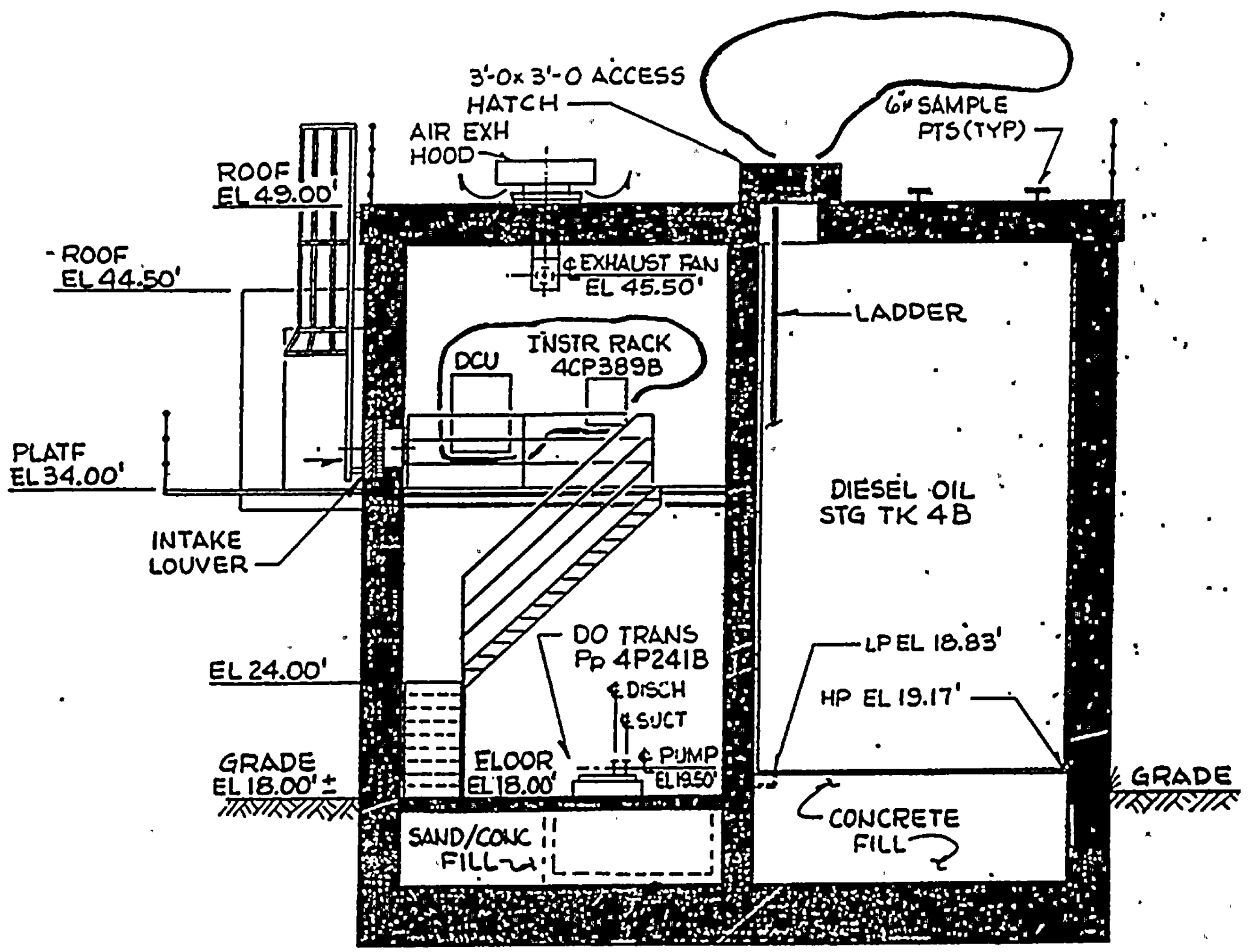


SECTION A-A
(D-6,12)

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

EMERGENCY POWER SYSTEM ENHANCEMENT
NEW EDG BUILDING
-SECTION A-A

FIGURE 6



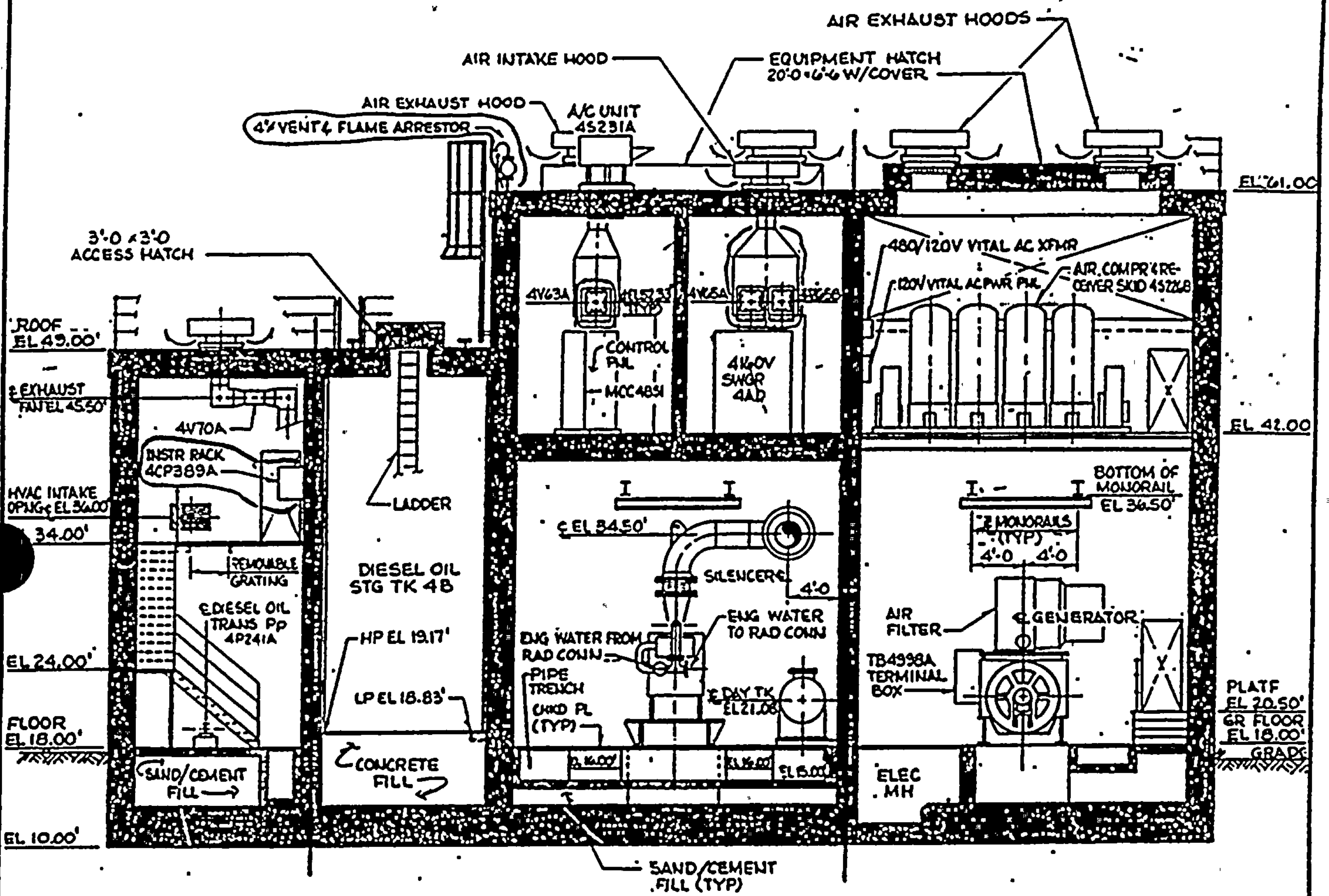
SECTION B-B
(6-5,11,17)

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

EMERGENCY POWER SYSTEM ENHANCEMENT
NEW DOST BUILDING
-SECTION B-B

FIGURE 7

[illegible]



SECTION C-C
(H-3,9,15)

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

EMERGENCY POWER SYSTEM ENHANCEMENT
NEW EDG & DOST BUILDINGS
-SECTION C-C

FIGURE 8

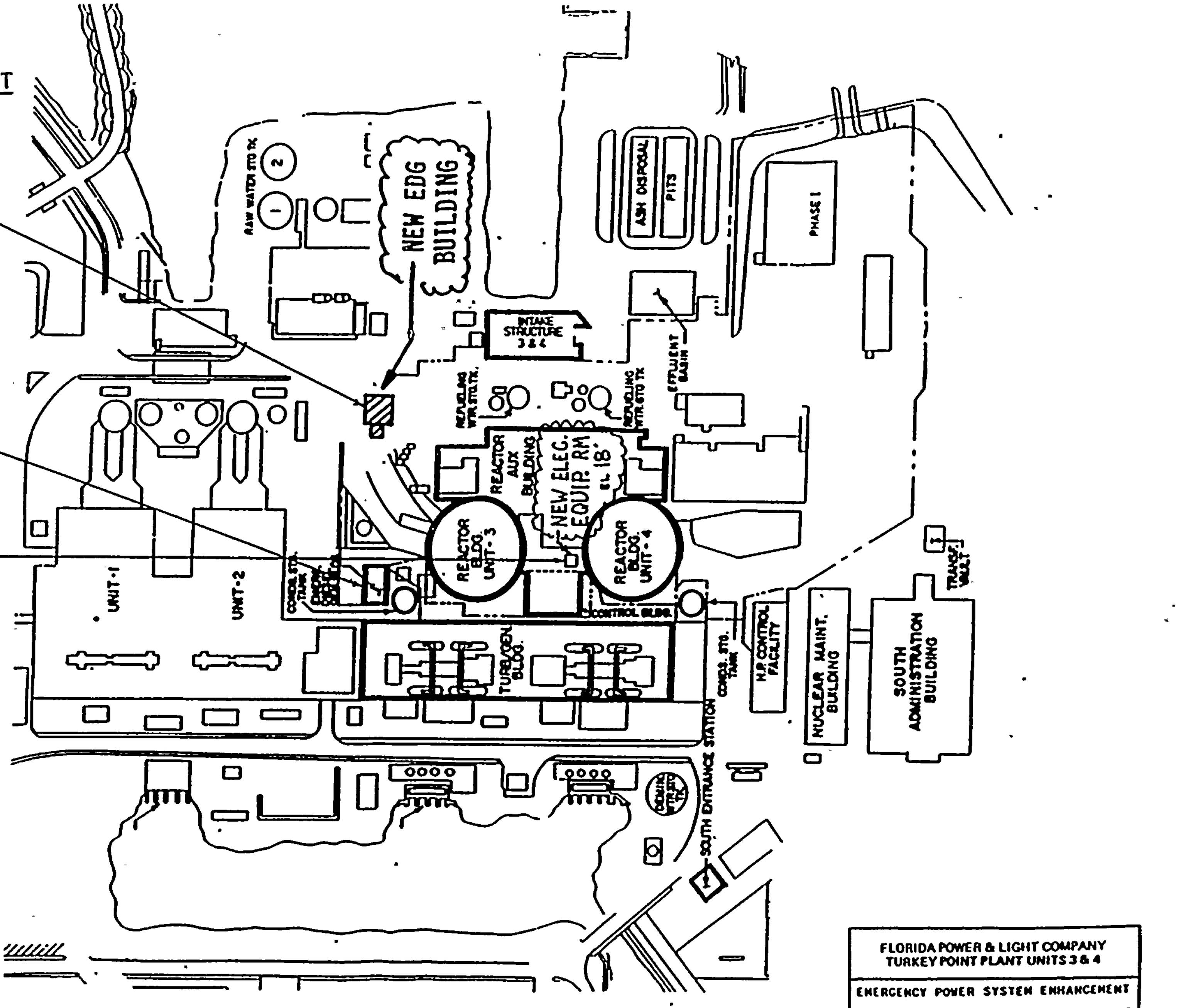
ADDITIONAL (MAJOR) EQUIPMENT AND LOCATIONS

New EDG Building
el. 42'
MCCs 4J and 4K
4 kV Swgr. 3D and 4D
el. 18'
EDGs 4A and 4B

Existing EDG Building
el. 18'
MCC 3K

New Elec. Equip. Rm.
el. 18'
MCC 4D
LCs 3H and 4H
Spare Battery
Bat. Chrs 4A2 and 4B2

el. 27'
Bat. Chrs 3A2 and 3B2



TURKEY POINT
SITE GENERAL ARRANGEMENT

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

EMERGENCY POWER SYSTEM ENHANCEMENT
ADDITIONAL EQUIPMENT LOCATIONS
FIGURE 9