REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 8606170014 DOC. DATE: 86/06/12 NOTARIZED: NO DOCKET #
FACIL: 50-250 Turkey Point Plant, Unit 3, Florida Power and Light C 05000250
50-251 Turkey Point Plant, Unit 4, Florida Power and Light C 05000251
AUTH. NAME AUTHOR AFFILIATION
WOODY, C. O. Florida Power & Light Co.
RECIP. NAME RECIPIENT AFFILIATION
RUBENSTEIN, L. S. PWR Project Directorate 2

SUBJECT: Requests expedited review of encl evaluation of emergency diesel generator loading for concurrent operation of Units 3 & 4, per 860402 confirmatory action ltr & for Unit 4 restart. Two addl items will be evaluated separately. Fee paid.

DISTRIBUTION CODE: A001D COPIES RECEIVED: LTR 1 ENCL 1 SIZE: 33
TITLE: OR Submittal: General Distribution

NOTES:

	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL
	PWR-A EB		1	1	PWR-A EICSB		2	2
	PWR-A FOB		1	1	PWR-A PD2 LA		1	0
	PWR-A PD2 PD 01		5	5	McDONALD, D		1	1
	PWR-A PSB		1	1	PWR-A RSB		1	1
INTERNAL:	ADM/LFMB		1	0	ELD/HDS4		1	0
	NRR/DHFT/TSCB		1	1	NRR/ORAS		1	0
	REG FILE	04	1	1	RGN2		1	1
EXTERNAL:	24X		1	1	EG&G BRUSKE, S		1	1
	LPDR	03	1	1	NRC PDR	02	1	1
	NSIC	05	1	1				

Rec'd w/check

TOTAL NUMBER OF COPIES REQUIRED: LTTR 24 ENCL 20

FLORIDA POWER & LIGHT COMPANY

JUN 1 2 1986
L-86-243

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

Dear Mr. Rubenstein:

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Emergency Diesel Generator Load Evaluation

Attached is the evaluation of emergency diesel generator loading for concurrent operation of Turkey Point Units 3 and 4 required by the NRC Region II Confirmation of Action letter dated April 2, 1986. Florida Power & Light Company requests your expedited review and approval of this evaluation in order to support the scheduled activities associated with the restart of Unit 4.

All plant modifications and procedure revisions necessary to support the attached evaluation will be completed prior to the Unit 4 restart. Required operator training will be completed before an individual operator assumes shift duties for the restart.

In the evaluation, there are several references to the "hot shutdown" unit. This refers to the unit which is not assumed to have the postulated accident. Under the recent Technical Specification addition of modes of operation, the hot shutdown unit refers to the unit in the hot standby mode.

On pages 11 and 12 of the evaluation, there is a discussion of two design features that will be modified. As stated in the evaluation, these items are being evaluated independently of the EDG load evaluation. A 10 CFR 50.59 evaluation and Justification for Continued Operation (JCO) will be developed for any interim actions required prior to completion of any required design modifications.

The evaluation's restriction on Computer Room/Cable Spreading Room temperature is being further evaluated to establish additional operational margin if possible.

L1:1

Recd w/checks

A001
1/1

In accordance with 10 CFR 170.12(c), FPL Check No. 1313 for $150.00 is attached.

If you have any questions regarding this submittal, please call us.

Very truly yours,

C. O. Woody
Group Vice President
Nuclear Energy.

COW/TCG:de

Attachment

cc: Dr. J. Nelson Grace, Region II, USNRC
Harold F. Reis, Esquire
PNS-LI-86-191

L1:1

SAFETY EVALUATION
TURKEY POINT UNITS 3 & 4 (PTPN)
EMERGENCY DIESEL GENERATOR
LOAD EVALUATION

SAFETY EVALUATION
TURKEY POINT UNITS 3 & 4 (PTPN)
EMERGENCY DIESEL GENERATOR
LOAD EVALUATION

INTRODUCTION

An Emergency Diesel Generator (EDG) load evaluation, conducted in December 1985, indicated that EDG loads were at acceptable limits. The study also indicated that EDG margins were not excessive (see Table 1), and that any future change in EDG loading requirements must be fully evaluated prior to implementation. Subsequent to completion of this study four items were identified by Power Plant Engineering that would affect EDG loadings; namely,

- The TMI-related Emergency Operating Procedures (EOPs) would require the addition of a charging pump in the initial (1-30 minutes) EDG load interval, and running a second high head safety injection pump in the second (30 minutes - 1 hour) EDG load interval.

- Inplant CCW and ICW testing indicated that pump kW loads would be higher than those assumed in December 1985.

- Environmental qualification (EQ) evaluations per 10 CFR 50.49 assumed that the Emergency Containment Coolers (ECCs) auto-connect and are not secured at 30 minutes.

- Load center transformer losses had not been accounted for in prior EDG load evaluations.

There is insufficient EDG margin available to accommodate the potential EDG loading levels that would result from incorporating these additional loads without some compensating actions.

EDG LOAD LIMITS

The EDG kW load ratings are provided in Table 2. The values provided in the column FSAR are those contained in the FSAR at Table 8.2-2. These values are consistent with those furnished by the EDG supplier. The diesel engine manufacturer's ratings for the engine are expressed in BHP in Table 2. These BHP ratings were converted into an equivalent kW rating. The ratings supplied by the EDG supplier and those derived from the engine manufacturer's published BHP data are in general agreement.

Table 2 indicates that EDG loadings greater than the 2000 hour rating of 2850 kW are severely restricted as to the duration that these loads may persist on the machine. For example, a modest increase of 100 kW above 2850 kW reduces the

recommended running time dramatically (from 2000 to 168 hours). Accordingly, a load limit of 2850 kW was established for short-term continuous loadings. Short-term is interpreted to mean a few hours.

During post-LOCA load management activities, loads must be added and removed from the EDGs. The 168 hour rating of 2950 kW was selected as a procedural limit to allow for transient load conditions that may occur during load management activities.

The current PTPN Technical Specifications at 4.8.1.c.8 require periodic testing and surveillance "Verifying that auto-connected loads to each diesel generator do not exceed 2750 kW." This limit refers to the cold start loading of the EDG at the onset of the LOCA with a loss of offsite power (LOOP).

The Standard Technical Specifications (STS) for Westinghouse Pressurized Water Reactors at 4.8.1.1.2.f.8 state that auto-connected loads to each diesel generator are to be verified to ensure that they "do not exceed the 2000 hour rating...", which is 2850 kW for the Turkey Point EDGs. The current Technical Specifications are more restrictive than the STS requirement.

Based on the above, the load limits on the EDG are established as follows:

Transient	2950 kW
Short-Term Continuous	2850
Auto-Connect	2750

The 2850/2950 kW load management philosophy has been incorporated in the plant procedures by the incorporation of the following **CAUTION** or its equivalent. (The markings in the caution statement are set based on instrument calibration. The Red mark accounts for instrument error such that the 2950 kW limit is not exceeded.)

CAUTION

Loading on the EDG should not exceed the Orange mark (2000 hour rating of 2850 kW). However, loads placed on the energized 4 kV buses (the power source) may approach the Red mark (168 hour rating of 2950 kW) on the wattmeter for short periods.

The PTPN EMD Model 20-645E4 engine has been tested by the supplier at 2950 kW for about 30 minutes, and it is routinely tested to 2750 kW in accordance with PTPN Technical Specification 4.8.1.c.6.

Additional testing of the EMD Model 20-645E4 engines at loads from 2500 kW to 3050 kW has been conducted at other installations. The results of a survey conducted by Power Plant Engineering is provided by Table 3. It indicates that two EMD Model No. 20-645E4 EDGs have been run at 2850 kW for 23.5 hours followed by a 1/2 hour run at 3050 kW.

CORRECTIVE ACTIONS

Corrective actions are required prior to two unit operation. These actions allow the EDGs to accommodate the recently defined loading requirements. Each item (and supporting basis) is discussed in detail below. In summary, they are:

- Secure a RHR pump on the accident unit at 30 minutes.
- Disable the auto-connect feature of the Instrument Air Compressors (IACs).
- Disable the ability of the IACs to reload upon Safety Injection Signal (SIS) reset.
- Provide EDG independent IACs. (Equipment to support IAC operation will also be EDG independent.)
- Disable the ability of turbine-related loads to reload upon SIS reset on both units.
- Initiate the Computer Room/Cable Spreading Room (CR/CSR) AC function after one hour.
- Provide Computer Room temperature indication in the Control Room.
- Disable the auto-connect feature of the Normal Containment Coolers (NCCs) on the non-accident unit.
- Upgrade, as required, NCCs and support equipment for operation at elevated temperature.
- Secure a Containment Spray (CS) pump at 30 minutes and maintain two Emergency Containment Coolers (ECCs) running beyond 30 minutes.
- Disable the auto-connect of boric acid-related loads (except heat tracing) when two EDGs start and operate.

The plant procedures require that a second high head safety injection (HHSI) pump be run in the second EDG load interval. To compensate for this, the residual heat removal (RHR) pump is secured in this load interval. This results in a break independent LOCA scenario; i.e., the operator response would be the same for all break sizes.

Analysis demonstrates that securing a RHR pump at 30 minutes does not affect the ECCS evaluation. Securing the RHR pump also extends the duration of the injection phase of the post-LOCA period. For the one EDG large break LOCA (LB LOCA) case, the injection phase is extended from about 39 minutes to 50 minutes. Thus, more time is provided for the operator to stabilize the plants prior to entering recirculation.

- The newly implemented PTPN version of the TMI-related EOPs include provisions to run two HHSI pumps and no RHR pump for the injection phase beyond 30 minutes. They also provide for running one HHSI pump and one RHR pump in the recirculation phase.

Upon SIS reset, the IACs and certain turbine-related loads would be re-enabled. The design has been altered to prevent these loads from auto-connecting to the EDGs upon SIS reset. EDG independent IACs will be provided to ensure the availability of instrument air post-LOCA. Equipment to support IAC operation will also be EDG independent. Furthermore, the plant procedures will not allow the manual loading of turbine auxiliaries unless EDG loading permits their addition. Sufficient EDG capacity is not available to power turbine-related loads when only one EDG is operating.

- The plant procedures will instruct the operator not to load turbine loads for the accident and non-accident units when only one EDG is available during a LOCA concurrent with a loss of offsite power (LOOP).

Inplant testing has demonstrated that the Computer Room/Cable Spreading Room (CR/CSR) AC function is not required immediately after the occurrence of a LOCA concurrent with a LOOP. The function will not be required for one hour. Computer Room temperature indication will be installed to allow the operator to monitor the temperature.

The CR/CSR AC function will be initiated from the Control Room one hour post-LOCA to ensure that the 90°F ambient temperature limit for the Safety Assessment System (SAS) is maintained. The Inadequate Core Cooling System (ICCS) ambient temperature limit is 104°F. The Computer Room is maintained at or below 67°F during normal plant operation.

- The plant procedures will instruct the operator to start the CR/CSR AC one hour after accident initiation to assure SAS availability.

- The plant procedures will instruct the operator to maintain the Computer Room at or below 67°F during normal operation to assure SAS availability.

Figure 1 provides the containment temperature response on the hot shutdown (non-accident) unit as a function of the number of NCCs operating. It indicates that if one NCC is operated, the containment temperature will rise from 120°F to a value asymptotic to 133° at more than 72 hours. Figure 2 indicates that the one NCC need not be started for the first hour post-LOCA. At one hour, when the NCC is started, the temperature is 127°F. Afterwards, the temperature profile conforms to that shown on Figure 1. Evaluation of the unit in the hot shutdown condition indicates that operation at elevated temperature is acceptable.

The NCC-related component evaluation assumed that NCC-related items on the unit currently in operation were identical to those on the unit currently in cold shutdown.

- o A documented field verification will confirm the validity of NCC-related component assumptions. If required, modifications will be made prior to operation to ensure continued NCC operability at the elevated temperature.

The NCC-related component evaluation also indicated that the NCC damper motors are designed for operation in an ambient temperature of 130°F. This temperature will be reached in about 27 hours post-LOCA. If a second NCC is not in operation within the first 20 hours or so, the damper function will be disabled manually to preclude spurious damper operation.

- o The plant procedures will instruct the operator to disable the NCC damper function at 24 hours when one NCC is run continuously.

Starting two NCCs per unit with a LOOP and no LOCA will maintain containment temperatures on the hot shutdown unit(s) below 120°F.

- o A design modification will be implemented to prevent EDG auto-loading of the non-accident unit's NCCs.

- o The plant procedures will instruct the operator to load one NCC on the EDG at one hour post-LOCA. Actuation of the NCC will be from the Control Room.

- o The plant procedures will place the following limitations on operation of the non-accident unit. This will enable the operator to ensure stable hot shutdown conditions are maintained:

  - Charging flow will be established during the 1-30 minute EDG load interval.

  - Pressurizer heaters (150 kW) will be established in the 30 minute-one hour EDG load interval.

  - The MSIVs and Main Feedwater Isolation Valves will be closed immediately post-trip to minimize Steam Generator heat loss.

  - After restoring and stabilizing Steam Generator level, AFW flow to the Steam Generators will be minimized to maintain RCS T_{avg} above 531°F.

  - Pressurizer pressure will be maintained at or above 1800 psig.

  - Containment pressure will be maintained below 3 psig.

  - Steam Generator pressures will be maintained equal (i.e., within 50 psid).

  - Steam Generator pressure will be maintained above 600 psig.

- o The plant procedures will instruct the operator to start two NCCs on each unit immediately after a LOOP without safety injection, i.e., for LOOP without a LOCA.

Figure 3 shows the effect on the containment temperature transient if the CS pump is secured after 30 minutes. The containment pressure transient exhibits an equivalent response. Evaluation of these transients against the EQ envelope confirms that the CS pump may be secured at 30 minutes, provided that two ECCs are maintained in operation thereafter.

- The plant procedures will allow the operator to secure the operating CS pump at 30 minutes for the one EDG operating post-LOCA scenario, and will instruct the operator to maintain two running ECCs beyond 30 minutes.

The fan horsepower required for operation of an ECC or an Emergency Containment Filter (ECF) is proportional to the containment pressure, which varies with time. The fan horsepower was calculated based on the peak pressure occurring in the first and second EDG load intervals. The calculation assumed the CS pump was secured at 30 minutes.

Boric acid-related loads (boric acid transfer pumps and boric acid tank heaters) auto-connect when two EDGs start and operate. These loads are not required on the accident or hot shutdown unit and do not auto-connect when only one EDG is available. This auto-connect feature will be disabled.

- The plant procedures will instruct the operator that the boric acid tank heaters may remain deenergized for up to eight hours without solidification of the solution therein.

Inplant testing and analysis confirmed that, as stated in the FSAR at Subsection 9.9.1, only one Control Room Air Conditioning (CRAC) unit is required. Two CRAC units are auto-connected to the EDG.

- The plant procedures will instruct the operator that one of the two CRAC units may be secured from the Control Room to facilitate EDG load management activities.

PUMP kW VALUES

The pump kW values for the ICW and CCW pumps were determined by inplant testing. The testing was conducted at design flow values and beyond design flow values. This provided inplant test data over the range of possible pump conditions, and reconfirmed the validity of plant startup test data. Figures 4 and 5 provide a plot of kW versus flow for CCW and ICW pumps, respectively.

Table 4 provides pump kW values and the confidence level associated with the value. Table 5 compares the pump kW values used in the FSAR and this load evaluation. The sum of individual pump kW values utilized in the current analysis is about equal to the sum of the FSAR values.

The computer code utilized for the failure modes and effects analysis (FMEA) required that individual pump kW values be utilized as an input for the FMEA. Limiting cases identified by the FMEA were analyzed utilizing the 95% confidence value for "total pump kW." Table 6 provides the expected total pump kW and the 95% confidence level pump kW for the one and two EDG operating cases.

FSAR LOAD EVALUATION COMPARISON

Pump kW comparisons between the FSAR and current load evaluations are discussed in the preceding section. Tables 7 and 8 provide a comparison with other assumptions for the FSAR and current case. The principal differences are:

- The NCCs are secured for one hour in the current evaluation, as are the CR/CSR AC units.
- Charging pump capability is provided earlier in the current evaluation, with pressurizer heaters provided after 30 minutes.
- The IACs and turbine-related loads are disabled from reloading on SIS reset.
- The RHR pump is secured at 30 minutes in the current evaluation.
- The CS pump is secured at 30 minutes in the current evaluation.
- Two HHSI pumps run during the entire injection phase in the current evaluation.
- Two ECCs are run beyond 30 minutes in the current evaluation.

Differences between the FSAR and current EDG load evaluations are discussed in the paragraphs that follow.

Tables 7 and 8 provide a comparison of EDG kW loads, based on the sum of individual pump kW values, with those contained in the FSAR. The EDG load evaluation sum must be corrected to account for a total pump kW value with a 95% confidence level, as shown. Thus, the current load evaluation results in EDG kW loads less than the FSAR. The FSAR total kW estimate remains bounding.

Securing the NCCs on the hot shutdown unit raised the containment temperature. The ability to maintain hot shutdown conditions is not adversely affected by the temperature increase. For the case of LOOP only, the operator starts two NCCs and the temperature is reduced to less than 120°F for non-LOCA LOOP scenarios.

Providing charging capability and pressurizer heaters on the hot shutdown unit earlier in the post-trip period than assumed in the FSAR enhances the operator's ability to maintain hot shutdown conditions.

Disabling the reload capability upon SIS reset for the IAC and turbine-related loads reduces currently required operator actions prior to SIS reset. Starting one NCC at about one hour from the Control Room does not impose any undue burden upon the operator, nor does the starting of a CR/CSR AC from the Control Room.

Disabling the NCC damper function occurs long term. The accident and non-accident units would be stabilized on the order of an hour or so. This activity would take place at about 24 hours.

For a small break LOCA (SB LOCA) the operator secures a RHR pump during injection. The FSAR evaluation would require the operator to secure one HHSI pump at 30 minutes. These two different operator actions would be replaced by one action; namely, secure a RHR pump at 30 minutes for all LOCAs. Thus the required operator actions are reduced by this break independent LOCA response scenario. The operator no longer has to differentiate between a SB LOCA and a LB LOCA since his actions are identical for all LOCAs.

In balance, implementation of the assumptions associated with this load evaluation reduces the operator actions currently in place. Securing one safety injection pump at 30 minutes is consistent with the FSAR load evaluation.

Securing the CS pump at 30 minutes does not invalidate equipment qualification. Running the ECCs beyond 30 minutes is consistent with current EQ requirements. Running two HHSI pumps for the injection phase beyond 30 minutes, and running one HHSI and one RHR pump in the recirculation phase is consistent with the newly implemented TMI-related EOPs.

The comparison with FSAR requirements indicates that implementation of the current load evaluation does not involve an unreviewed safety question since the FSAR load evaluation bounds this case. Individual 50.59 evaluations will be provided with each plant design change package, and where appropriate for procedural changes.

FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

A FMEA was conducted to evaluate the ability of the EDGs to accommodate single failures in the electrical system for various combinations of accident assumptions. Potential single failures were evaluated by Power Plant Engineering and those resulting in the highest EDG loadings were included in the FMEA.

The results of the FMEA are provided by Table 9. Limiting cases defined by the FMEA are reviewed to determine the appropriate EDG loading conditions, since FMEA assumptions are overly conservative.

With no single failures, the maximum auto-connected load determined by the FMEA calculation is 2673 kW. For the one EDG cases, the maximum auto-connected load is 2694, determined by the FMEA calculation kW. Thus, for those cases that are subject to the Technical Specification auto-connected limit of 2750 kW, all FMEA cases are within this limit.

All two EDG cases assume that each EDG auto-connects the following pumps:

	Number
CCW	2
ICW	2
RHR	1
CS	1
HHSI	2

In the 1 - 30 minute EDG load interval, one HHSI is assumed to be secured by the operator on each EDG.

The operator has considerable load management flexibility when two EDGs are operating because the number of large running pumps is greater than required. On the other hand, the operator has little load management flexibility when one EDG is operating. The single EDG case is more restrictive from a load management standpoint.

The FMEA evaluated the case where a LOCA occurs with one unit at cold shutdown, even though the FSAR design basis does not address this case. The analysis assumed that the RHR on the cold shutdown unit is not restarted until 30 minutes after the LOCA. This assumption is acceptable without further restriction if the LOCA occurs in excess of 30 hours after shutdown. The probability of a LOCA not occurring during this 30 hour period is acceptably low. For example, assuming one refueling per unit per year, the probability is about 6.8×10^{-3} less than that associated with the design basis event.

From an EDG loading standpoint, starting a RHR pump in the 1 - 30 minute EDG load interval is acceptable. The EDG kW load based on a 95% confidence level for total pump kW is 2849 kW, and the load based on expected pump kW is 2826 kW. One CRAC unit (27 kW) can be secured prior to starting the RHR pump on the cold shutdown unit.

- o The plant procedures will instruct the operator not to initiate RHR on the cold shutdown unit for the first 1/2 hour when a LOCA occurs with one unit in cold shutdown and only one EDG is operating. RHR on the cold shutdown unit would be started after RHR or CS is secured on the accident unit.

    - If the LOCA on the running unit occurs within 30 hours after shutdown, the operator would be instructed to stop one of the two running CRAC units and start the RHR pump during the first 1/2 hour.

    - If the LOCA occurs when the Reactor Coolant System is drained to the mid-nozzle height, the operator shall restore RCS level prior to restart of RHR. Two charging pumps with suction from the RWST provides sufficient flow to restore RCS level.

The single tie breakers connecting load centers with A and B power supplies are maintained open with either unit at power. This precludes any unacceptable interaction between the A and B power supplies.

- o The plant procedures will ensure that load center tie breakers are racked out for both the A & B trains when either unit is at power, unless a safety evaluation or Technical Specification limit is provided to justify short-term operation with the breaker closed.

For the electrical system single failure cases, only the MCC vital to non-vital tie breaker cases result in a high auto-connected EDG load on one of the two operating EDGs. This loading can be mitigated immediately by securing one or two large pumps on the heavily loaded EDG.

The MCC D vital to non-vital evaluation assumes that the Battery Room AC (22kW), two Control Room ACs (54 kW), and all boric acid heat tracing (20 kW on EDG B) are fully loaded on the EDG during the 0-1 minute auto-sequencing of loads. If none of these loads were demanded by process controls during this one minute interval, then the calculated load would be reduced by 96 kW. A further reduction in kW is obtained by utilizing the most probable value for total pump kW, i.e., the expected value provided by Table 6. Adjusting the FMEA results indicates that the expected load on EDG B, due to a MCC D tie breaker failure, would be anywhere from 2805 to 2901 kW.

A similar evaluation for the other MCCs indicates that the EDG A load due to an MCC 3A tie breaker failure could be anywhere from 2805 to 2852 kW, and for MCC 4A from 2836 to 2883 kW.

The expected auto-connect kW load is within the EDGs' 2950 kW limit; is greater than the Technical Specification auto-connect limit of 2750 kW; and is in the order of the STS requirement of 2850 kW. Thus the single failure of a MCC tie breaker results in an unanalyzed PTPN EDG auto-connect loading scenario on one of the two operating EDGs. This scenario approaches current NRC requirements embodied in the STS.

The FMEA vital to non-vital tie breaker failure results assume that Main Transformer cooling equipment, which is normally supplied from MCCs 3A and 4A, is powered from the alternate C-Bus supply. Thus, until design changes are implemented:

- The plant procedures shall be modified to ensure that the Main Transformer cooling equipment normal supply breakers on MCCs 3A and 4A are open, and that the alternate C-Bus supply breakers are closed.

The FMEA identified two design features that will be modified; viz:

- MCC 4A receives its normal power supply from LC 4A. Auxiliaries for EDG B are powered from this bus.

- As shown in FSAR Figure 8.2-2, a single breaker connects the vital to non-vital bus sections of MCCs D, 3A and 4A. Failure of one of these breakers to open will cause both the vital and non-vital bus section loads to be auto-connected to the EDGs.

The effect of these design items are being evaluated independently of the EDG load evaluation. Appropriate design changes will be developed to modify these items such that they do not have a potential for adversely affecting the ability

of the EDGs to accommodate required loads. Appropriate safety, 10 CFR 50.59 and 10 CFR 21 evaluations will be conducted in parallel with this design effort. A 50.59 evaluation and Justification for Continued Operation (JCO) will be developed for any interim actions required prior to completion of any required design modifications.

DURATION OF ONE EDG OPERATION: PLACING THE PROBLEM IN PERSPECTIVE

The occurrence of a LOCA followed by a unit trip, which is postulated to result in a loss of offsite power to both units, and then a subsequent failure of one EDG, constitutes the design basis accident scenario. This is an unlikely event. The probability of occurrence of this event has been calculated, and is 2.3×10^{-5} events/year.

Given that the event has occurred, the AC power question is reduced to how long one EDG operation will be required. To respond to this query, the LOOP events to FPL fossil and nuclear facilities since 1973, and the repair time associated with EDG failures for both the St. Lucie and Turkey Point nuclear facilities have been analyzed. The results indicate:

	EDG FAILURES	LOOP
Number of Occurrences	46	27
Median Time to Restore	240 min.	20 min.
Mean Time to Restore	640 min.	26 min.

The probability of not restoring AC power is dominated initially by the restoration of offsite power.

There are five Black Start Diesels installed at PTPN. These diesels can also be used to power either the A or B buses via the C bus. This power source can be made available within about 15 minutes after the decision is made to initiate this AC source. It is thus reasonable to assume that this power source can be made available at about one hour post-LOCA. The Black Start Diesel reliability analysis assumes that these units are well maintained and available for nuclear plant use. Maintenance of these units will become the responsibility of the Nuclear Energy Department, and an appropriate maintenance program will be implemented to ensure their continued availability.

Figure 6 provides the results of the evaluation of the failure to restore an additional source of AC power. Assuming restoration of offsite power and EDG repair only, the probability of not restoring one of these sources decreases by an order of magnitude per hour. That is, at one hour, failure to restore an additional AC power source will occur 1 out of 10 times, at two hours 1 out of 100 times, at three hours 1 out of 1000 times, etc.

If the Black Start Diesels are started, 1 out of almost 1000 times the attempt to

power an A or B bus from the diesels will not be successful. Thus the presence of the Black Start Diesels dramatically reduces the probability of not restoring an additional AC power source.

It is reasonable to conclude that an additional AC power source can be made available on the order of an hour post-LOCA.

CONCLUSIONS

The EDG loading evaluation, and associated plant changes and changes to the plant procedures, result in a substantial improvement in EDG margin when compared to the FSAR (see Tables 7 & 8). In addition, the reliance on operator action will be reduced after correction of the MCC tie breaker and EDG B auxiliary power supply design items are implemented. Implementation of the evaluation's assumptions demonstrates that the FSAR load evaluation remains bounding, and that the EDGs meet all loading requirements set forth in the PTPN Technical Specifications.

Detailed evaluations and supporting calculations are available at FPL for review by NRC. Each PC/M will contain a written safety evaluation and 50.59 evaluation.

TABLE 1

EDG kW LOADING MARGIN BASED ON 12/85 EVALUATION

	Auto-Connect	1 min. - 30 min.	30 min. - 1 hr.
EDG Loading*	2747 kW	2875	2794
Margin to 2950 kW EOP Limit	NA	75 (2.5%)	156 (5.3%)
Margin to 3050 kW ½ Hr. Rating	NA	175 (5.7%)	256 (8.4%)
Margin to 2750 kW Tech. Spec. Auto-Conn. Limit	3 (0.1%)	NA	NA

---

* From 12/85 EDG Load Evaluation Study

TABLE 2

EMERGENCY DIESEL GENERATOR RATINGS

	BHP*	kW**	FSAR kW
Base Continuous Rating	3600	2567	2500
110% Rating (2 hours/24 hours)	3960	2828	2750
2000 Hour/Year	3950	2821	2850
200 Hour/Year	4100	2930	----
168 Hour/Year	----	----	2950
4 Hour/Year	4150	2966	----
1/2 Hour/Year	4225	3020	3050

* Diesel engine manufacturer's rating for EMD Model No. 20-645E4 engine.

** Calculated assuming a 60 horsepower fan and 0.972 generator efficiency.

TABLE 3

TESTING OF EMD MODEL 20-645E4 EDGs

NO. EDGs	TEST TIME	POWER LEVEL kW
1	22 Hours	2468**
	2 Hours	2900
1	22 Hours	2500
	2 Hours	2900
4	4 Hours	2600
	2 Hours	2850
	5 Minutes*	2950
	6 Minutes*	3050
3	24 Hours	2750
2	23.5 Hours	2850
	0.5 Hours	3050

---

* Run until stabilized at load.

** Average value, load varied from 2420 to 2520 kW.

TABLE 4

PUMP kW VALUES AND CONFIDENCE BOUNDS

PUMP	#EDGs*	PUMP kW	CONFIDENCE (%)
HHSI	1	302	95
HHSI	2	302	95
RHR	1	220	95
RHR	2	195	95
CS	1	216	95
CS	2	216	95
ICW	1	265	99
ICW	2	265	99
CCW	1	380	95
CCW	2	365	95

---

* With two EDGs operating the flow per pump may be reduced, which results in a kW per pump reduction.

TABLE 5

PUMP kW COMPARISON

	FSAR	6/86
RHR	224	220
CS	199	216
HHSI	612	604
CCW	764	760
ICW	524	530
	2323	2330

TABLE 6
(Sheet 1 of 2)

TOTAL PUMP kW

One EDG Case Less than 30 Minutes

	# Pumps	Expected Pump kW
HHSI	2	585
RHR	1	214
CS	1	209
CCW	2	741
ICW	2	507
		2256

95% Total kW = 2278

One EDG Case Greater than 30 Minutes

	# Pumps	Expected Pump kW
HHSI	2	585
RHR	0	0
CS	0	0
CCW	2	741
ICW	2	507
		1833

95% Total kW = 1854

TABLE 6
(Sheet 2 of 2)

TOTAL PUMP kW

Two (2) EDG Case Less than 30 Minutes

	# Pumps Per EDG	Expected Pump kW
HHSI	2	585
RHR	1	189
CS	1	209
CCW	2	712
ICW	2	507
		2202

95% Total kW = 2224

One EDG Case Less then 30 Minutes (One Unit in Cold Shutdown)

	# Pumps Per EDG	Expected Pump kW
HHSI	2	585
RHR	2	428
CS	1	209
CCW	2	741
ICW	2	507
		2470

95% Total kW = 2493

TABLE 7

ONE EDG AVAILABLE
COMPARISON WITH FSAR kW LOADS
0 - 30 MINUTES

	FSAR TABLE 8.2-2	EDG LOAD* EVALUATION
HHSI	612	604
RHR	224	220
CS	199	216
CCW (Accident Unit)	399	380
CCW (Hot Shutdown Unit)	365	380
ICW (Accident Unit)	262	265
ICW (Hot Shutdown Unit)	262	265
Normal Containment Coolers	124	0
Emergency Containment Coolers	50	44
Emergency Containment Filters	122	104
Battery Chargers	0	0
Charging Pump	0	101
Pressurizer Heaters	0	0
Turbine Loads	0	0
Emergency Lighting	40	31
Control Room AC	44	54
BA Heat Tracing	40	40
EDG Auxiliaries	6	17
Miscellaneous Loads	22	9
Load Center Transformer Losses	-	14
Battery Room AC	-	22
H_2 Analyzer Related	-	14
Security Building Transformer	0	8
Computer Room/Cable Sprdg. Room AC	-	0
Boric Acid Pump	0	0
	2771	2788
95% Total Pump kW Correction		-50
		2738

* PTPN 3 & 4 at Power, SIS on PTPN 3, EDG A fails (see Table 9).

TABLE 8

ONE EDG AVAILABLE
COMPARISON WITH FSAR kW LOADS
BEYOND 30 MINUTES

	FSAR TABLE 8.2-2	EDG LOAD EVALUATION*
HHSI	306	604
RHR	224	0
CS	199	0
CCW (Accident Unit)	399	380
CCW (Hot Shutdown Unit)	365	380
ICW (Accident Unit)	262	265
ICW (Hot Shutdown Unit)	262	265
Normal Containment Coolers	124	0
Emergency Containment Coolers	0	30
Emergency Containment Filters	122	74
Battery Chargers	130	194
Charging Pump	125	0**
Pressurizer Heaters	0	150**
Turbine Loads	54	0
Emergency Lighting	40	31
Control Room AC	44	54
BA Heat Tracing	40	40
EDG Auxiliaries	4	8
Miscellaneous Loads	10	9
Load Center Transformer Losses	-	13
Battery Room AC	-	22
H_2 Analyzer Related	-	15
Boric Acid Pump	27	0
Security Building Transformer	-	8
Computer Room/Cable Sprdg. Room AC	-	0
	2737	2542
95% Total Pump kW Correction		-40
		2502

* PTPN 3 & 4 at Power, SIS on PTPN 3, EDG A fails (see Table 9).
** Alternate charging pump and pressurizer heaters (150 kW) operation.

TABLE 9

(Sheet 1 of 3)

EDG LOADING (kW) FMEA SUMMARY

No Single Failures	EDG	Auto-Conn.	1-30 Minutes	30 Min. - 1 Hr.
o PTPN 3 & 4 at power, SIS on PTPN 3	A	2515	2311	2330
	B	2673	2362	2317
o PTPN 3 & 4 at Power, SIS on PTPN 4	A	2515	2311	2330
	B	2593	2287	2265
o PTPN 4 in Cold Shutdown, SIS on PTPN 3	A	2515	2429	2399
	B	2673	2362	2317
One EDG Available				
o PTPN 3 & 4 at power, SIS on PTPN 3,	A	0	0	0
EDG A fails to load	B	2694	2788	2542
o PTPN 3 & 4 at power, SIS on PTPN 3,	A	2693	2787	2541
EDG B fails to load	B	0	0	0
o PTPN 4 in Cold Shutdown, SIS on PTPN 3,	A	0	0	0
EDG A fails to load	B	2694	2686	2611

TABLE 9

(Sheet 2 of 3)

EDG LOADING (kW) FMEA SUMMARY

Battery Failures	EDG	Auto-Conn.	1-30 Minutes	30 Min. - 1 Hr.
o PTPN 3 & 4 at power, SIS on PTPN 3	A	2753	2499	2445
Battery 3B failure, breaker 3AB20	B	966	1068	1117
fails to close				
o PTPN 3 & 4 at Power, SIS on PTPN 4	A	1014	1116	1161
Battery 4A failure, breaker 4AA20	B	2708	2454	2405
fails to close				
1-1/2 EDGs Available				
o PTPN 3 & 4 at power, SIS on PTPN 4,	A	2531	2267	2237
breaker 4AB21 fails to close	B	1169	1364	1391
o PTPN 3 & 4 at power, SIS on PTPN 4,	A	2672	2468	2487
breaker 3AB20 fails to close	B	1456	1452	1430
o PTPN 3 & 4 at power, SIS on PTPN 4,	A	1501	1497	1471
breaker 3AA20 fails to close	B	2653	2448	2472

TABLE 9

(Sheet 3 of 3)

EDG LOADING (kW) FMEA SUMMARY

Nonvital Tie Breaker Failures	EDG	Auto-Conn.	1-30 Minutes	30 Min. - 1 Hr.
o PTPN 3 & 4 in power operation, SIS on PTPN 3,	A	2515	2311	2330
MCC D tie breaker fails to open	B	2975	2665	2619
o PTPN 3 & 4 in power operation, SIS on PTPN 3,	A	2926	2620	2590
MCC 3A tie breaker fails to open	B	2673	2464	2468
o PTPN 3 & 4 in power operation, SIS on PTPN 3,	A	2957	2651	2621
MCC 4A tie breaker fails to open	B	2673	2464	2468
MCC Transfer to Alternate Supply				
o PTPN 3 & 4 in power operation, SIS on PTPN 3,	A	2496	2292	2315
transfer of MCC 4A to LC 4D	B	2692	2381	2332
o PTPN 3 & 4 in power operation, SIS on PTPN 3,	A	2469	2265	2288
transfer of MCC 3A to LC 3D	B	2718	2408	2359
o PTPN 3 & 4 in power operation, SIS on PTPN 3,	A	2736	2426	2372
transfer of MCC D to LC 4C	B	2451	2247	2274

TURKEY POINT LONG–TERM CONTAINMENT HEATUP

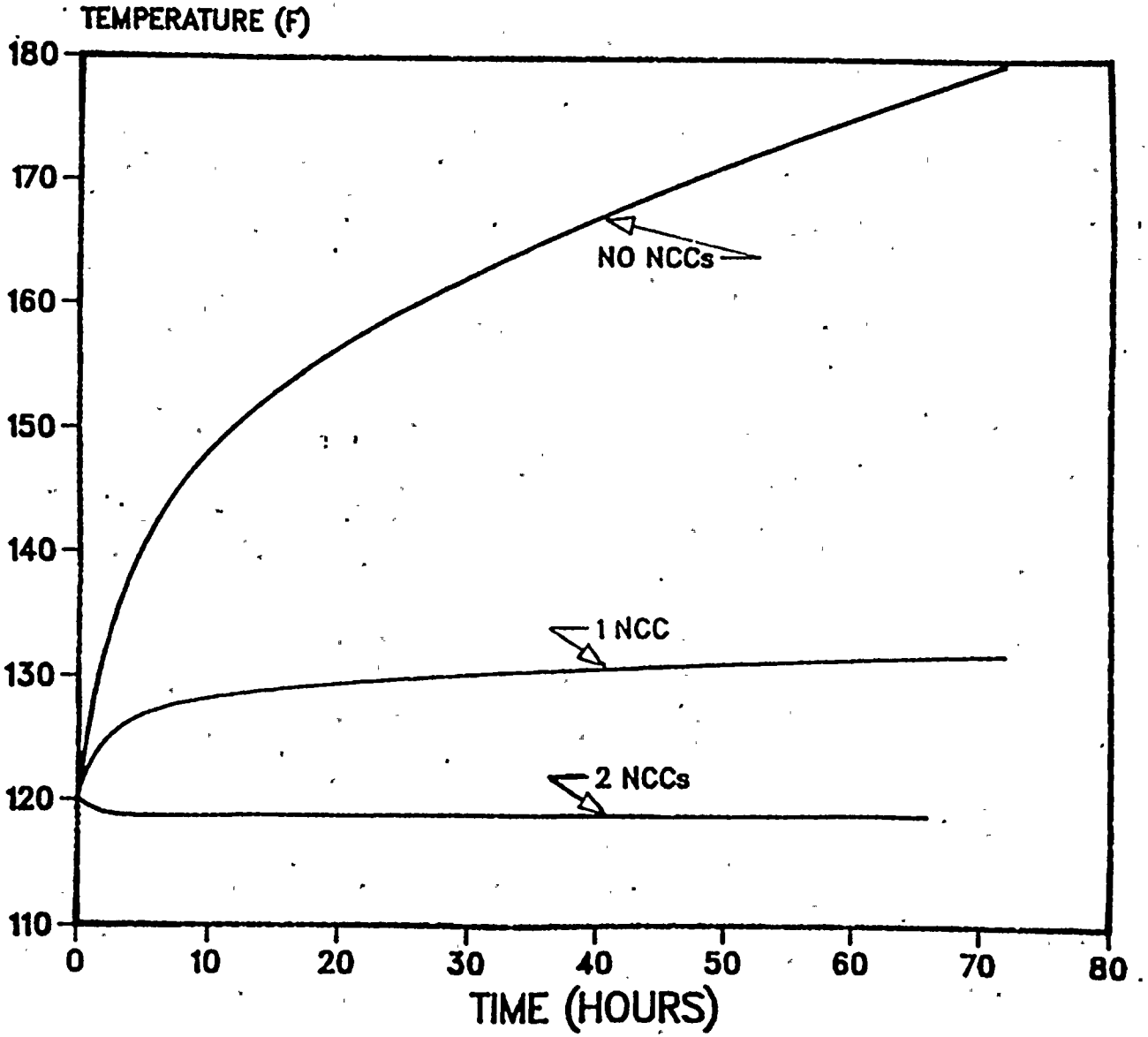

FIGURE 1

TURKEY POINT CONTAINMENT HEATUP
1 NCC STARTING AT 0 HR, 0.5 HR, 1 HR

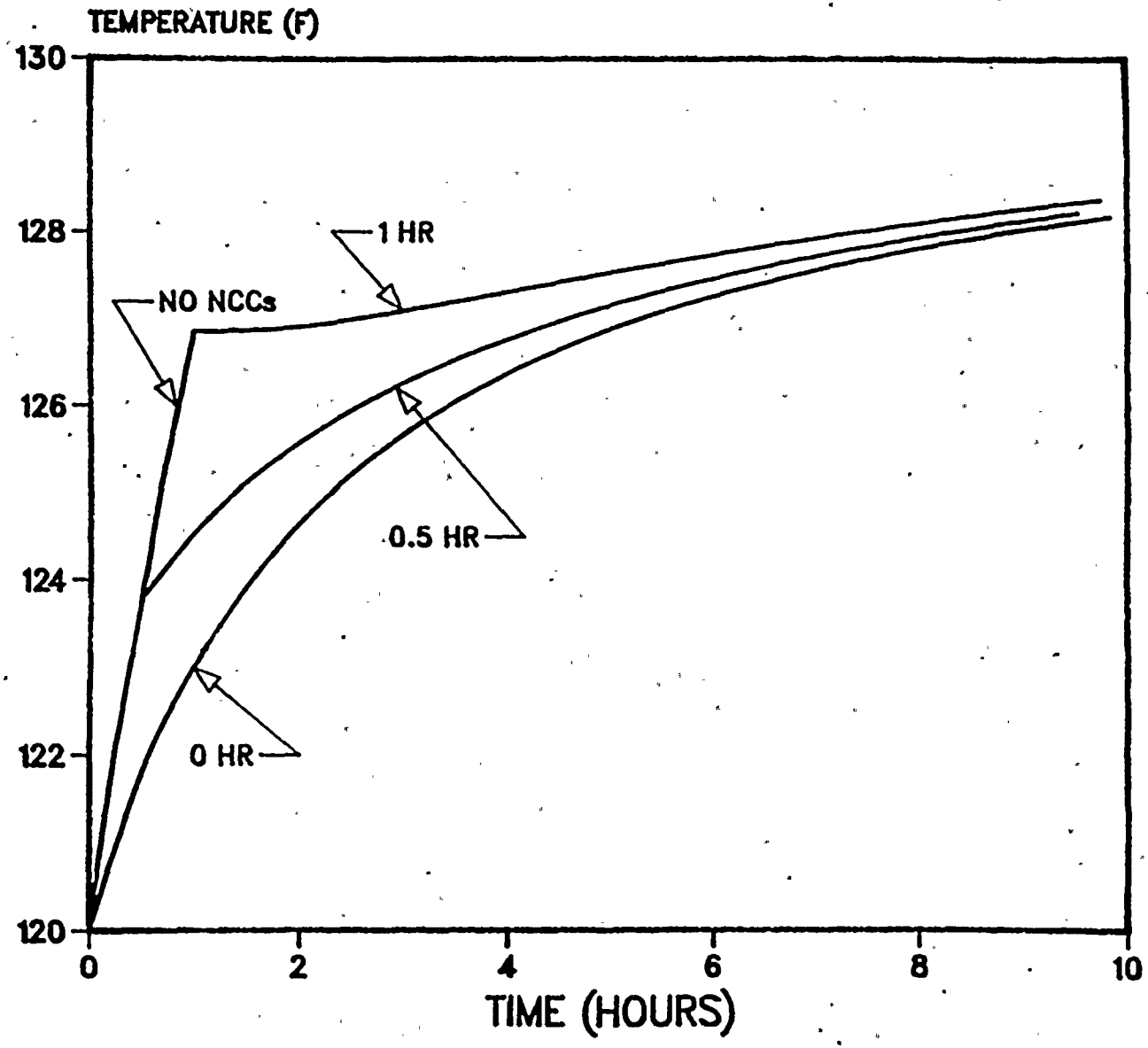

FIGURE 2

CONTAINMENT TEMPERATURE ANALYSIS

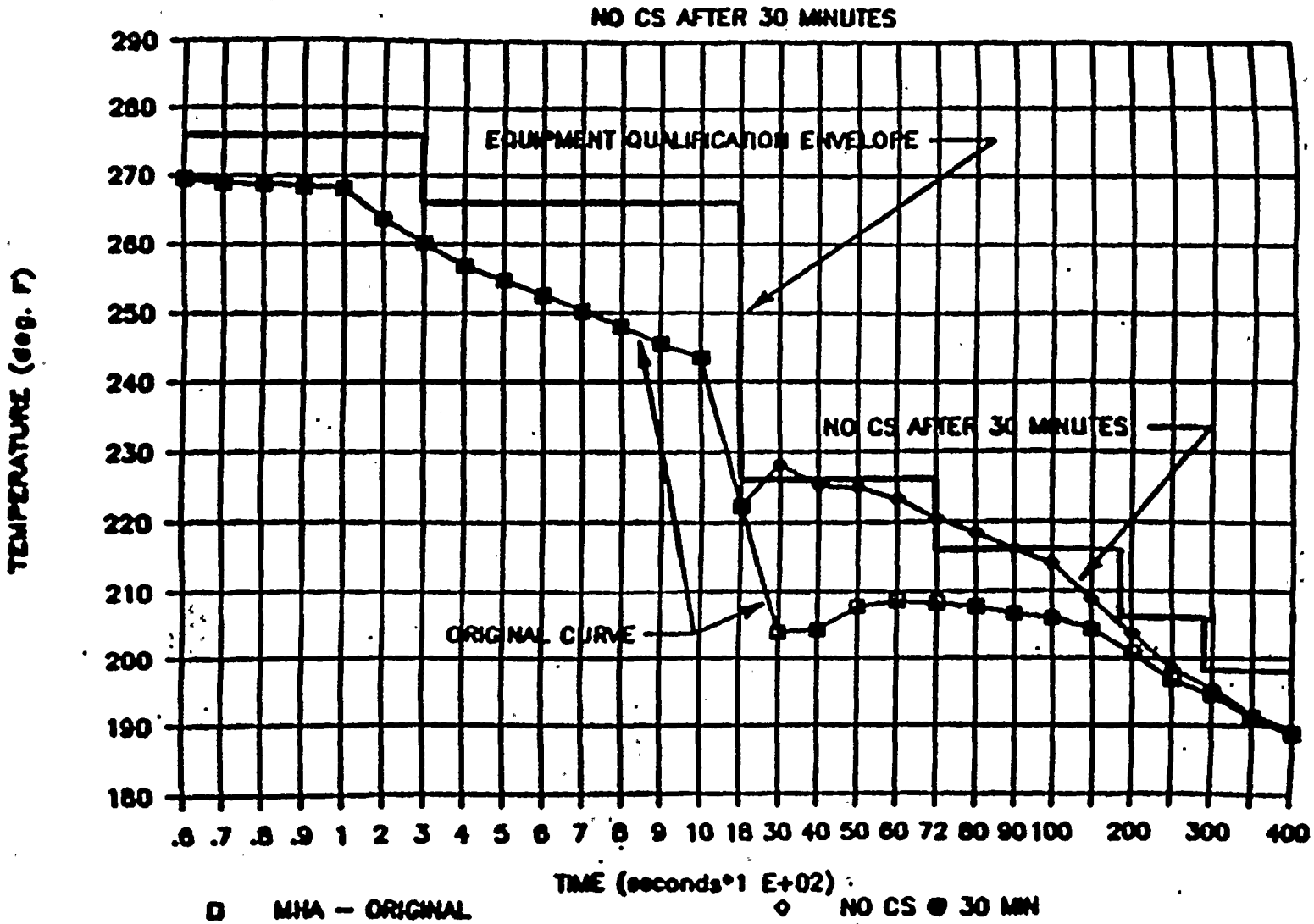

FIGURE 3

COMPONENT COOLING WATER PUMP

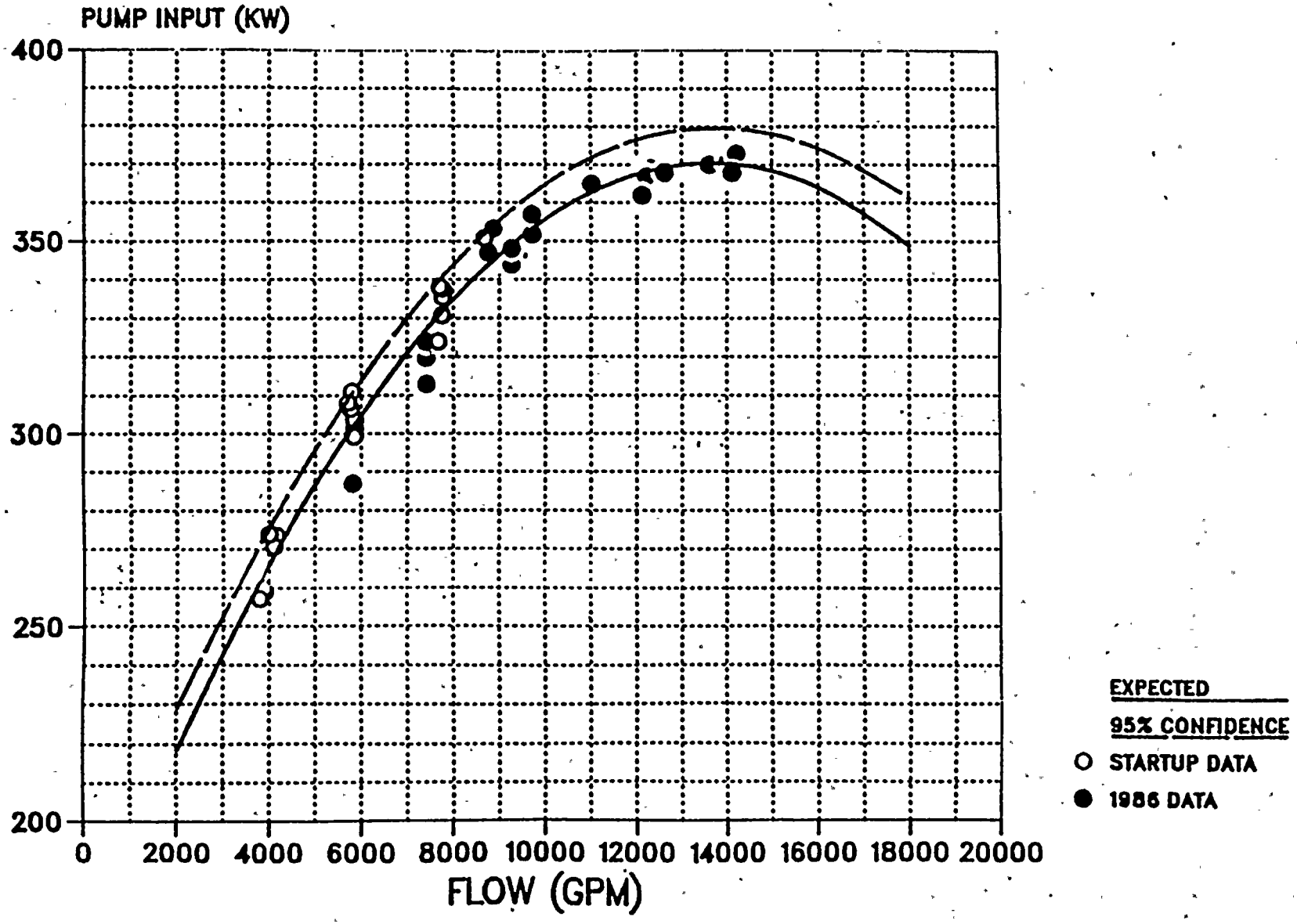

FIGURE 4

INTAKE COOLING WATER PUMP

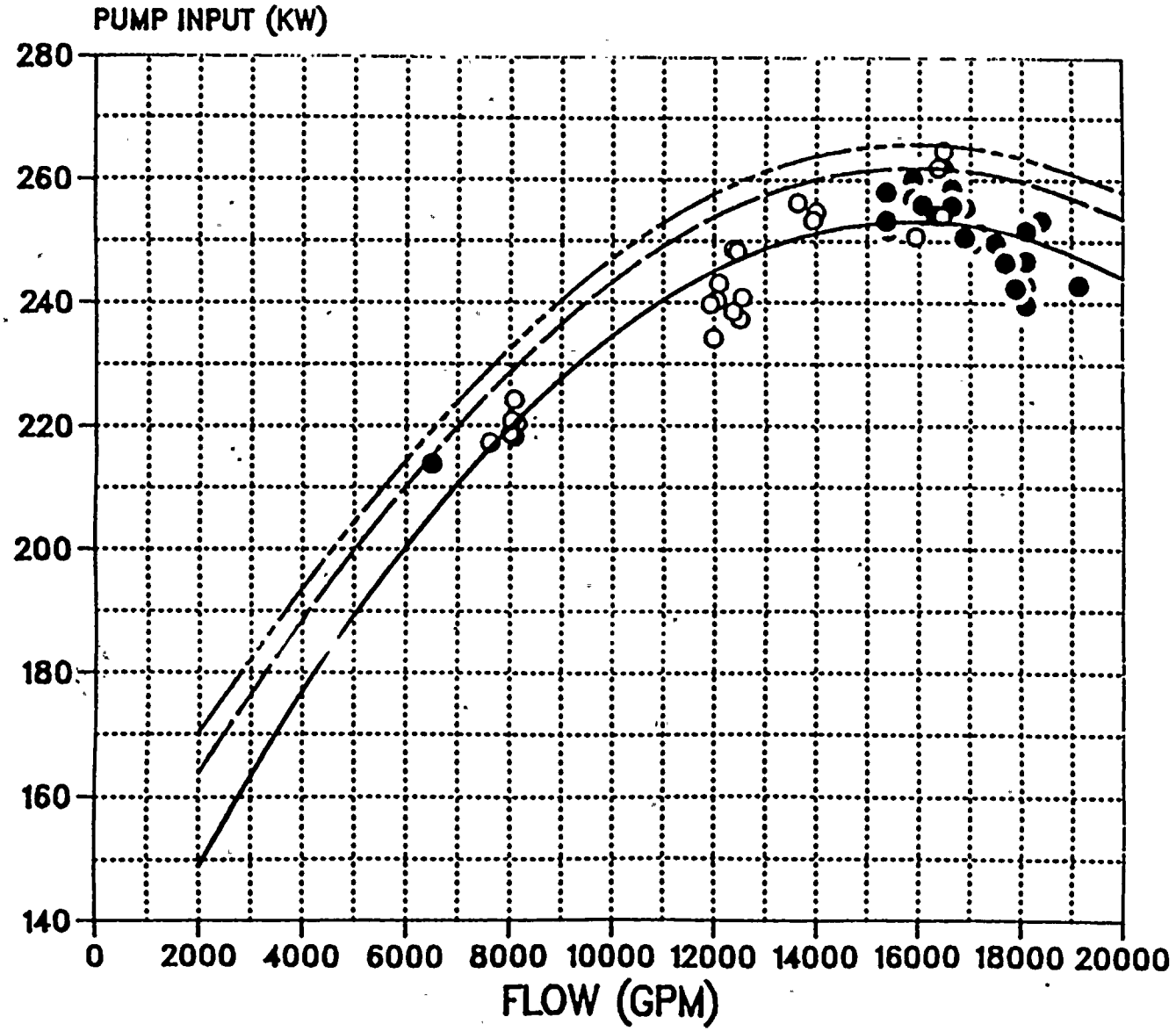

FIGURE 5

FAILURE TO RESTORE ADDITIONAL AC POWER

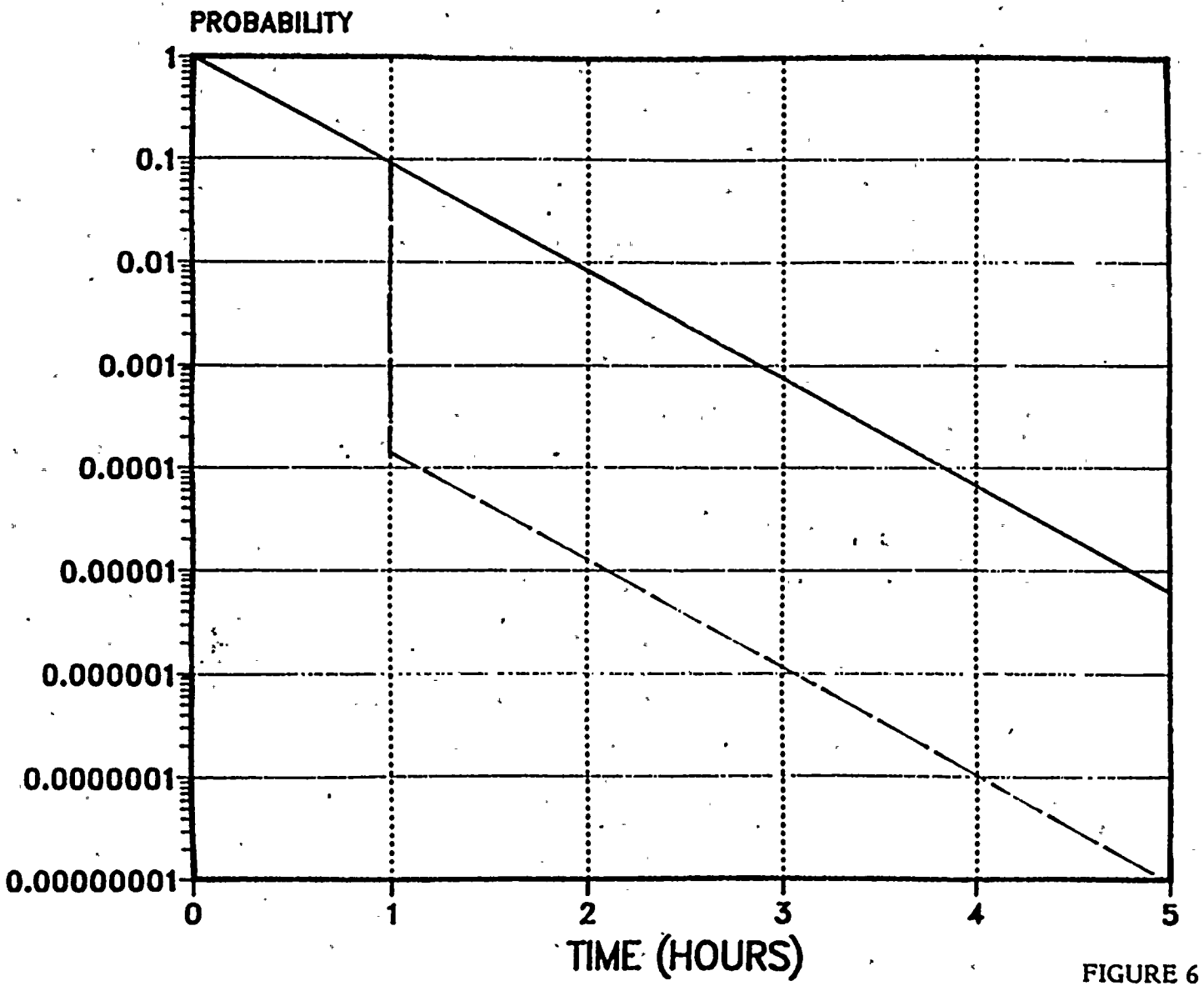

FIGURE 6