FLORIDA POWER & LIGHT COMPANY

TURKEY POINT UNITS 3 AND 4

EMERGENCY POWER SYSTEM ENHANCEMENT REPORT

JUNE 1988

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

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 concerns and their resolution. 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 1989.

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 concerns 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. The specific concern 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. FPL believed that the EDGs were in a condition that was outside the design basis of the plant. 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 concerns. 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 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.

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 1990. Actual plant electrical reconfigurations of Train A and Train B on each Unit are tied to a dual Unit outage scheduled 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 REFERENCES FOR SECTION 1.0

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).

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 power to both Units plus a failure of one EDG) result in about 2750 kW of automatically connected loads and then approximately 2500 kW for the duration of the accident. In the first half-hour of this postulated accident scenario, this 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 #4 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 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 sequencers 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 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, new 4.16 kV switchgears, new 480V load centers, new 480V motor control centers, new 125V DC transfer/ distribution panels, new sequencers, breakers, battery chargers, etc, plus lighting distribution panels, transformers, cabling and numerous components necessary for modifying the existing equipment. 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 #3, presently supplying power to the A system of both Units, is reassigned to the Unit 3A power system, and relabeled EDG 3A. Similarly, existing EDG #4 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 sequencers are replaced with four new qualified solid-state type sequencers.

The new swing 4.16 kV switchgear 3D supplies power to 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 is 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.

Each Unit has a new 480V load center swing bus located on the (future) mezzanine floor in the Auxiliary Building hot machine shop (which is being converted to a Chemistry laboratory). 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 is 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 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.

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

The existing MCCs 3A and 4A have Telemand Transfer Systems which allows them to be powered from either existing Train A or Train B. These existing Telemand operators will be deleted as there are no safety loads without redundant counterparts connected to these MCCs.

The existing MCC D provides power to the Plant's common, shared and third service loads. This MCC has a Telemand Transfer System which allows it to be powered from either Unit 3 (Train B) or 4 (Train A). This existing Telemand operator will be deleted. The enhanced design thus eliminates the complicated Telemand logic and replaces it with a much simpler power-seeking transfer design.

Two battery chargers are added (see Figure 2) and the two existing spare chargers are being realigned. This results in two chargers aligned to each DC bus, each powered from a different MCC to assure that at least one charger is always available per DC bus. See Figures 1 and 2.

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 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 Unit 4 4.16 kV buses, are removed under the Emergency Power System Enhancement Project.

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.

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:

Continuous rating: 2865 kW
Short Time rating: 3150 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 a nonoperable A or B Component Cooling Water pump or an Intake Cooling Water pump.

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 (future) mezzanine floor in the Auxiliary Building hot machine shop. Each swing load center has the capability of being automatically connected to either the A or the B bus of its Unit via a tie containing two breakers, to either the (3C) 4C load center or the (3D) 4D load center.

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 fans and auxiliaries while MCC 4K is fed from Load Center 4D and supplies EDG 4B 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 next to present MCC "D" (relabeled 3D) 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 3D, previously normally fed from Load Center 3D, is now powered from Load Center 3H. All existing Telemand transfer systems (for existing MCCs 3A, 4A and D) are being deleted.

3.5 125V DC BUSES

The existing plant DC distribution systems consist of four 125 volt DC buses 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 for testing. Since this swing charger will be dedicated and the existing tie removed, a new tie will be provided for battery testing. The breakers associated with this tie-line are normally maintained in the open position. Refer to Figure 2.

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. Two new DC breaker panels are provided (as extensions of buses 4A and 3B) to accommodate new loads.

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

3.6 LOAD SEQUENCERS

New sequencers are provided for switchgear 3A, 3B, 4A and 4B to ensure an orderly automatic loading of essential equipment under the emergency mode conditions. The sequencer consists of timing devices that determine the steps for load applications. The sequencer is provided with a test capability to verify proper sequencer operation.

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 systems 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 Overcurrent
b. Loss of Excitation
c. Reverse Power
d. Time Overcurrent
e. Voltage Balance
f. Under Frequency
g. Over Voltage
h. Under Voltage

All of the above protective relays, except the generator differential overcurrent, are bypassed under emergency operation. In addition to the generator differential overcurrent relay, the only other fault 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 supply breaker. The breaker on the bus receiving power is the feeder 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 Feeder Breaker

The automatic operation of this breaker (which is not being changed) is tied to the start-up and operation requirements of the Emergency Diesel Generator, bus stripping and bus cleared relays and permissives. During EDG load testing, this breaker is manually closed after synchronizing with the bus.

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

Each breaker is automatically tripped by the 4.16 kV Bus undervoltage 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 a control switch 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 From 4.16 kV Bus Supply Breakers
(Supply from secondary of 4.16 kV/480V transformer)

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 From 480V Load Center 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 lines to the 4.16 kV Buses A and B. Thus, a swing bus has capability to receive power from either the A or B power train. 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 emergency power supply at any given time.

Both breakers in the alternate tie line are in the open position. Each breaker is provided with overcurrent protection. Each breaker can be closed/tripped with a local control switch or from the control room. Position indication is provided in Control Room.

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

Each 480V Swing Load Center (3H/4H) is provided with tie lines to 480V Load Centers (4C/4D,3C/3D) 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 'A' position, the tie breakers in line with Bus 'B' receive a trip signal and the tie breakers in line with Bus 'A' 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, if at least one of these breakers are 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 a selector switch in Control Room; or 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. Isolation 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. 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 or deterioration of voltage at the 4.16 kV switchgear or at the 480V Load Centers, the voltage monitoring relays will actuate the undervoltage actuation system.

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 a 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 by energizing bus stripping relays. The bus stripping relays open all bus supply breakers and all safety-related load feeder breakers, energize the bus isolation relays, and start the diesel.

The bus isolation relays, when energized, open all non-safety related load feeder breakers and establish the emergency mode of operation for the EDG. In the emergency mode of operation the diesel achieves its normal operating speed and voltage in fifteen seconds and the trip functions of all protective devices, with exception of overspeed and generator differential relay, are deactivated. 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. The emergency mode of operation for an EDG is defined as the condition when the EDG is the sole source of power connected to the 4.16 kV bus and consequently the bus isolation relay is operated.

When the frequency and voltage of the EDG are within the acceptable limits, an automatic closure signal is issued to close the EDG breaker.

When the normal power supply is re-established, the 4.16 kV bus may be transfered to the start-up transformer. The synchronization of the EDG and transfer of the 4.16 kV bus to the start-up transformer can be performed from the main control board or locally. As soon as the 4.16 kV bus supply from start-up transformer breaker is closed, the operating mode of EDG is changed from emergency to normal. Subsequently, the EDG may be 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 operation of EDG.

In the normal mode the diesel is started manually by depressing the start push button. During the start-up period the diesel operates at a predetermined idle speed to allow an orderly warm up of the engine to minimize wear. After the warm up period is completed, the diesel speed increases to the level of normal operation in preparation for loading. An undervoltage signal or safety injection signal will take precedence over the normal mode of operation (as discussed above).

When the diesel is at normal speed and voltage is established, the operator may proceed with synchronization of the generator voltage with the 4.16 kV bus voltage 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 with a control switch. When the EDG is disconnected from the 4.16 kV power bus, the stop push button is depressed to initiate the normal diesel shutdown. During the shutdown period the diesel will operate for a period of time at a predetermined idle speed to allow the engine heat to dissipate in an orderly manner. After this period of cooldown, idle operation is completed and the diesel will stop.

An "emergency stop" push button is provided for a fast stop of the diesel. By depressing the push button, the period of engine cooldown, at idle speed, is eliminated from the diesel shutdown process thus resulting in a fast stop of the diesel. The stop signal is effective only in the normal mode of diesel operation.

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 EDGs receive the auto-start signal, due to SIS actuation, until the diesels attain normal operating speed. The diesels continue to operate in a no-load condition at normal operating speed unless an undervoltage signal is received or until they are stopped manually.

The normal or emergency diesel shutdown process may be initiated by depressing the related push button on the control panel. However, if SIS is actuated again, the diesel will be started in the same automatic mode as delineated above.

In case a loss of normal power supply occurs subsequent to SIS actuation, the normal mode of EDG operation is immediately superseded by the emergency mode of operation. 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.

4.2.3 Load Sequencer Operation

The following Subsections describe operation of the load sequencers.

4.2.3.1 Loss of Normal Power Supply

Upon detection of a degraded voltage condition (see Subsection 4.2.1), the sequencer starts automatically upon closure of the EDG breaker. The timing contacts of the sequencer close the breakers 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 resets the timing contacts of the sequencer to the zero time condition regardless of the state of progress for the 4.16 kV bus loading operation. Those loads that have been already connected to the 4.16 kV bus by the sequencer action, in response to loss of normal power supply, remain connected if they are required in response to an SIS.

4.2.3.3 Actuation of SIS With Normal Power Supply Available

The sequencer closes all breakers of equipment required for the mitigation of consequences of an accident immediately and simultaneously.

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 <u>4.16 KV Swing Switchgear</u>

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 swithgear 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 <u>480V Swing Load Center Including 480V MCC</u>

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 allow for loading of the load center onto the EDG before transfer occurs. 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 the automatic transfer of the 480V swing load center to the 480V alternate bus.

4.2.6 Monitoring of Emergency Diesel Generator Operability

The diesel generator is periodically started and loaded in parallel with the plants normal power supply for the purpose of proving 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.

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 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 postulated DBA with the existing design.

Table 2 presents the EDG loading for a LOCA and LOOP on Unit 3 and a LOOP on Unit 4 with the enhanced design. 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) and manually loaded components such as plant investment loads (e.g., turbine loads) and desired loads such as pressurizer heater banks and charging pumps.

On Table 2, components which are 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 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 loads on EDGs 3A and 4A are shown as if MCC 3D and MCC 4D have swung to the A power train. The loads on EDGs 3B and 4B are 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 #4 loads shows that potential EDG loading concerns have been alleviated with the enhanced design.

Table 2 presents the loads on the four EDGs 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 kW loading on each EDG, for this Unit 4 accident scenario, is as follows:

EDG 3A: 2100 kW (assuming loss of LC 3D, and LC 3H swings to LC 3C)
EDG 3B: 2200 kW (assuming LC 3H is aligned to LC 3D)
EDG 4A: 2085 kW (assuming loss of LC 4D, and LC 4H swings to LC 4C)
EDG 4B: 2135 kW (assuming LC 4H is aligned to LC 4D).

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 mezzanine floor, etc. 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 steel missile 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 latter. 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.

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 Duct Banks

New underground electrical duct banks are constructed for the routing of new cables.

5.1.4 Materials and Quality Control

The structures are reinforced concrete and structural steel. The fundamental design and quality requirements for these materials 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

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. The system consists of one diesel oil storage tank, one transfer pump, one day tank, interconnecting piping, valves and associated instrumentation and control for each EDG.

a. Diesel Oil Storage Tanks

Each Diesel Oil Storage Tank (DOST) has an approximate capacity of 38,000 gallons, which is sufficient to operate a diesel at continuous load rating for a minimum of seven days. Additional capacity is added to each tank, to provide the capability of receiving a diesel oil load (8,000 gallons) from a transport vehicle without having to reduce the tank's inventory below the minimum Technical Specification requirements.

The concrete steel lined DOSTs are 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 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 posulated 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 take suction from the diesel oil storage tanks and discharge into the diesel day tanks. The new pumps have enough capacity (approximately 10 GPM) for supplying diesel oil for at least two diesels at continuous load rating.

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

The new (for Unit 4) and existing (for Unit 3) Diesel Oil Transfer Pump discharge lines are interconnected, which provides flexibility of operation.

c. Piping and Valves

The system piping external to the engine skid 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 provided:

i. Local oil level and temperature indication for each diesel oil storage tank and local oil level indication for the day tank.

ii. Day Tank oil level switches for providing Diesel Oil low and high level alarm in the Control Room.

iii. Oil level switches for low, low-low, high and high-high signals in the day tanks. These signals 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. The low-low and high-high levels in the day tank are locally alarmed, with a "Diesel Trouble" alarm in the Control Room.

iv. Oil pressure and flow indications at the Diesel Oil Transfer Pump discharge.

5.2.2 Emergency Diesel Engine Starting System

The starting system for each diesel is comprised of two redundant systems which includes two air compressors (one diesel and one electric motor driven), 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. The air receivers are sized to ensure that each redundant 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 air intake is located at approximately 32 feet above grade (see Figure 6). The intake is provided with multiple turns to prevent air entrained water from entering the diesel air intake. Provision for draining the entrained water from the air intake is provided.

The air intake is designed and located as far as possible from the exhaust to ensure that dilution or contamination of the intake air by the exhaust products will not preclude operation of the diesel engine at rated power output.

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 portion of the exhaust piping located outside the Diesel Generator Building is protected against missiles and possible clogging.

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 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 engine water outlet high 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 diesel control panel or locally.

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 and high lube oil temperature.

c. Pressure Indicators for Standby Lube Oil Pressure and Lube Oil Filter Inlet and Outlet.

d. Pressure Switches for low standby pressure alarm, low engine pressure alarm, low engine pressure shutdown and crankcase pressure.

Readouts are provided on the diesel control panel or locally.

Engine lube oil piping is designed in accordance with the requirements of the ANSI B31.1. This piping meets Seismic Category I requirements.

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 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 have a capacity of less than 660 gal. and 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 above. 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 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.

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) 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 testing of the new components including the Emergency Diesel Generators will be discussed in a later submittal.

6.2 OUTAGE ACTIVITIES

Both Units will be shut down in order to tie-in the new EDGs, modify the existing EDGs and separate and install the load sequencers. The implementation of these modifications is required on a per-train basis (train A and then train B) to ensure the availability of equipment required for plant conditions.

The tie-in of the 4A EDG to the Unit 4 Train A electrical auxiliary system also includes the associated tie-ins of the 4.16 kV switchgear 4D, 480V Load Center 4H, the connection of MCCs 4J to Load Centers 4A and the relocation of associated Train A loads to load center 4H, and switchgear 4D.

Simultaneous to the tie-in of the 4A EDG the EDG (#3) presently supplying power to buses 3A and 4A will be modified and sequencers 3A and 4A replaced. The train 3A modifications will include the associated Train A tie-ins of the 4.16 kV switchgear 3D, 480V Load Center 3H, and the relocation of loads. Upon completion of train 3A and 4A modifications, including satisfactory system testing, the tie-in of the diesel generator to the electrical system and the modifications to the Unit 3 Train B electrical system can be initiated. The activities for modifying trains 3B and 4B are similar to those described for trains 3A and 4A except for the relocating of the loads to MCC 4D. Following completion of the modifications required, an integrated safeguards test will be performed prior to returning either Unit to service.

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 on 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 enables 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 on Table 2, each required safeguards load remains on its existing train, each of which is now supplied from an emergency diesel generator. Failure of one emergency diesel generator leaves the remaining diesel generators providing power to those loads on the unaffected trains. 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 on 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 to be required if additional loads are changed over 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.

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 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. During two-Unit operation, it would take two single failures to result in only one energized 4.16 kV bus on each Unit. Because of this capability, overall plant safety is enhanced.

The design is undergoing review to ensure that if equipment is taken out of service each Unit can still meet the single failure criterion.

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.

7.5 SAFEGUARDS TESTING

At present, both Units are shutdown 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 since the operability of the other unit is not affected. The enhanced EPS with its increased capacity and load distribution diversity ensures that the non-tested unit will have sufficient equipment available for both normal operation and accident mitigation while 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 300 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.

It is expected that future analysis will demonstrate that plant operation under the enhanced EPS will be bounded by current FSAR accident analyses. Detailed evaluations supporting this conclusion together with revised plant Technical Specifications will be the subject of future submittals.

TABLE 1

LOOP PLUS LOCA PLUS EDG FAILURE
ONE EDG AVAILABLE
0 - 30 MINUTES

	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
95% Total Pump kW Correction	-51
	2760

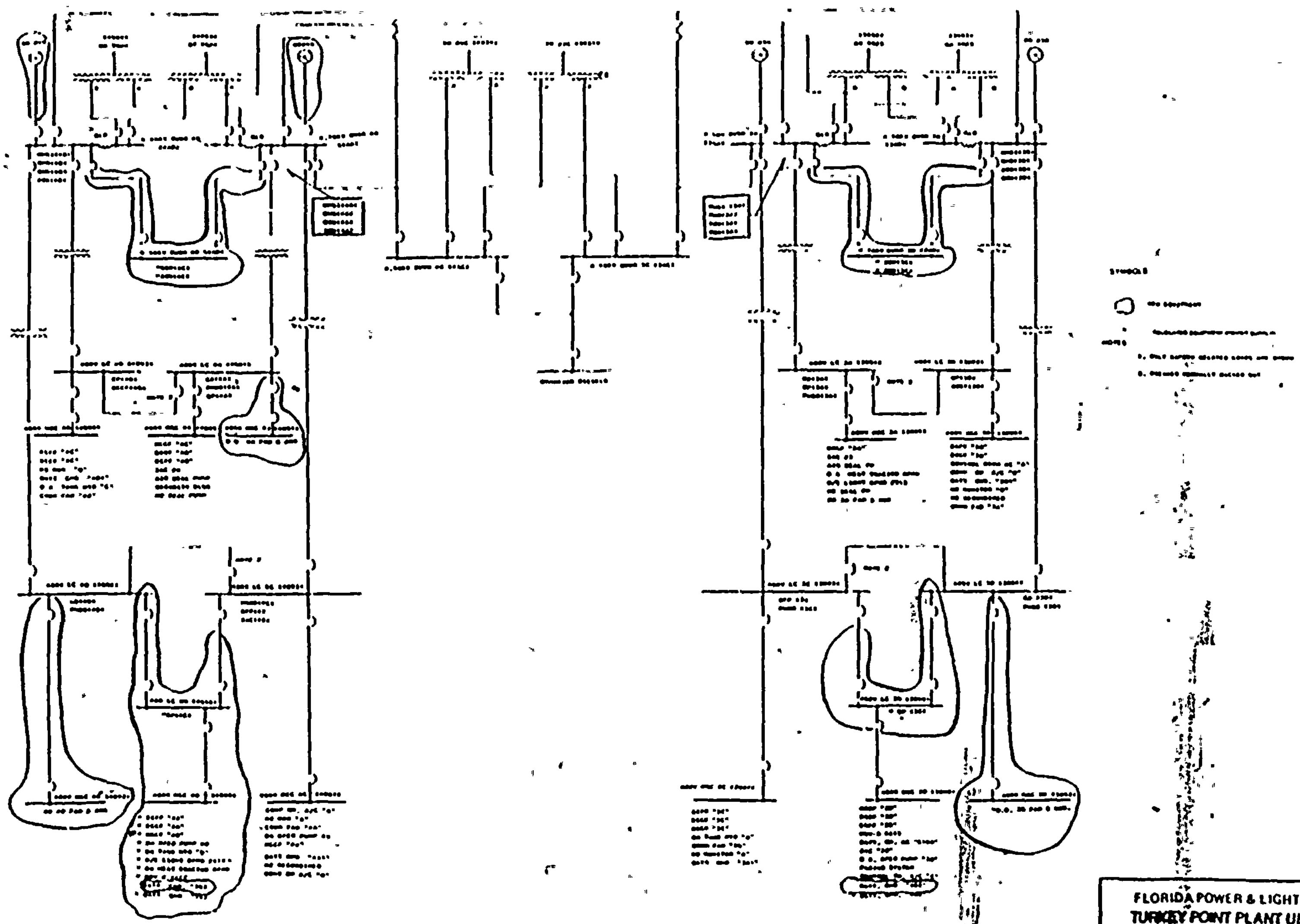
* PTPN 3 & 4 at Power, SIS on PTPN 3, EDG A fails; see Subsections 1.3 and 2.1

TABLE 2

EDG kW LOADS FOR LOOP PLUS LOCA, TWO-UNIT OPERATION
(NOTE: COMPONENT kW LOADS INCREASED FOR CONSERVATISM)

REFER TO SECTION 4.3 DISCUSSIONS

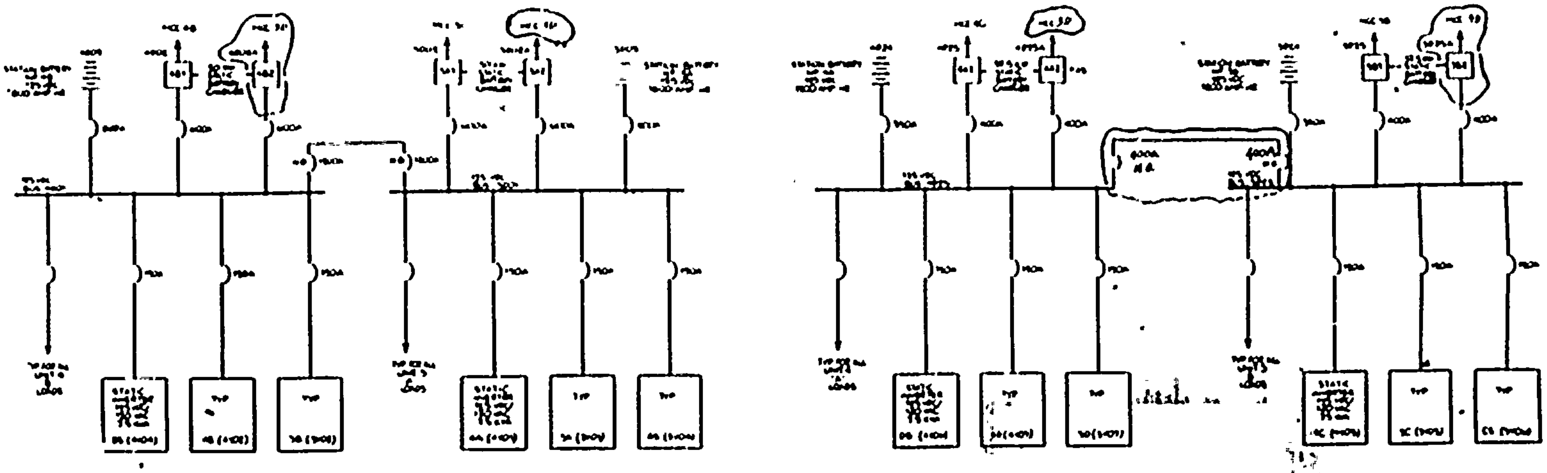
COMPONENTS	U3: LOOP + SIS EDG 3A	EDG 3B	U4: LOOP ONLY EDG 4A	EDG 4B	REMARKS
HHSI	305	305	305	305	Only two HHSI pumps required for accident Unit
RHR	225	225	225	225	Only one RHR pump per Unit required
CS	225	225	N/A	N/A	Only one CS pump required on accident Unit
CCW (Accident Unit)	380	380	N/A	N/A	Only 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	195/130	65/130	Higher kW load on EDG 4A if loss of LC 4D swings NCC 4B (MCC 4B)
Emergency Containment Coolers	50/25	25/50	N/A	N/A	Higher kW on EDG 3A if loss of LC 3D swings ECC 3C (MCC 3D)
Emergency Containment Filters	130/65	65/130	N/A	N/A	Higher kW on EDG 3A if loss of 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 battery chargers (4 required)
Charging Pump	N/A	N/A	(125)	(125)	Manually loaded for hot shutdown RCS inventory control; one req.
Pressurizer Heaters	N/A	N/A	(150)	(150)	Manually loaded for hot shutdown RCS pressure control; one req.
Turbine Loads	see "plant investment"		see "plant investment"		Plant invstmnt loads incl turbine loads, both manual & process-auto.
Emergency Lighting	20	—	20/0	0/20	Highr kW load on EDG 4A if loss of LC 4D swngs Emrg Ltg XFMR 412 (MCC 4D)
Control Room AC	30/0	30/60	30	—	Higher kW on EDG 3A if loss of LC 3D swings CRAC C (MCC 3D)
BA Heat Tracing	N/A	N/A	(25/0)	(0/25)	Not required, manual load; loss of LC 4D swings BA Ht Tr B (MCC 4D)
EDG Auxiliaries	20	20	110	110	Estimated
Miscellaneous Loads	25	25	25	25	Estimated
Load Center Transformer Losses	10	10	10	10	Varies depending on load
Battery Room AC	25/0	0/25	—	—	Higher kW on EDG 3A if loss of LC 3D swings Batt. Rm. AC A (MCC 3D)
H_2 Analyzer Related	10	10	10	10	One Train per Unit required
Security Building Transformer	—	—	10	—	Independent feed from offsite power
Computer Rm/Cable Sprdg Room AC	—	(60)	(60)	—	One Train manually loaded
Boric Acid Pump	N/A	N/A	(60/30)	(0/30)	Manually loaded; loss of LC 4D swings BA xfer pump 4B (MCC 4D)
Plant Investment Loads (est.)	(150)	(300)	(150)	(300)	Manually loaded
LARGEST TOTAL KW LOADING: (including manual loads)	1950 (loss of LC 3D)	2170 (Train B align.)	2235 (loss of LC 4D)	2190 (Train B align.)	NOTES: 1) Component kW loads increased for conservatism. 2) Swing of LC shown for comparison of loads: LCs 3D and 4D do not fail concurrently. 3) Charging pump and pressurizer heaters not actually concurrent loads. 4) Refer to Section 4.3. 5) The assignment of loads to LCs and MCCs is still being evaluated for single failure considerations.
EDG Continuous Rating (nom.)	2500	2500	2865	2865	



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

EMERGENCY POWER SYSTEM ENHANCEMENT
AC ONE-LINE DIAGRAM

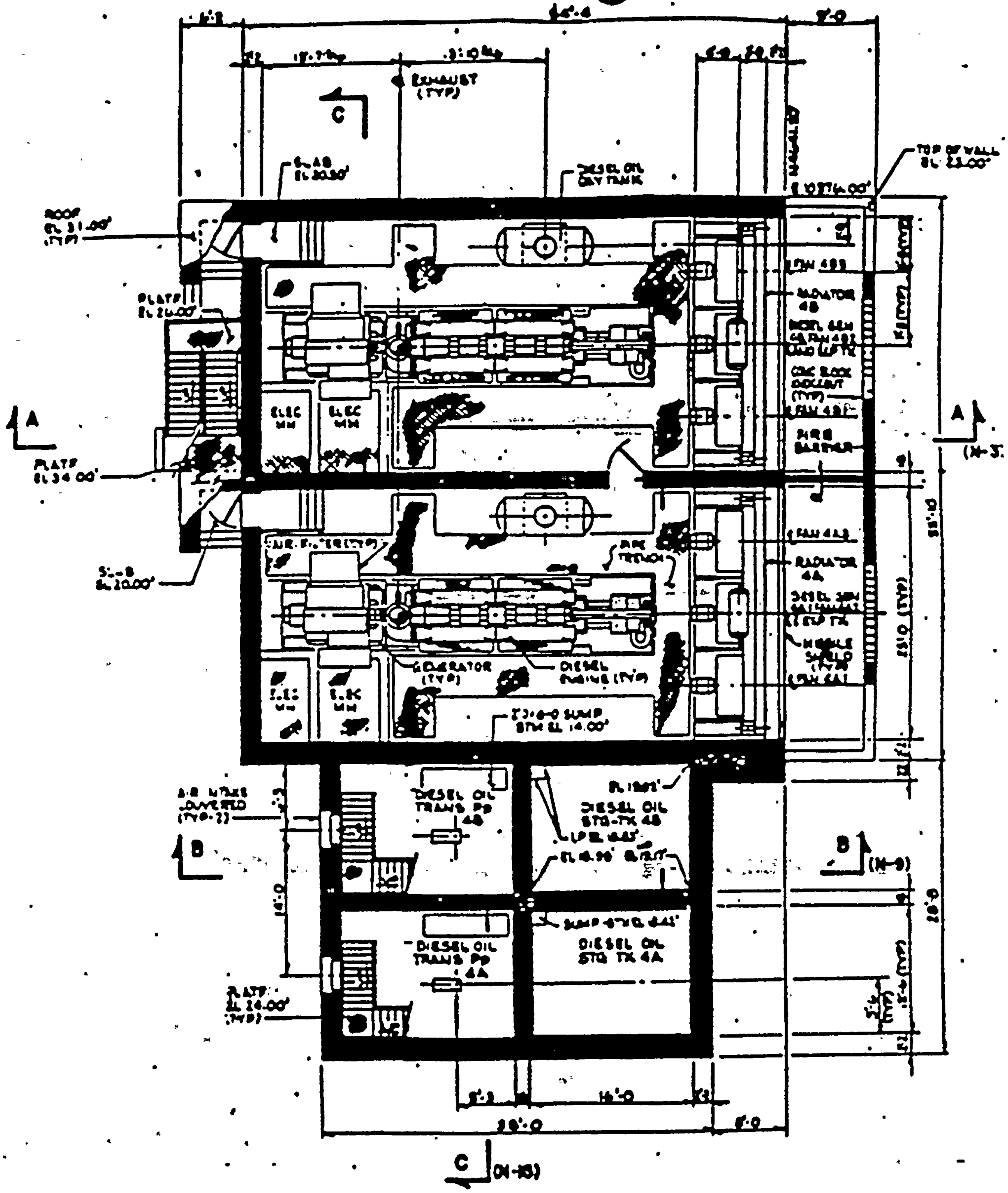
FIGURE 1



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

EMERGENCY POWER SYSTEM ENHANCEMENT
DC ONE-LINE DIAGRAM

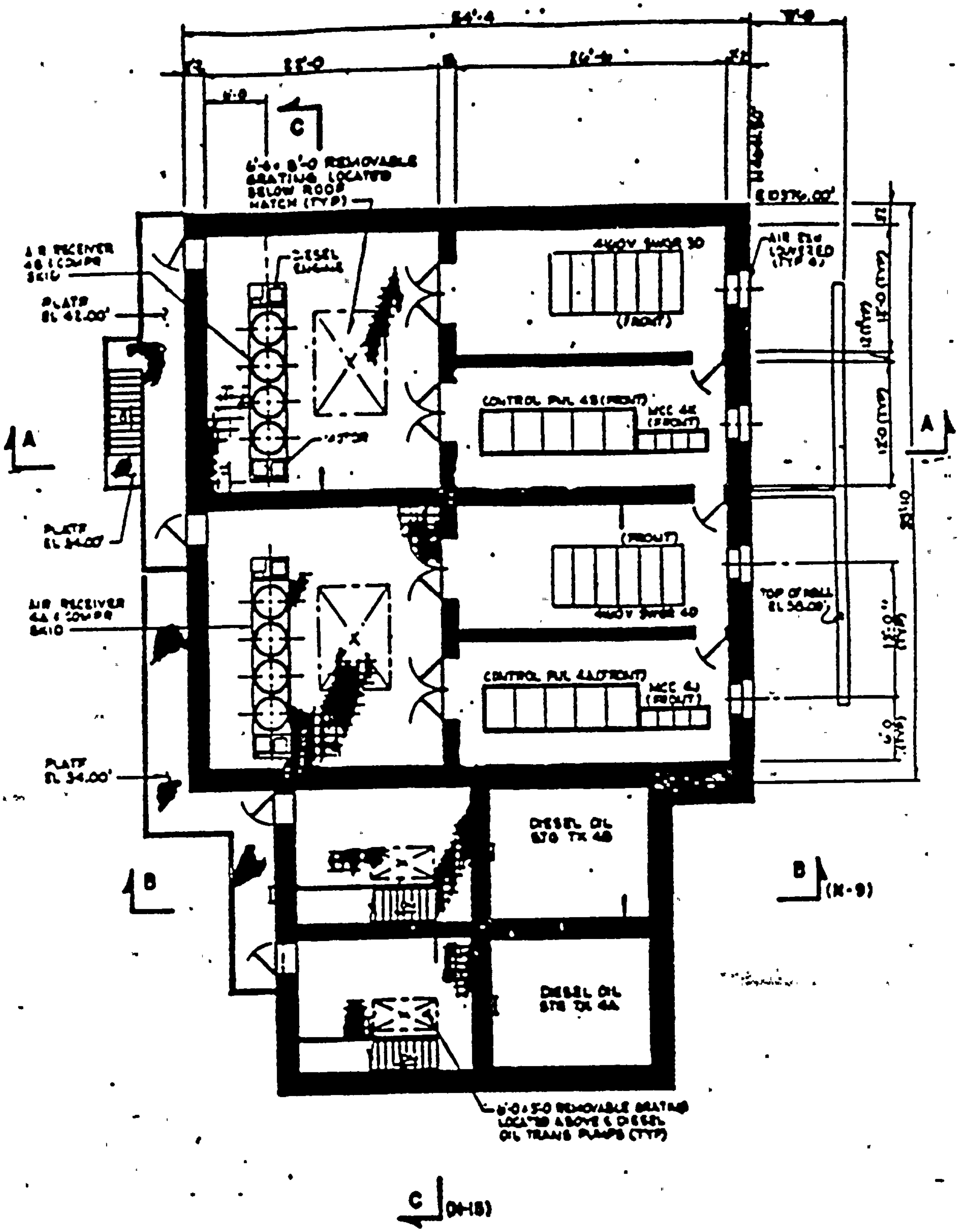
FIGURE 2



GROUND FLOOR PLAN

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

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

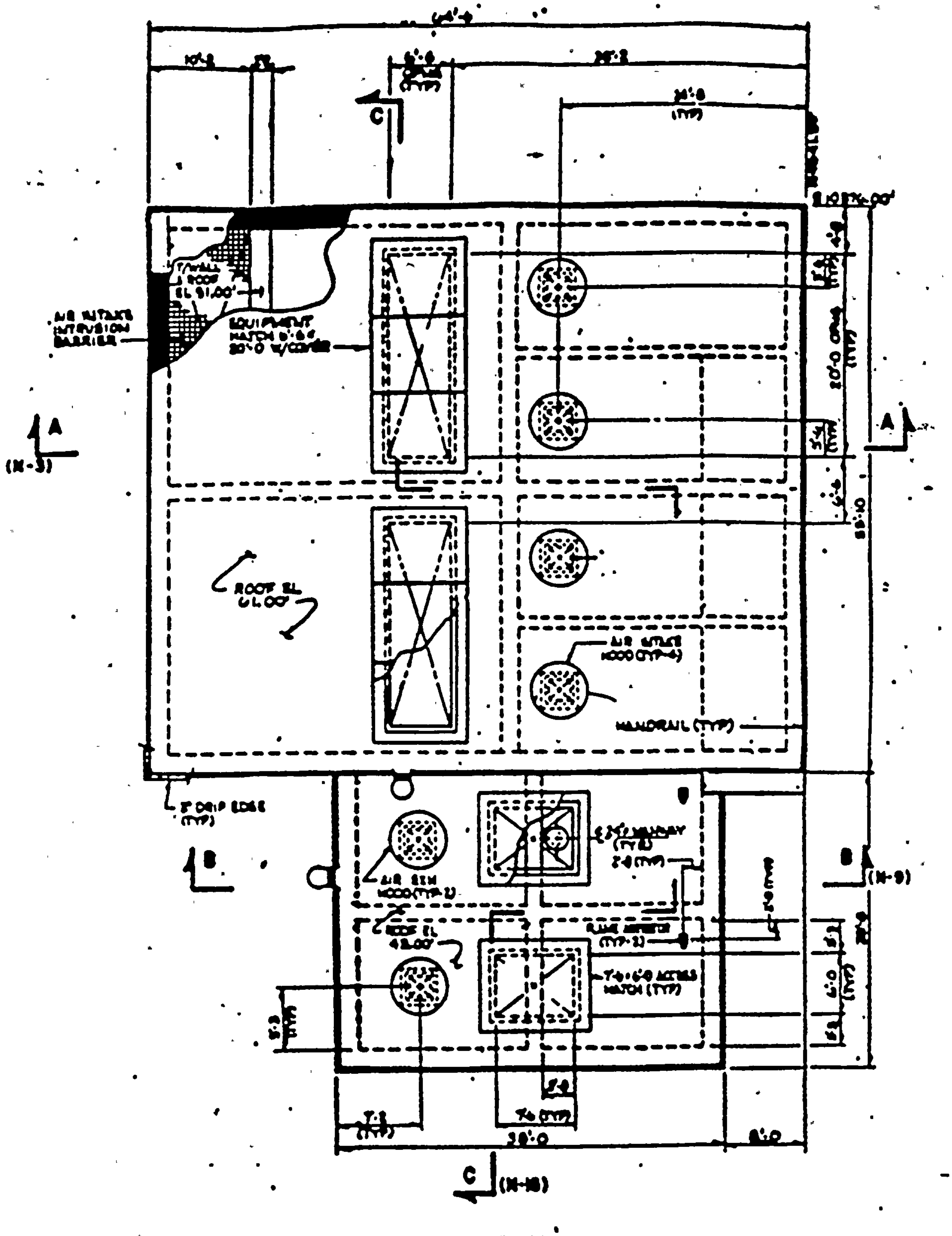


SECOND FLOOR PLAN

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

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

FIGURE 4

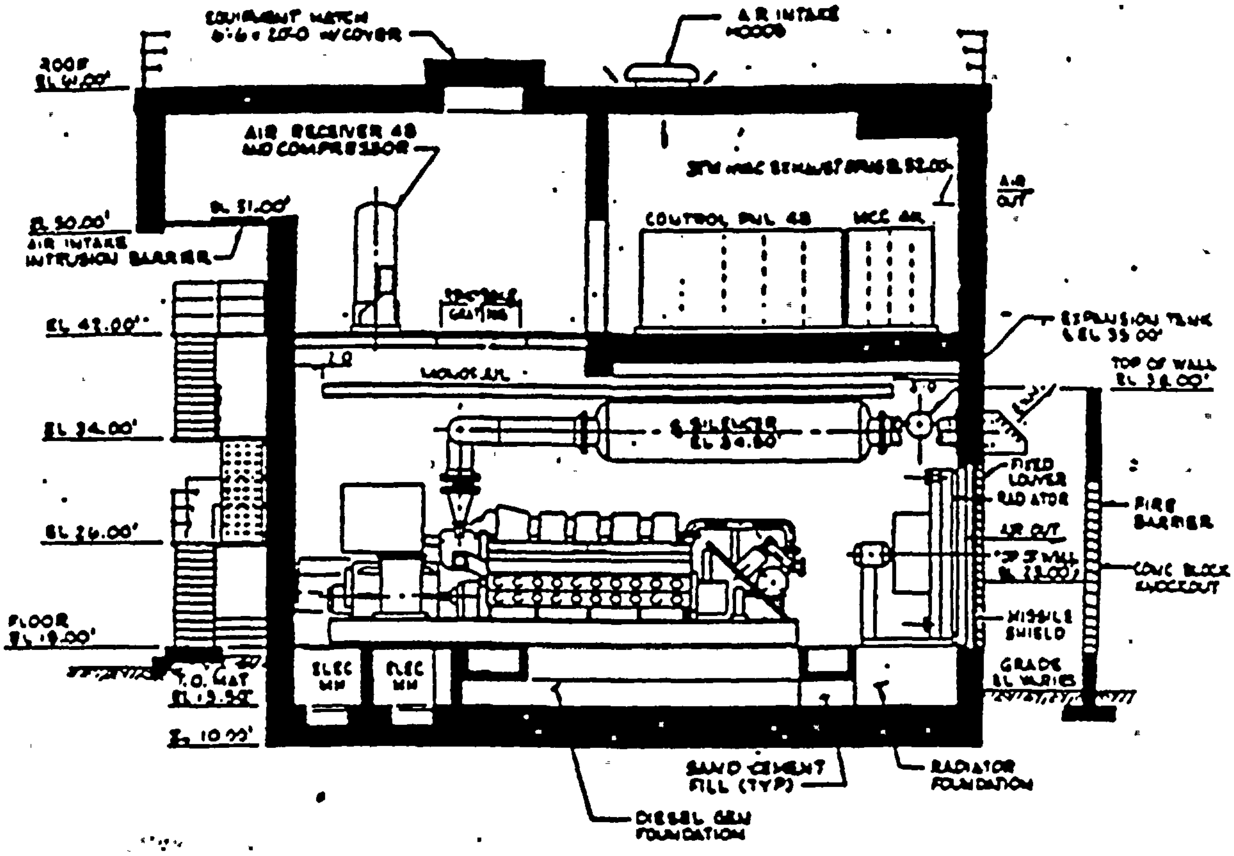


ROOF PLAN

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

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

FIGURE 5

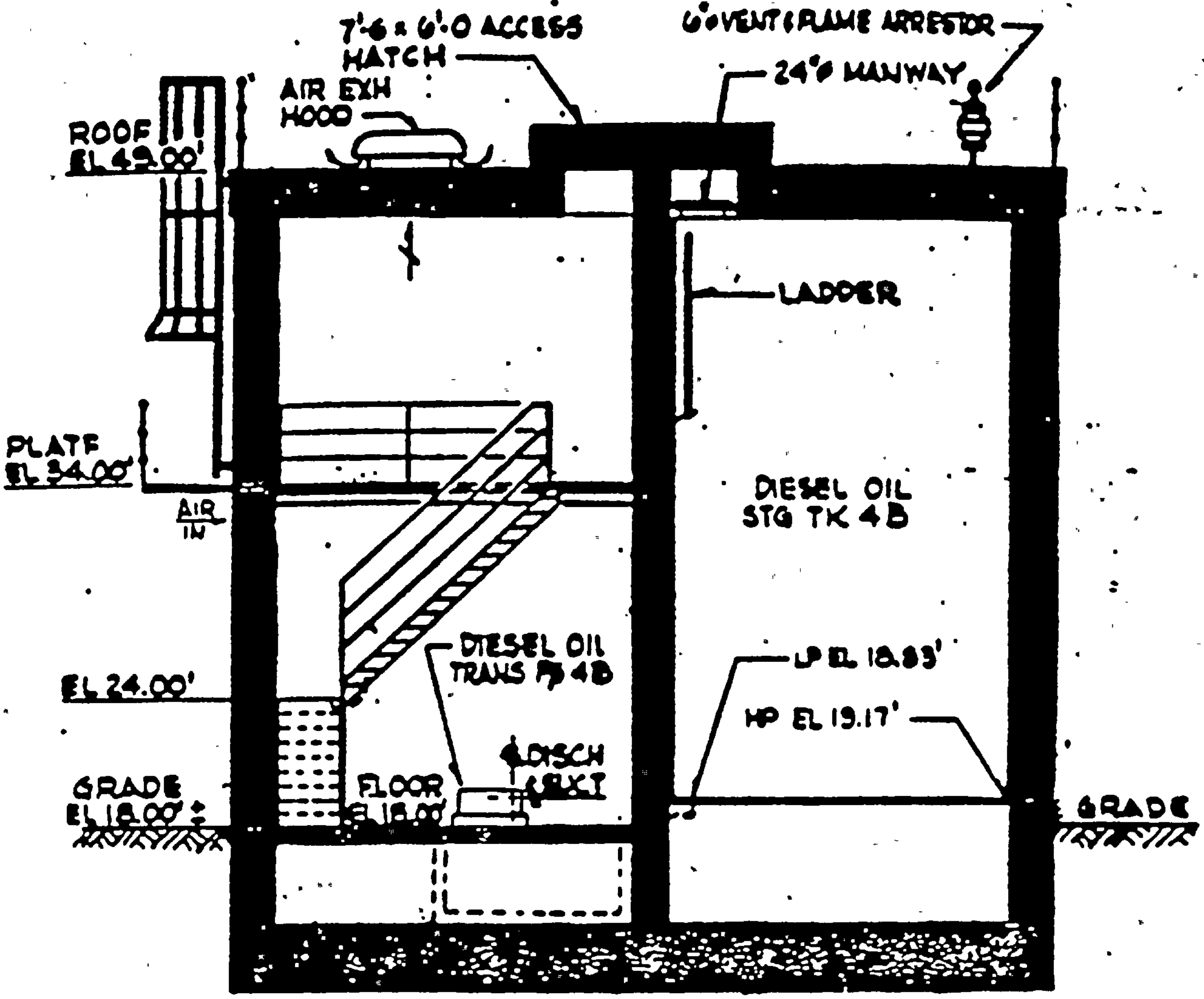


SECTION A-A
(D-6,12)

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

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

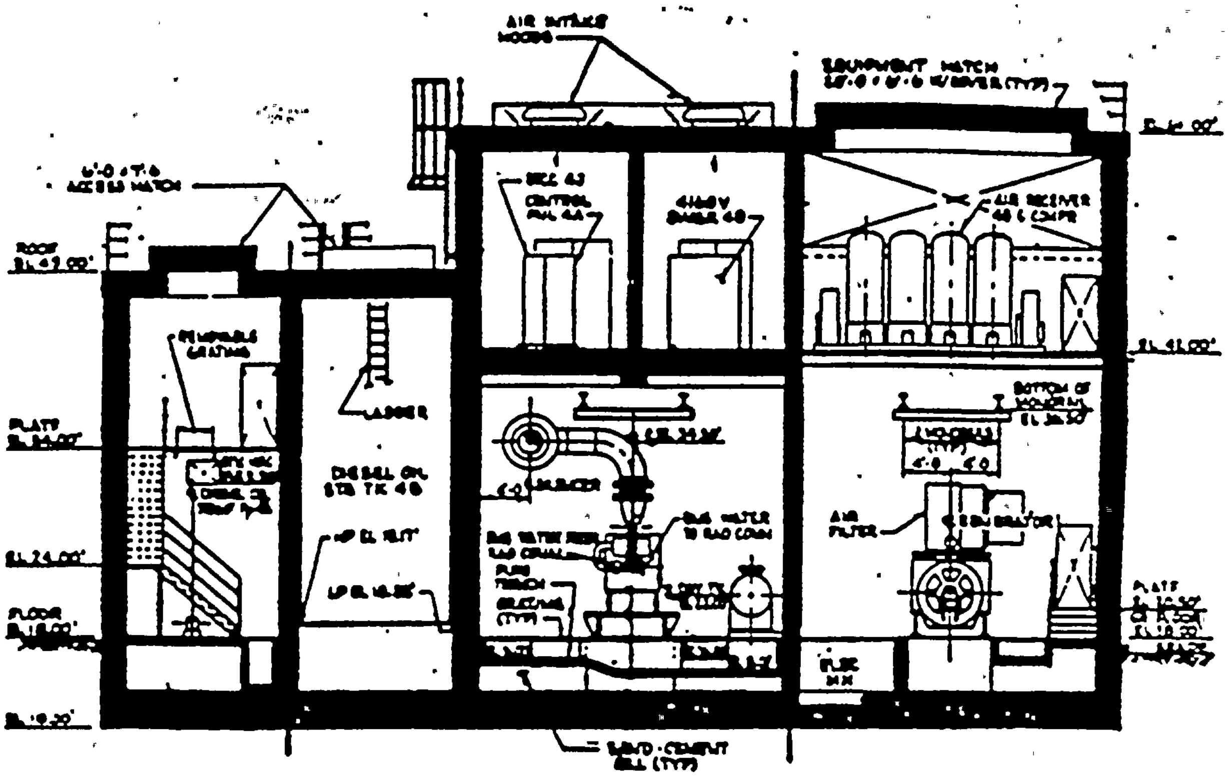
FIGURE 6



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

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

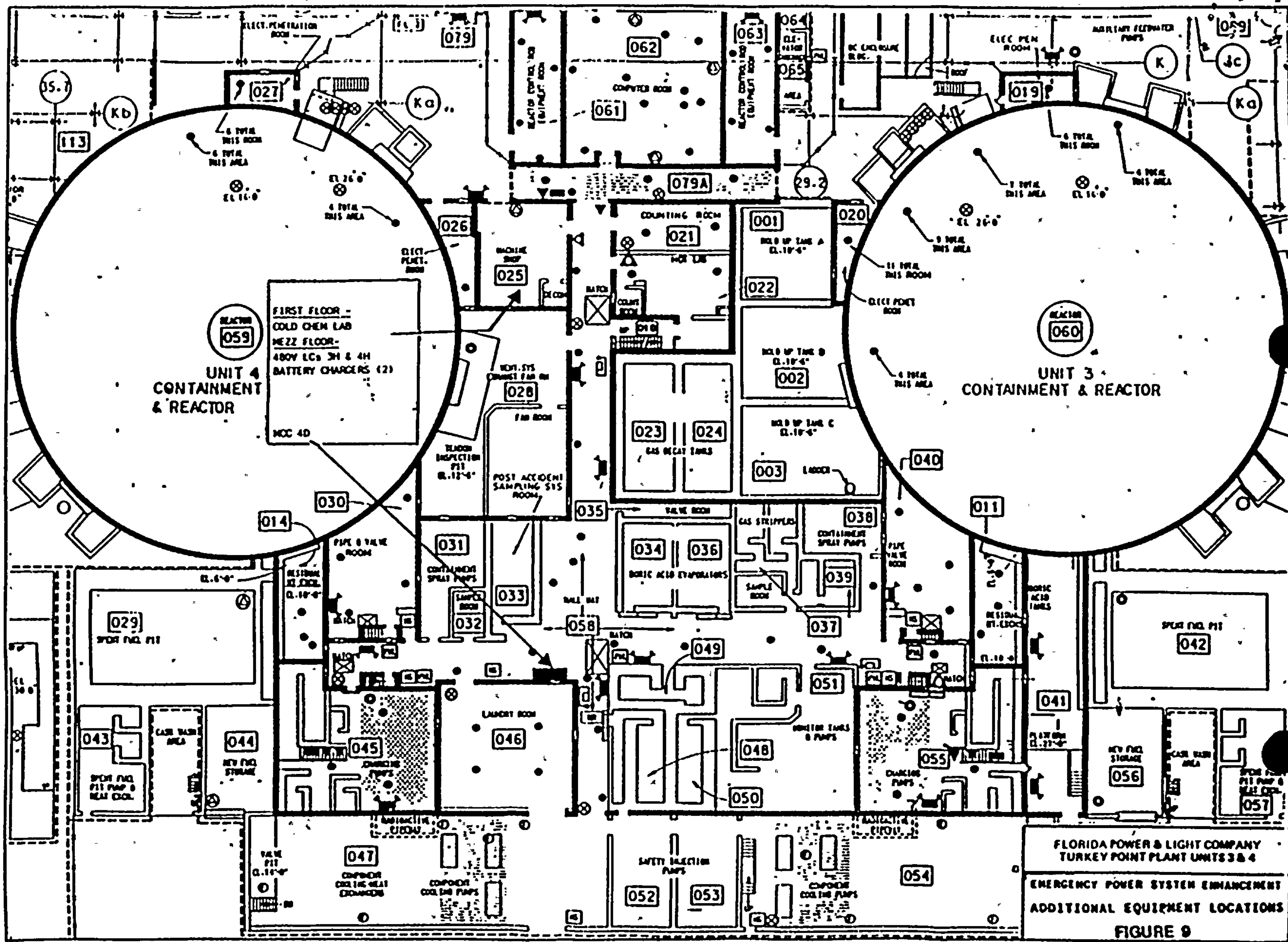
EMERGENCY POWER SYSTEM ENHANCEMENT
NEW DOST BUILDING
-SECTION B-B
FIGURE 7



SECTION C-C

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

EMERGENCY POWER SYSTEM ENHANCEMEN
NEW EDG & DOST BUILDINGS
-SECTION C-C
FIGURE 8



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

EMERGENCY POWER SYSTEM ENHANCEMENT
ADDITIONAL EQUIPMENT LOCATIONS

FIGURE 9

The Electrical Systems Branch has been, and will continue to be, deeply involved in reviewing the licensee's submittals and is preparing necessary SER(s). Our January 11, 1989 memorandum alerted you that there may be review needed in other disciplines also, although we have not identified any specific area needing review (other than ESB). However, possibilities include Plant Systems, Structural, I&C, Fire Protection, Reactor Systems, and Safeguards.

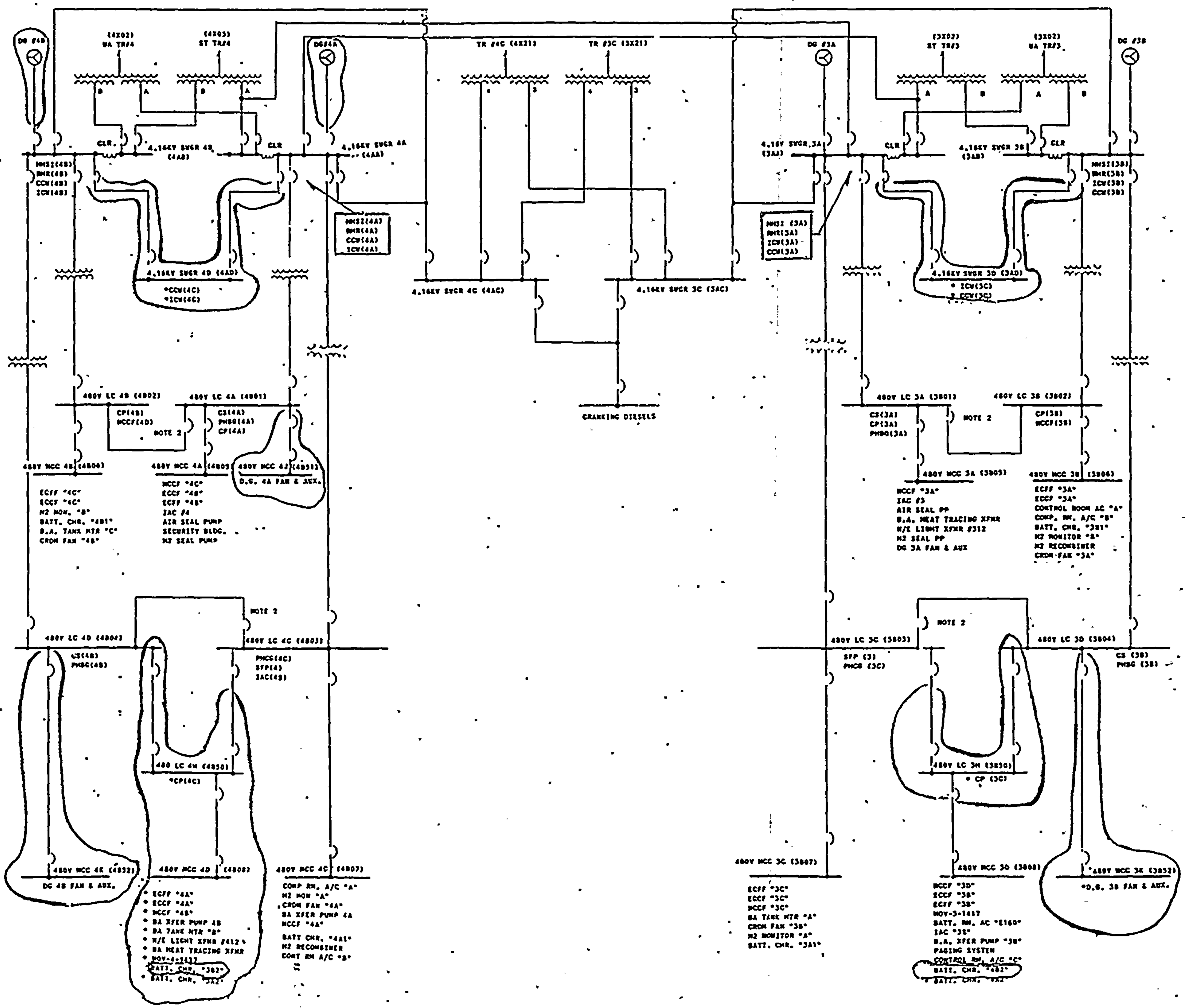
I request you provide by October 20, 1989 a memorandum which either confirms that no additional staff review is required in your area, or identifies the review required and the name of the reviewer assigned. A copy of the licensee's 6/23/88 design report is enclosed for your information.

G E Edison

Gordon E. Edison, Sr. Project Manager
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Licensing Approach
2. FPL Design Report

cc w/enclosures:
F. Rosa
C. McCracken
S. Newberry
P. McKee
C. Y. Cheng
L. B. March
G. Bagchi
F. Miraglia



SYMBOLS

◯ NEW EQUIPMENT

• RELOCATED EQUIPMENT POWER SUPPLY

NOTES

1. ONLY SAFETY RELATED LOADS ARE SHOWN
2. BREAKER NORMALLY RACKED OUT

TI APERTURE CARD

Also Available On Aperture Card

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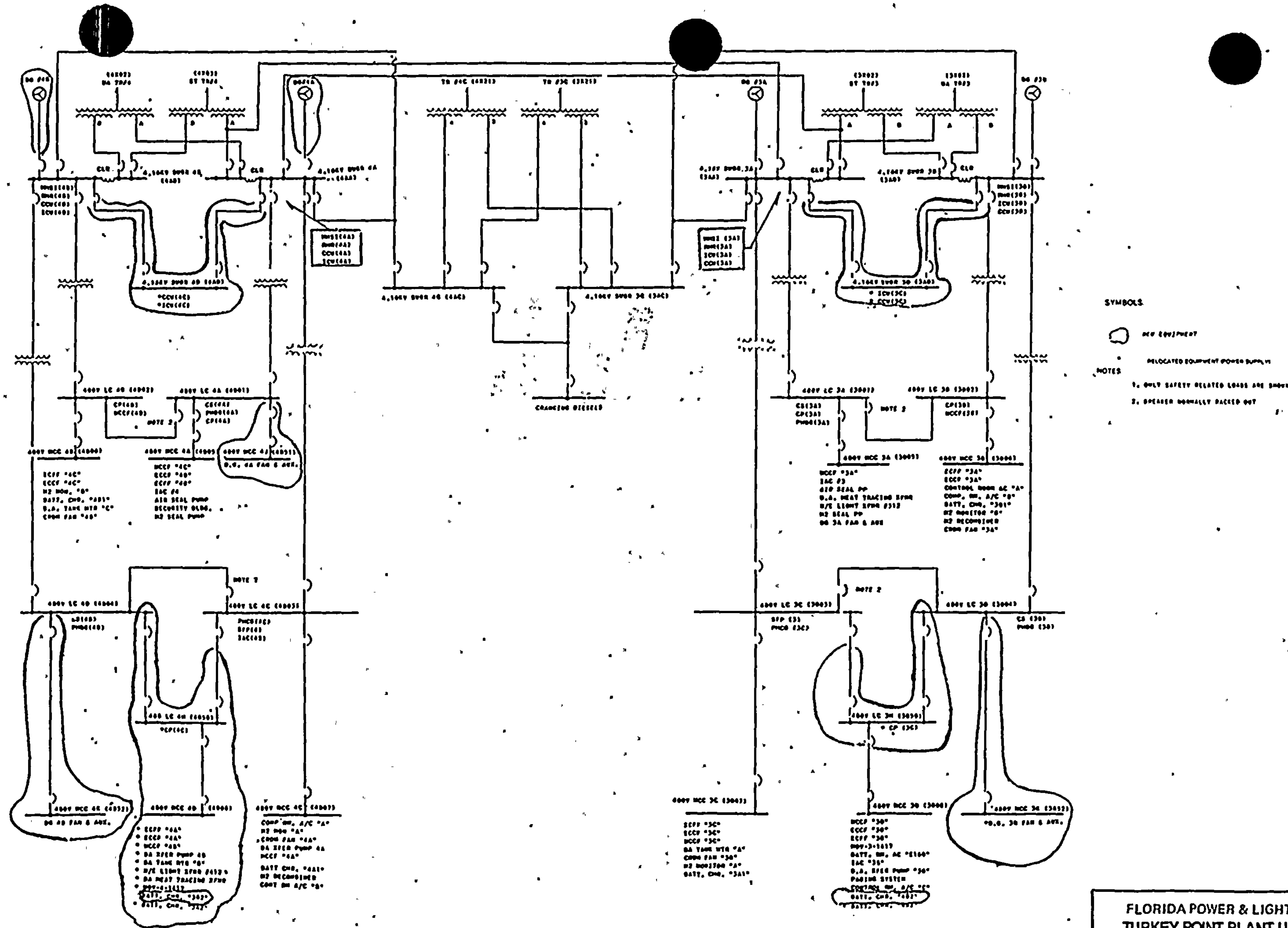
FLORIDA POWER & LIGHT COMPANY
TURKEY POINT PLANT UNITS 3 & 4

EMERGENCY POWER SYSTEM ENHANCEMENT
AC ONE-LINE DIAGRAM

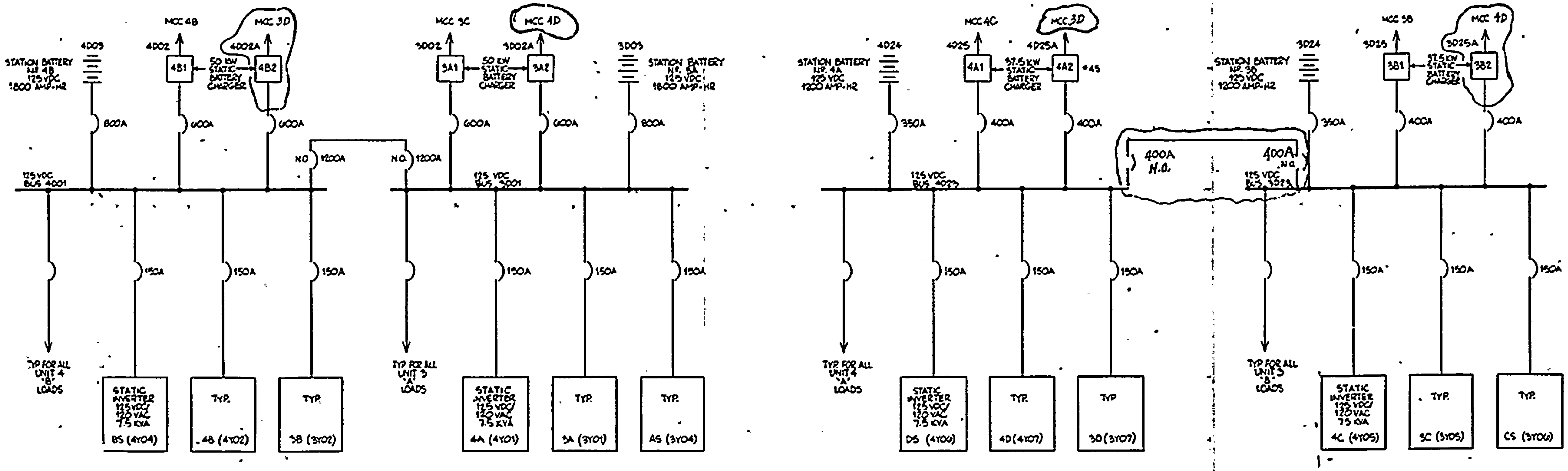
FIGURE 1



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

EMERGENCY POWER SYSTEM ENHANCEMENT
AC ONE-LINE DIAGRAM

FIGURE 1



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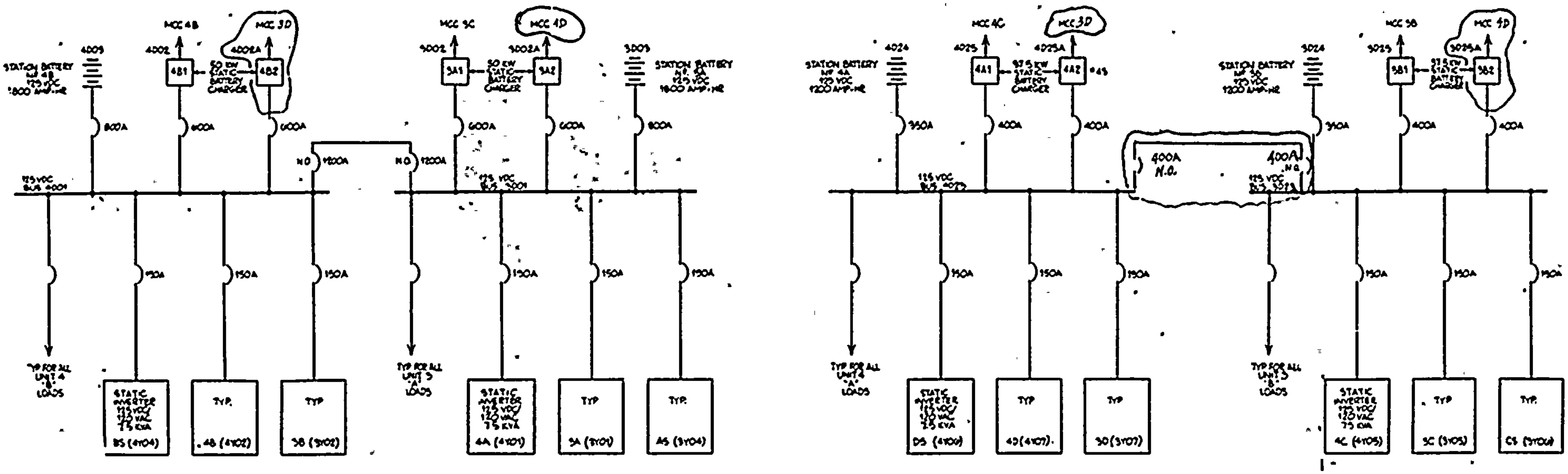
FLORIDA POWER & LIGHT COMPANY
TURKEY POINT PLANT UNITS 3 & 4

EMERGENCY POWER SYSTEM ENHANCEMENT
DC ONE-LINE DIAGRAM

FIGURE 2

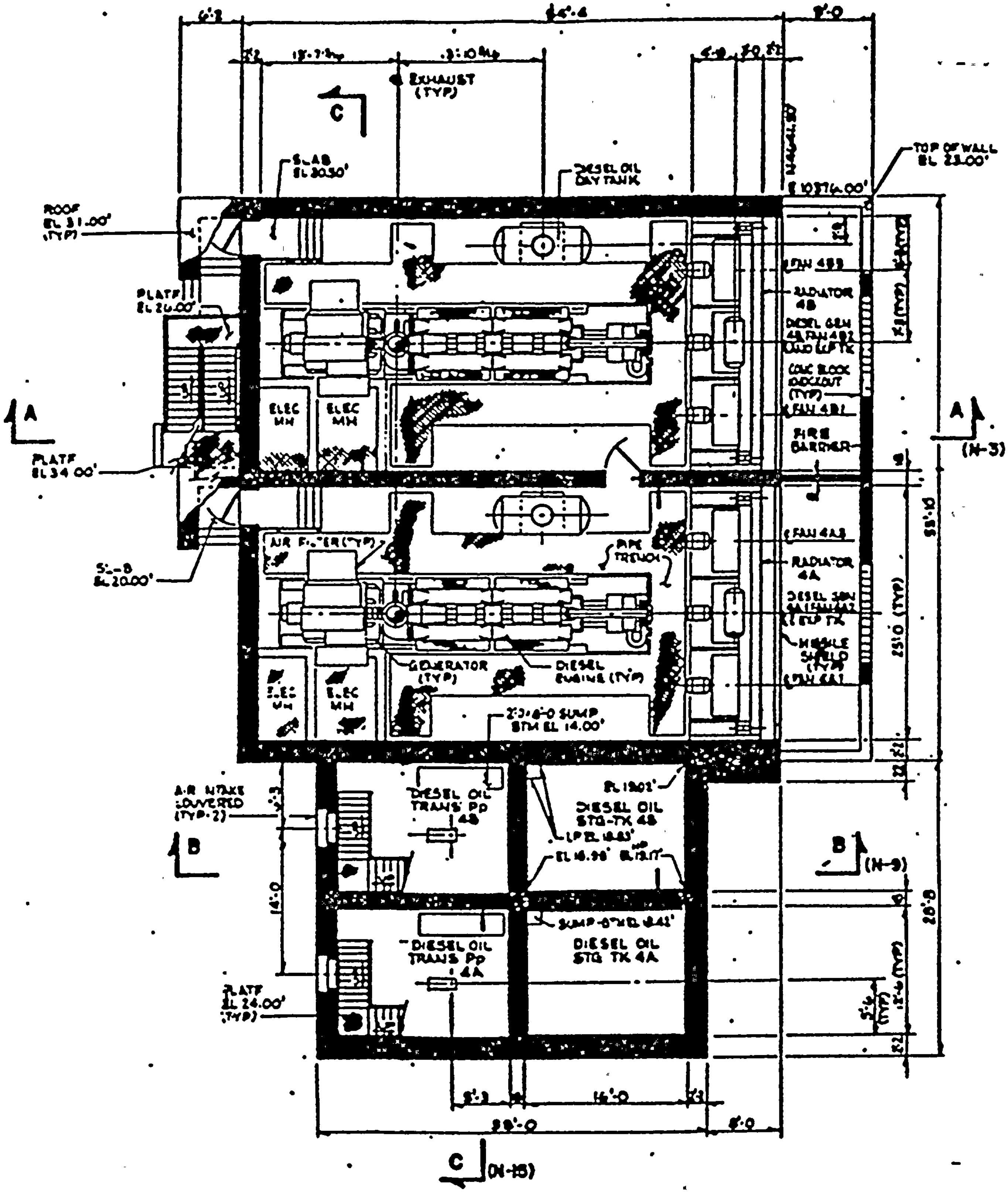


FLORIDA POWER & LIGHT COMPANY
TURKEY POINT PLANT UNITS 3 & 4

EMERGENCY POWER SYSTEM ENHANCEM

DC ONE-LINE DIAGRAM

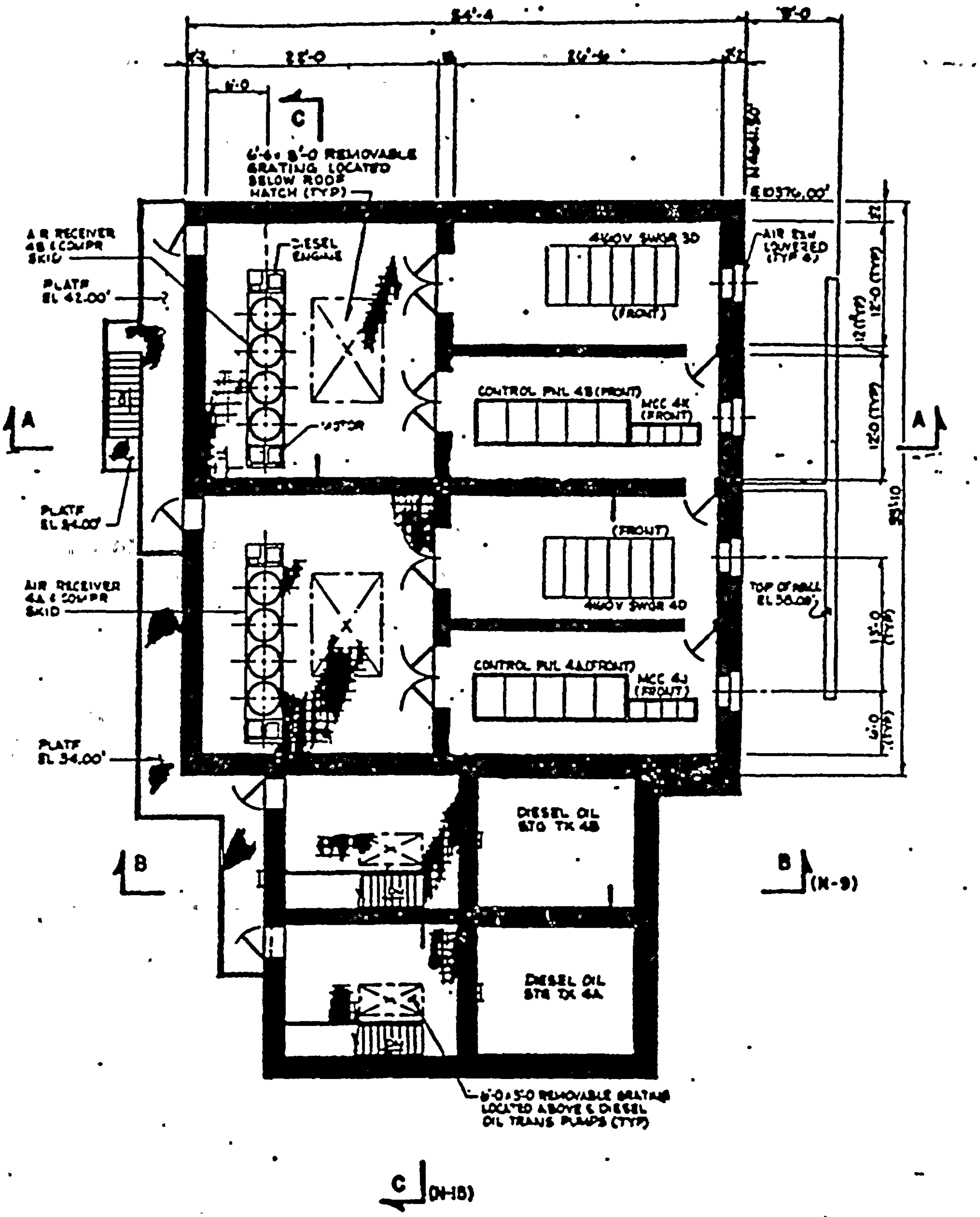
FIGURE 2



GROUND FLOOR PLAN

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

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

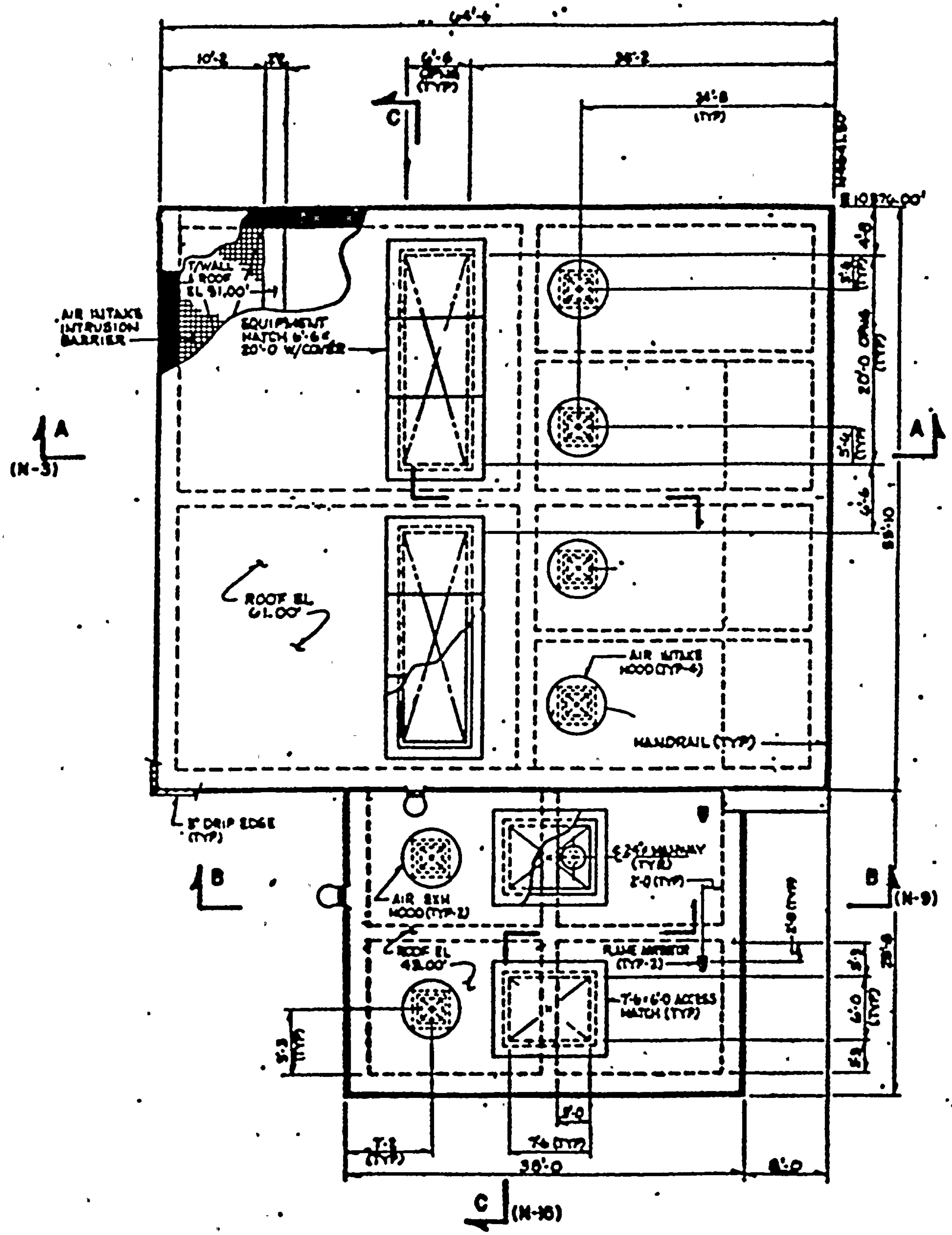


SECOND FLOOR PLAN

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

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

FIGURE 4

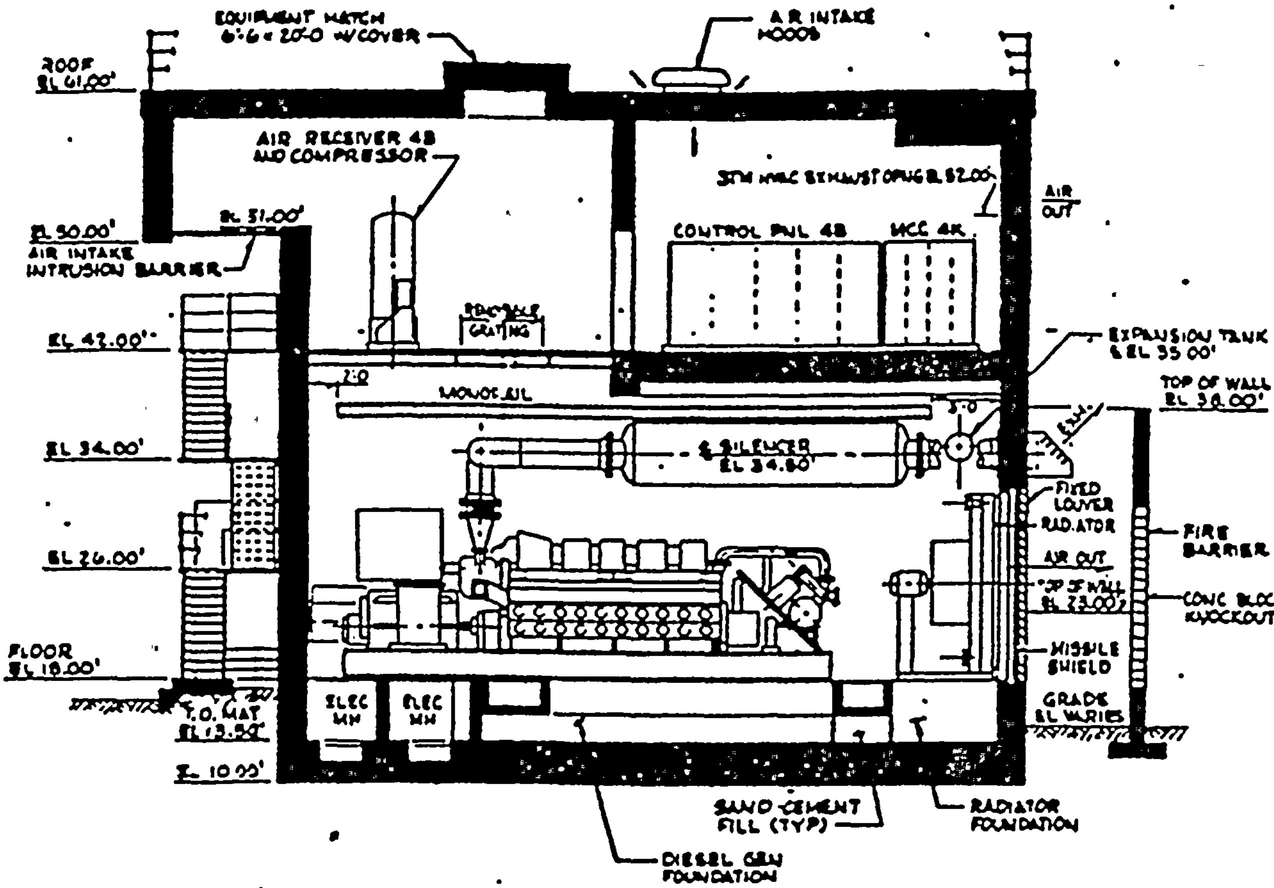


ROOF PLAN

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

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

FIGURE 5

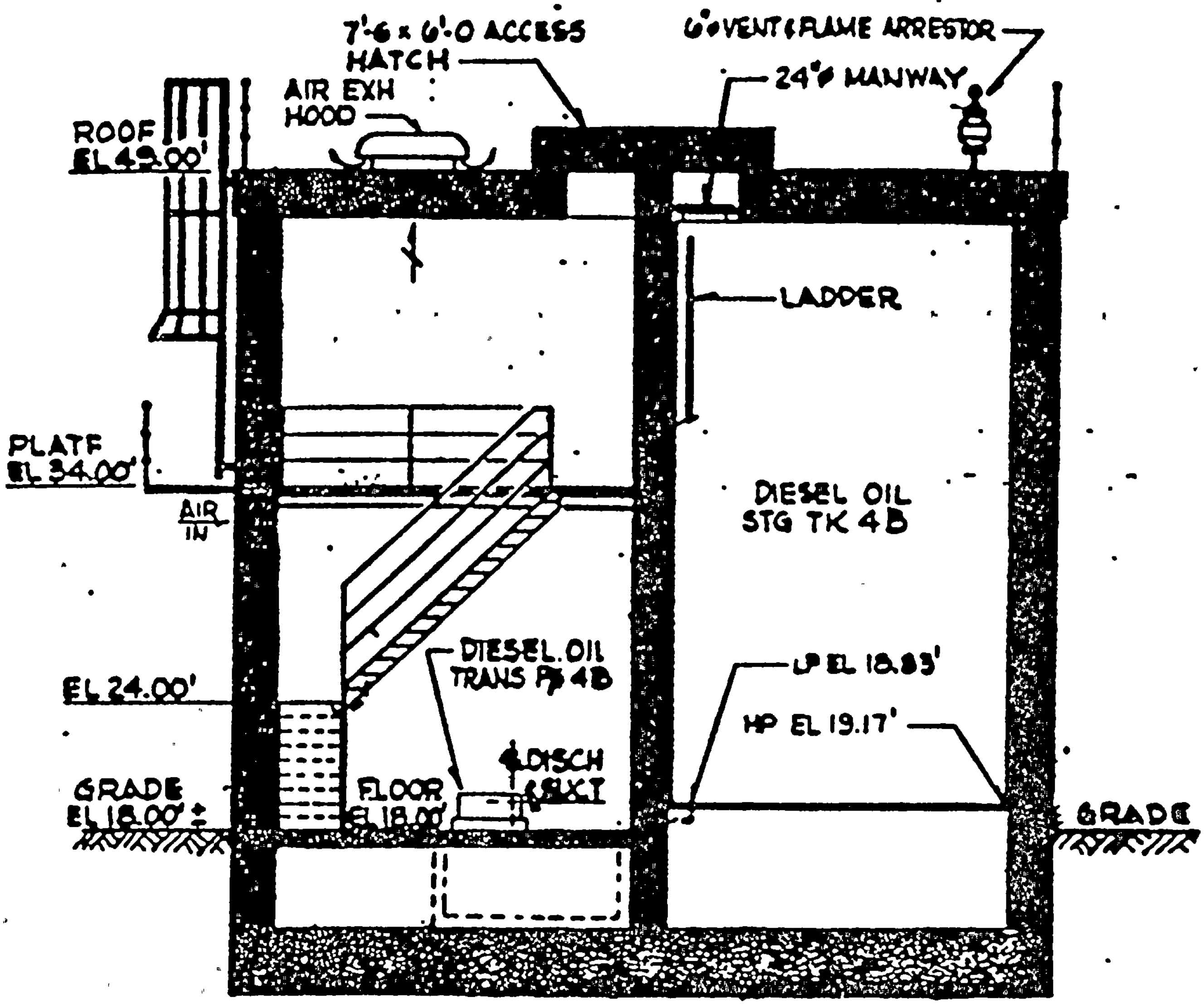


SECTION A-A
(D-6,12)

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

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

FIGURE 6

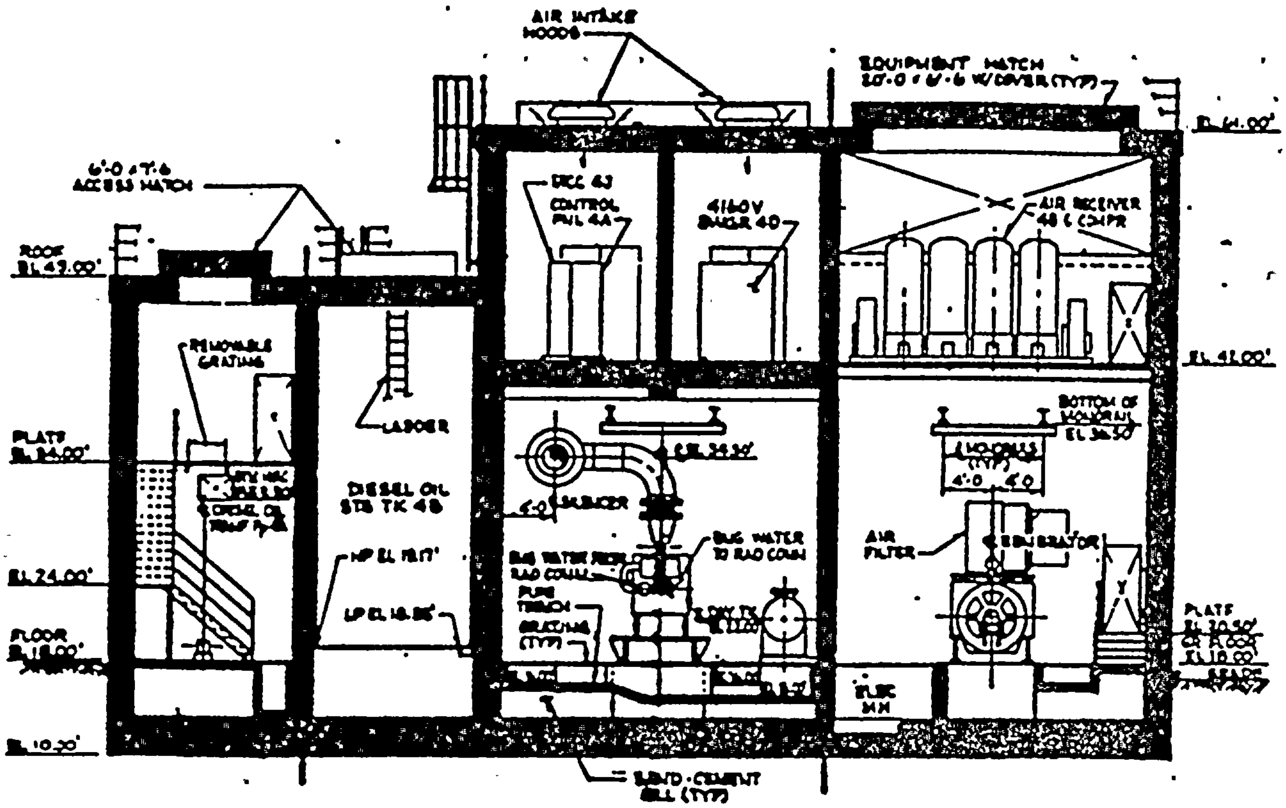


SECTION B-B
(6-5,11,17)

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

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

FIGURE 7

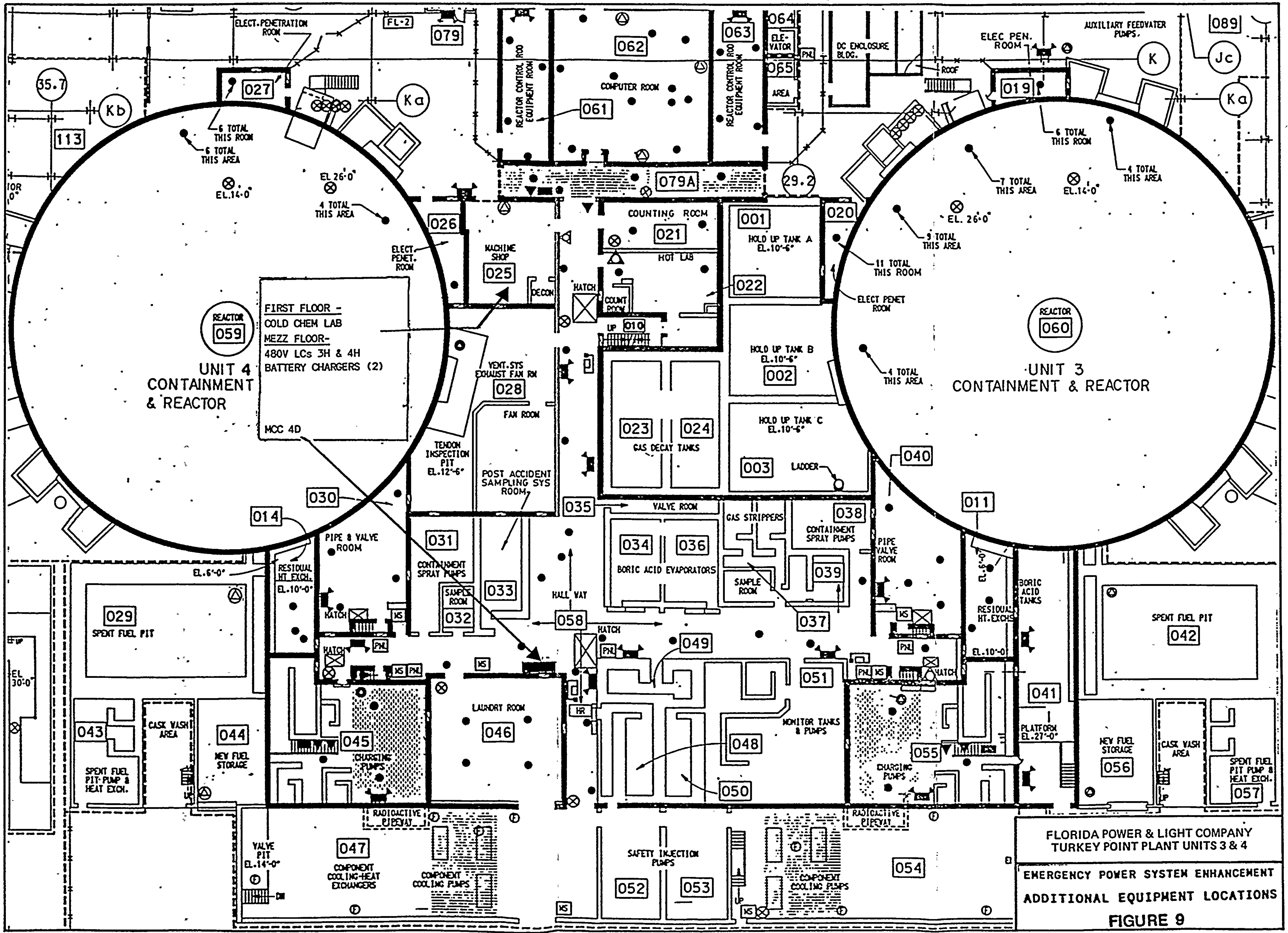


SECTION C-C
(M-3,9,15)

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

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

FIGURE 8



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

EMERGENCY POWER SYSTEM ENHANCEMENT
ADDITIONAL EQUIPMENT LOCATIONS

FIGURE 9

TI APERTURE CARD

Also Available On Aperture Card

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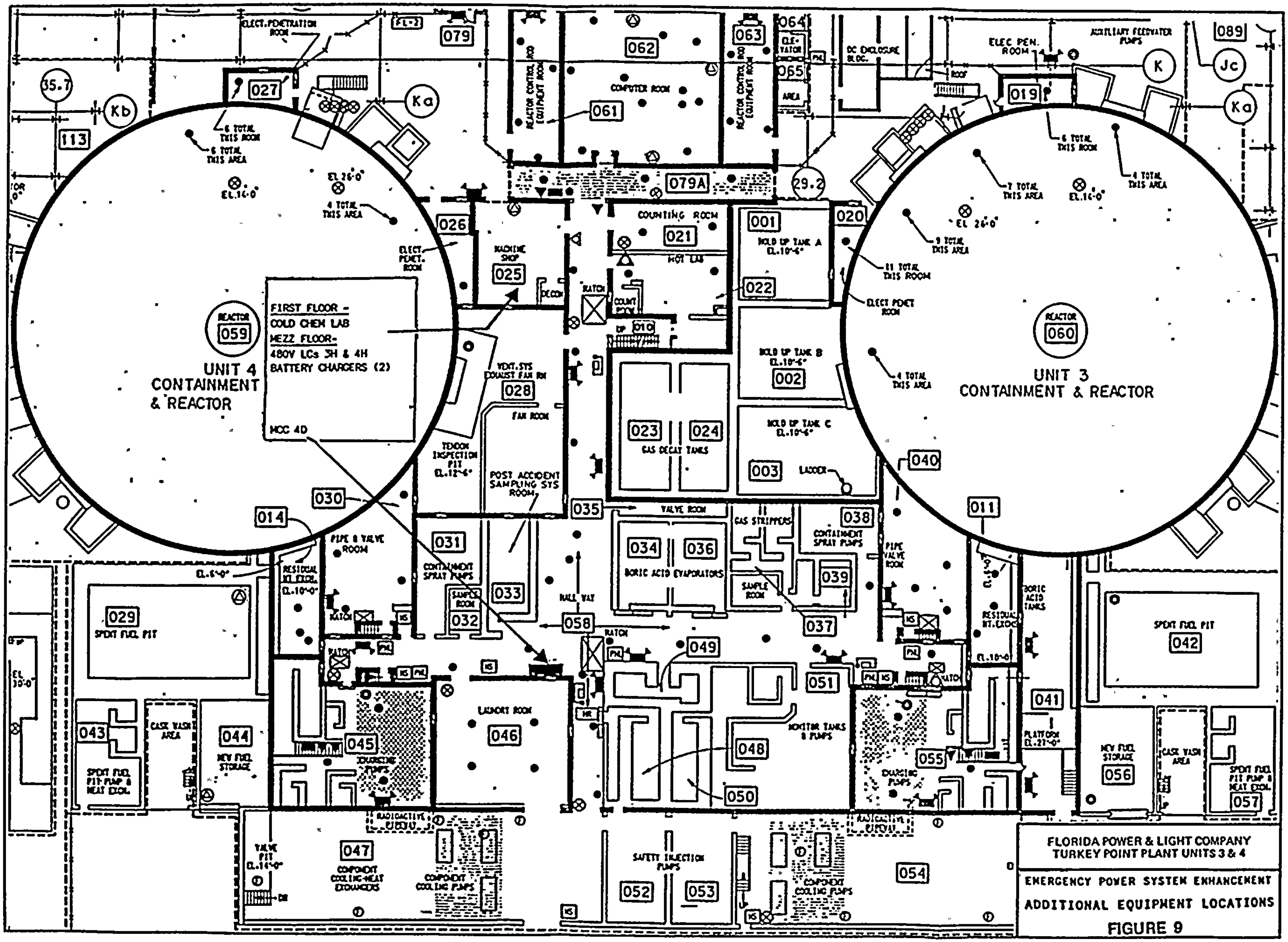

FLORIDA POWER & LIGHT COMPANY
TURKEY POINT PLANT UNITS 3 & 4

EMERGENCY POWER SYSTEM ENHANCEMENT

ADDITIONAL EQUIPMENT LOCATIONS

FIGURE 9