Florida Power
CORPORATION

February 1, 1988
3F0288-02

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Additional Information - Diesel Generator Loading

Dear Sir:

Florida Power Corporation (FPC) met with the NRC staff on January 20, 1988 concerning diesel generator loading. During this meeting, several concerns were discussed. As a result, additional information concerning diesel generator loading is attached.

Should you have any further questions, please do not hesitate › contact this office.

Sincerely,

E C Simpson

E. C. Simpson
Nuclear Operations Site Support

DGG:LMG
Attachment

xc: Dr. J. Nelson Grace
Regional Administrator, Region II

Mr. T. F. Stetka
Senior Resident Inspector

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QUESTION 1: Explain why pump curves cannot be used.

RESPONSE 1: The load (kW) test data showed reasonable correlation with the pump curves except for MUP-1B and BSP-1A.

The reason for the difference between the test results and the pump curve for MUP-1B is currently under evaluation. The use of this pump in its present condition aligned to the "A" emergency diesel generator (EDG) will only be done if sufficient margins for EDG loading are justified using existing load (kW) test data or additional testing confirms lower power requirements.

The test of BSP-1A showed agreement with the brake horsepower versus flow curve but the flow to discharge head data was not in agreement with the pump curve. The load (kW) test was performed on 12/21/87 (at approximately 1100 hours) to obtain data on load (kW) versus flow for BSP-1A. Additional data was also taken during the test which included pump discharge pressure. The test data taken indicates that the discharge pressure was low during the pump run. This was not discovered immediately since no acceptance criteria for pump discharge pressure was defined in the load test procedure.

Subsequent pump and valve testing for operability, was performed for BSP-1A, on 12/21/87 (at approximately 0200 hours) and on 12/27/87. The discharge pressure was within acceptable limits during both of these tests. The applicable data sheets for the load test and the pump and valve tests are attached.

Additional discussion with regard to BSP-1A discharge pressure is provided in response to Question 12.

QUESTION 2: Why are Gilbert Commonwealth calculated values being revised at this time?

RESPONSE 2: The calculations are currently being revised to reflect the load test results, as well as modifications, which were performed to reduce emergency diesel generator (EDG) load. These calculations will also formally document changes in total load that were previously provided to the NRC by letter 3F1287-16 dated December 14, 1987. The revised calculations are currently scheduled to be submitted with the supplement to LER 87-19 by February 29, 1988. Additionally, documentation that supports the flow rate changes for SWP-1A and RWP-2A will also be provided with the calculations.

QUESTION 3: Identify all EDG loads. Include those that are auto connected, manually connected, and those that are tripped and must be reconnected when the EDG load can be reduced to allow adding the desired loads.

SP-340A
DATA SHEET IV
BSP-1A

Initial Suction Pressure (BS-9-PI1) 37 psig

PUMP OPERATING PRESSURES

	Normal (psig)	Actual (psig)
Discharge Press BS-2-PI1	199.5 - 219.6	200
Suction Press BS-9-PI1	34 - 38	35
Differential Pressure (calc)	165.5 - 181.6 (psid)	(165)

may be due to operating conditions SO-340A will be performed again to determine operability WKB 12/23/87

	Low psid	High psid
dp Alert	≥160.2–<165.5	181.6 –≤183.3
dp Action	< 160.2	> 183.3

Pump Start time: 0100

Pump Stop time : 1200

Performed By: C McKeown Date 12-21-87 Time 0208

Reviewed By: [signature] Date 12-22-87 Time 0600

MOTOR POWER VERSES PUMP FLOW DATA
FOR PUMP BSP 1A

DATA POINT	FLOW (GPM)		TEMP (F)	PRESSURE (PSIG)	
	BS-1-FI1	BS-92 FK1 1	DH 10-TI	SUCTION BS 9 PI1	DISCHARGE BS 2 PI1
1	1460	1470	78	34	145
2	1600	1600	78	34	144
3	1550	1550	78	34	133
4	1400	1390	78	34	143
5					
6					

DATA POINT	SWITCH GEAR METERS					
	POTENTIAL (VOLTS)			CURRENT (AMPS)		
	A-B	B-C	C-A	A	B	C
1	4150	4280	4150	26.5	27	26.5
2	4150	4250	4150	27.5	27.5	27.0
3	4150	4250	4150	27.5	27.5	27.0
4	4150	4250	4150	26.5	26.5	26.0
5						
6						

INITIALS/DATE
[illegible] / 12-21-87

SP-340A
DATA SHEET IV
BSP-1A

[illegible]l Suction Pressure (BS-9-PI1) 58 psig

PUMP OPERATING PRESSURES

	Normal (psig)	Actual (psig)
Discharge Press BS-2-PI1	199.5 - 219.6	201
Suction Press BS-9-PI1	34 - 38	34
Differential Pressure (calc)	165.5 - 181.6 (psid)	167

	Low psid	High psid
dp Alert	≥160.2-<165.5	181.6 -≤183.3
dp Action	< 160.2	> 183.3

Pump Start time: 1210

Pump Stop time : 1730

Performed By: M. [signature] Date 12-27-87 Time 1530

Reviewed By: [signature] Date 12-27-87 Time 1910

RESPONSE 3: A table is attached which identifies the loads discussed above. This table is preliminary and subject to verification once the final revised calculations are received.

QUESTION 4: Establish the basis for the accuracies assumed in load values [Flow measurement and electrical loads (kW)].

RESPONSE 4: A discussion of the treatment of accuracies associated with the flow measurement (gpm) and electrical load measurement (kW) for the tested load values is presented below. This treatment of accuracies will be utilized in developing the February 1988 submittal concerning the results of the testing including adjusting for instrument accuracy.

kW Measuring Instrumentation Error Treatment

The testing provided observed kW readings at various flow points. Since it was not always possible to attain the exact flow point assumed in the accident analysis, regression analysis was used to determine what the observed kW reading would have been at the accident flow. First order regression analysis was performed where three or less than three test points were taken. Second order regression analysis was done where more than three test points were taken.

The next step was to correct this observed kW value at accident flow for the accuracy of the kW measuring instrument (trade name Dranetz). The multipoint calibration was performed prior to and after each pump test, except for Make Up Pump 1A where only a post-test calibration was done. Each calibration point represents kW input at a certain voltage, current and power factor. Enough calibration points were obtained to cover the kW range of interest. Second order regression analysis was done to correct the observed kW at power factors of unity, 0.86 and 0.5. Finally a first order regression was done to further correct this kW value for the power factor observed at or near accident flow.

The more conservative corrected kW value obtained from regression analysis performed on pre-test or post-test calibration data was selected as the correct kW value.

Flow Measuring Instrumentation Error Treatment

The treatment of accuracies associated with the flow measuring instruments during the testing is presented here for each of the pumps tested since the rationale for treatment varied based on the system being tested.

Auto Connected loads on "A" Emergency Diesel Generator.

EQUIPMENT	FLOW	KW	
BSP-1A	1600	185.7	*
SWP-1A	8500	485.5	*
MUP-1A	600	615.4	*
RWP-2A	15500	537.9	*
RWP-3A	10500	194.6	*
DHP-1A	3250	273.8	*
EFP-1	430	527.9	*
DECAY HEAT CL CYCLE COOLING WATER PUMP DCP-1A	3400	74	**
CONTROL COMPLEX LIGHTING		32.6	**
INVERTERS		58.9	**
MISC AC DISTRIBUTION PANELS		14.7	**
MISC PUMPS AND SMALL MOTOR LOADS		34.3	**
REACTOR BLDG FAN AHF-1A		61	**
DECAY HEAT CLOSED CYCLE COOLING FAN AHF-15A		2.8	**
FLUSH WATER PUMP DOP-2A		8.9	**
ES A 4160V/480V TRANSFORMER LOSSES		1.3	**

TOTAL LOAD ON EDG 3A FOR THE FIRST 10 MINUTES 3109
(The Operator has been provided guidance to trip EFP-1 ------
at time T≅10 minutes, upon determining > 400 GPM LPI Flow.)

Manually connected loads applicable to both "A" and "B" Diesel Generators

EQUIPMENT	KW	
SPENT FUEL COOLANT PUMP	41	**
CHILLED WATER SUPPLY PUMP	17	**
CONTROL COMPLEX WATER CHILLER	193	**
EFIC CONTROL COMPLEX FAN	13	**

EDG "A" loads that are tripped and must be reconnected by Operator action

EQUIPMENT	KW	
HEAT TRACING	41	**
BATTERY CHARGERS	93.1	**

The following load is a manually applied swing load which is normally aligned to the "B" side. The load on EDG "A" must be reduced to allow realignment of this load to the "A" side.

EQUIPMENT	KW	
ES MCC 3AB	91	**

NOTES

* TEST VALUES CORRECTED FOR KW INSTRUMENT ERROR. A FLOW ERROR CORRECTION OF 8 GPM WAS MADE TO EFP-1 FLOW TEST VALUES. ALL OTHER PUMP FLOW TEST VALUES DO NOT INCLUDE ANY FLOW ERROR CORRECTION.

** CALCULATED VALUES. MAY CHANGE AFTER REVISED G/CI CALCS ARE RECEIVED.

PRELIMINARY

RWP-2A (Emergency Nuclear Services Sea Water Pump) - The required system flow for its safety function is 13,400 gpm. The system is throttled to 14,600 gpm to account for worst case conditions of tide level, system fouling, and instrument error. Flow was measured with a portable ANNUBAR with a range of 0-20,000 gpm and accuracy of ±200 gpm. The accident flow will be as left and test instrument error does not affect this.

RWP-3A (Decay Heat Service Sea Water Pump) - The required system flow for its safety function is 9,700 gpm. The system was tested at 10,500 gpm with no additional throttling. Flow was measured with a portable ANNUBAR with a range of 0-20,000 gpm and accuracy of ±200 gpm. The accident flow will be as left and test instrument error does not affect this.

SWP-1A (Nuclear Services Closed Cycle Cooling Pump) - The total required system flow under emergency conditions is 8,375 gpm. The system individual components flow rates were adjusted to their specific design value +3% to account for the inaccuracy of the flow instrument used. The pump load (KW) determination for accident conditions used a flow indication from an installed flow instrument with a range of 0-16,889 gpm with an accuracy of ±200 gpm. The accident flow will be as left and test instrument error does not affect this.

BSP-1A (Reactor Building Spray Pump) - The normal system flow is 1500 gpm. The system has automatic flow control which is set at 1550 gpm. The flow instrumentation string has a range of 0-1800 gpm with a calibration tolerance of ±36 gpm. The pump loads (KW) determination for the accident condition relied upon the same instrument string as the automatic control logic to monitor the system flow at 1600 gpm. Accident flow will be controlled to the setpoint with the same error as existed in test, which is within allowed tolerances.

DHP-1A (Low Pressure Injection Pump) - The minimum required system flow for core cooling is 2700 gpm. The system has automatic flow control with a setpoint which is adjustable from the Main Control Board (MCB). Procedurally, this control is set at 3000 gpm for the LPI standby mode. This flow control instrumentation string has a range of 0-5000 gpm with a calibration tolerance of ±100 gpm which is also the range and tolerance on the MCB indicator. The pump loads (KW) determination for accident conditions used the automatic setpoint control on the MCB to set the designed flow and readings were taken from the MCB indicator. Accident flow will not change because the automatic flow control will maintain the rate with the same accuracy as used in the test, which is within the allowed tolerance.

MUP-1A (High Pressure Injection Pump) - The total required flow for the system is 500 gpm delivered to the Reactor Coolant System (RCS) at a pressure of 600 psig. This capability is demonstrated by system tests which take into account pressure and flow instrument inaccuracy (+25 psi and actual calibration data of flow strings). The flow is also balanced between the four injection legs and each pump is throttled to maintain flow between 500 and 545 gpm. The flow instrumentation ranges are 0-500 gpm for each of four injection legs and 0-200 gpm for the normal makeup path with calibration tolerances of ±10 gpm and +4 gpm, respectively. The load (kW) test used these same instruments to monitor the flow, therefore, accident flow is not affected by instrument error. The effect of RCS pressure lower than 600 psig is conservatively accounted for by an extrapolation of the pump flow/vs. kW curve out to a runout flow of 600 gpm.

EFP-1 (Emergency Feedwater Pump) - Emergency Feedwater is not required for a large break LOCA because of primary to secondary uncoupling. However, the automatic control of EFIC will continue its designated logic of filling both steam generators (SG) to the natural circulation level at a rate of 8 to 2 inches per minute until terminated by the operator. This is dependent on SG pressure which varies this rate from 1050 to 800 psig, respectively. The system flow of emergency feedwater will vary from 330 gpm to 82.5 gpm to each SG and assuming shared flow with the turbine drive pump is 330 gpm to 82.5 gpm plus a recirculation flow of 100 gpm for a total of 430 gpm to 182.5 gpm. For conservatism the higher value was used for kW calculations. The load (kW) test flow measurements were corrected for an offset in calibration of +8 gpm at the 25% of span (0-1000 gpm) because the EFIC control will call for a real flow to satisfy its programmed fill rate.

QUESTION 5: Identify design basis flow rates required to assure function. Also identify flow rates (actual) for the systems without operator action. In those cases where operator action is required to reduce or otherwise control flow, discuss the basis for assuming this can be accomplished successfully. Document where the design basis has been changed.

RESPONSE 5: The design basis flow rates required to assure functions including revisions to design basis flow requirements for SWP-1A and RWP-2A were provided in letter 3F0188-08 dated January 7, 1988, and letter 3F1187-19 dated November 16, 1987. In the case of the EDG load analysis, no credit was taken for operator action to reduce or control flow.

QUESTION 6: Identify where in Technical Specifications, etc., the operator will be made aware of the required flows.

RESPONSE 6: This information will be placed in the FSAR update on the EDG analysis. It is currently scheduled for inclusion in the July, 1988 FSAR submittal. Technical Specification Bases are expected to include this information after Technical Specification Improvement is implemented.

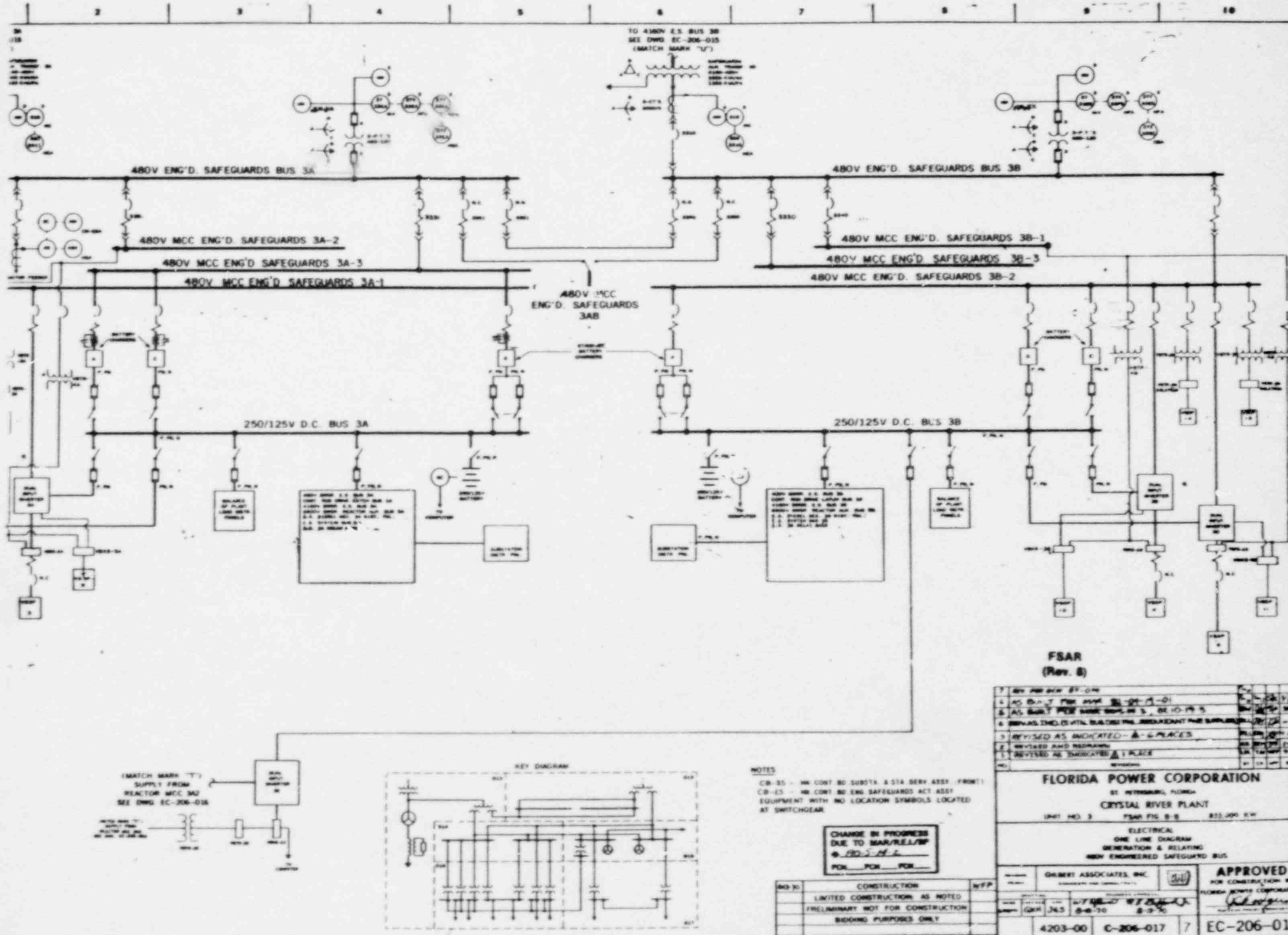
QUESTION 7: With regard to tripping the Class 1E battery charger, what is the battery voltage (terminal and at the load) at its lowest point before the charger(s) are reconnected. What provisions are there to ensure that they are reconnected. What is your basis for assuming that the inverter loads will remain functional when connected to the d.c. bus.

RESPONSE 7: Battery chargers 3A, 3C and 3E each have an output capability of 125V, 200 amps. Battery charger 3E is a standby for either 3A or 3C. This is accomplished via mechanical interlock that allow charger 3E to replace either 3A or 3C.

The modification to battery chargers 3A, 3C and 3E provides a control scheme which trips the battery chargers under a condition of a Loss of Offsite Power coincident with ES actuation. This is accomplished by connecting a contactor in the power circuit of each charger between the charger and MCC feeder breaker (see the attached drawing). This control scheme will allow the operator to reconnect the chargers administratively after approximately 30 minutes. The battery voltage at the end of this time period (30 minutes after tripping the chargers) has been analyzed to be 109 volts.

A list of non-safety related loads on the "A" battery is also attached in response to an NRC request. However, this list is preliminary and subject to verification once the final revised EDG calculations are received.

The inverters used at CR-3 have their primary source of power as ES 480V/AC from Motor Control Centers which are fed from the EDG. The battery/chargers serve as an alternate source of power for the inverters. The primary source of power is AC converted to DC and is held at a slightly higher DC voltage level than the alternate source DC. When primary source is lost, power will automatically be supplied from the alternate source DC and an alarm will be sounded in the Control Room alerting the operator that the inverters are on alternate source. When primary source AC power is reestablished, the inverters automatically revert back to primary source because of its slightly higher converted DC voltage level. There is no operator action involved in transfer between primary and alternate source.



FSAR
(Rev. 8)

NOTES

CB-SS - HN CONT BD SUBSTA & STA SERV ASSY (FRONT)
CB-ES - HN CONT BD ENG SAFEGUARDS ACT ASSY
EQUIPMENT WITH NO LOCATION SYMBOLS LOCATED AT SWITCHGEAR

CHANGE IN PROGRESS
DUE TO MAR/REJ/BP

NO.	REVISIONS
7	REV PER DCN 87-014
6	AS BUILT PER MAR ...
6	AS BUILT PER ...
5	...
4	REVISED AS INDICATED - 6 PLACES
3	REVISED AND REDRAWN
2	REVISED AS INDICATED 1 PLACE

FLORIDA POWER CORPORATION
ST. PETERSBURG, FLORIDA
CRYSTAL RIVER PLANT
UNIT NO. 3 FSAR FIG. 8-8 825,000 KW

ELECTRICAL
ONE LINE DIAGRAM
GENERATION & RELAYING
480V ENGINEERED SAFEGUARD BUS

GILBERT ASSOCIATES, INC.

APPROVED
FOR CONSTRUCTION BY
FLORIDA POWER CORPORATION

NO.	CONSTRUCTION	WFP
	LIMITED CONSTRUCTION AS NOTED	
	PRELIMINARY NOT FOR CONSTRUCTION	
	BIDDING PURPOSES ONLY	
DATE	RELEASED FOR	ENGR

4203-00 | C-206-017 | 7 | EC-206-017

Non-Safety Related Loads on "A" Battery

LOAD COMPONENT	VOLTS	AMPS	WATTS
Turb. Emer. Lube Oil Bearing Pump TBP-3 Motor	250	213.0	53250.0
Turb. Emer. Lube Oil Bearing Pump TBP-3 Control	125	1.0	125.0
DPDP-4A:			
Control Board Section ICSAR	125	3.0	375.0
Turb. Auto Stop Trip Sol. Valves	125	1.0	125.0
WDV-1022 WDG Decay Tank Vent Valve	125	0.5	62.5
DPDP-3A:			
CR3 Main Transformer	125	2.0	250.0
CWV-6, 8 Sec. Svce Ht. Exch. Isol. Vlv/ARV-3, 4 Water Box Rel. Vlv, ARV 52, 54 Cond. Vac. Bkr Vlv	125	3.0	375.0
CWV-1, 3 Sec. Svce Ht. Exch. Isol. Vlv/ARV-14, 17 Water Box Rel. Vlv, ARV 56, 57 Cond. Vac. Bkr. Vlv	125	3.0	375.0
Feedwater Pump 3a Turb. Emer. Oil Pump Motor	250	18.8	4700.0
WTCP-1 Cyc. Makeup Demin Regen Cont. Pnl	125	5.0	625.0
CR3 Unit Aux Transformer	125	2.0	250.0
CR3 Start up Transformer	125	2.0	250.0
Turb. Thrust Brg. Wear Detect	125	0.6	75.0
Electro Hydraulic Fluid-Alm., Misc.	125	8.0	1000.0
EFV-2 (Control) Hotwell Iso. Vlv	125	1.0	125.0
EXV-3, 9, 21, 22 Extraction Stm Check Vlv	125	2.0	250.0
Feedwater pump 3a Turb. Emer. Oil Pump Control	125	1.0	125.0
SCV-3 Sec Svc Cl Cyl Pp 3A Disch Iso Vlv	125	0.5	62.5
Main FW Pump 3A Cont, Pnl.	125	2.0	250.0
ARV-49 (Control) Cond. 3A Vac. Bkr. Relief Vlv	125	1.0	125.0
ARV-49 (Motor) Cond. 3A Vac Bkr. Relief Vlv	250	2.1	525.0
EFV-2 (Motor) Hotwell Iso. Vlv	250	0.7	175.0
DPDP-2A:			
Oil Lift Pp for Reac Coolant Pp 3C (Control)	125	1.0	125.0
Oil Lift Pp for Reac Coolant Pp 3A (Motor)	250	10.7	2675.0
Oil Lift Pp for Reac Coolant Pp 3C (Motor)	250	10.7	2675.0
Oil Lift Pp for Reac Coolant Pp 3A (Control)	125	1.0	125.0
DCV-10 Decay Ht Cl Cyc Tk 3A Dem Wtr Cont Vlv	125	0.5	62.5
Hydrogen Purge Filter	125	2.0	250.0
		(WATTS)	69,387.5
		(kW)	69.4

QUESTION 8: Present the results of your voltage analysis of the 480 volt system (Bus and at load terminals). This should also be considered in light of battery discharge and whatever impact this might have on 480/120 volt loads.

RESPONSE 8: Upon Loss of Offsite Power coincident with ES actuation, the auto-connected loads are applied to the Emergency Diesel Generator (EDG) in load blocks at 5 second intervals. At the instant each load block is applied the EDG voltage dips because of the starting inrush KVA demand of applied load block. The resulting EDG voltage profile on 4000V base was calculated to be as follows:

	Minimum Voltage	AT Time T =
Load Block 1	70.8%	0 Seconds
Load Block 2	83.3%	5 Seconds
Load Block 3	83.2%	10 Seconds
Load Block 4	84.8%	15 Seconds
Load Block 5	85.2%	20 Seconds

The effect of these voltage dips was analyzed as follows:

1) It was recognized that the Block 1 voltage dip would cause a pick up delay at the Motor Control Center contactor level. This delay was conservatively assumed to be 2 seconds which is the time it takes for the EDG voltage to recover to 100% level from the 70.8% level. The Second Level Undervoltage Relaying time of 5 seconds takes this two second delay into consideration and allows CR-3 to meet Technical Specification response time requirements.

2) For Blocks 2 through 5, the Block 3 voltage dip is the worst case. This case was analyzed and it was determined that the corresponding voltage at the Motor Control Center contactor level is 73.4% of 120 VAC. This is above the contactor drop out level of 65%. Therefore it was concluded that the contactors will not drop out during block loading. Analysis of the testing done to verify voltage dips at the EDG during ES actuation testing has not been completed yet.

There is no impact of the battery discharge on the 480/120 volt loads. The Inverters will rely on the battery for their primary source of power for only 50 seconds after a Loss of Offsite Power. The Inverters will automatically revert back to the primary source of power after EDG block loading is complete. The battery discharge load profile for CR-3 assumes that the Inverters are supplied from the battery for 100 minutes. The load profile also assumes no available AC power. Therefore, battery discharge during this event will be conservative relative to the assumed load profile. The "A" EDG calculations include 58.9 KW load for the Inverters.

QUESTION 9: Is AHF-1A a required load?

RESPONSE 9: Containment Cooling Fan (AHF-1A) is a required load. There are three Containment Cooling Fans. Two are required to be operable by Technical Specification 3.6.2.3. The third fan is an installed spare. AHF-1A is currently out-of-service for repair. As a result, the spare third fan has been aligned to the "A" train.

QUESTION 10: Provide the basis for the control complex fans not being an auto-connected load. (Where is the analysis to support this change?)

RESPONSE 10: The control complex emergency supply and return fans have always been a manually applied load. As a result, this is not a change to the plant configuration. A revised Control Room Habitability analysis (which continued to assume these fans where a manually applied load) was submitted by letter 3F0687-16 dated June 30, 1987. This revised analysis was provided in response to NUREG 0737, Item III D.3.4 (Control Room Habitability Requirements). Further, FPC is unaware of any generic guidance, applicable to the CR-3 licensing basis, which delineates the loads that should be auto-connected.

QUESTION 11: The MUP-1B (spare third pump) load is <u>significantly larger</u> than MUP-1A. Will the spare ever be aligned to the EDG as an auto connected load? (What is the ΔKW of pump?)

RESPONSE 11: The spare third makeup pump (MUP-1B) load is larger than assumed in the calculation and larger than the "A" train pump. As a result of testing, the load for MUP-1B was determined to be approximately 80 kW greater than MUP-1A. The MUP-1B may be aligned to the "A" EDG in the future. This would only be done if MUP-1A was out-of-service. Under these conditions, if sufficient margin did not exist on the "A" EDG, the Technical Specification Action statement for an inoperable EDG would be entered.

In order to assure that the loads on the "A" EDG do not exceed the load at which it was tested (3248 Kw), an "A" EDG load configuration management program will be utilized. This program will remain in effect for the remainder of Cycle VII. The program consists of the following elements:

1) A matrix of loads and assumptions used in the EDG calculations will be issued to system engineers, maintenance and operations personnel. This matrix will be maintained to reflect the current configuration of the plant with respect to the load on the EDG.

2) Any new loads will be evaluated prior to addition to ensure the EDG has available capacity. Design modification procedures will be revised to provide for this.

3) Operating and surveillance procedures will be revised to provide assurance that positions of valves that were throttled during load testing will not be changed without engineering concurrence that the effect on EDG load is acceptable.

4) The procedure governing work requests will be modified to ensure that no work is performed that could affect the EDG load without engineering concurrence. Guidance will be provided to maintenance regarding the types of activities that could have an impact on EDG load. Additionally, post-maintenance test procedures will be developed and utilized to quantify the impact of maintenance activities on total "A" EDG load (i.e., replacing an "A" train pump or pump motor).

5) Plant vital bus receptacles on the EDG will be identified and controlled to ensure the assumptions in the calculation are maintained.

6) Training covering the EDG load configuration management program will be provided to all operations and maintenance personnel.

These elements are considered to be sufficient to assure the loads on the "A" EDG do not exceed the tested load value of 3248 kW for the remainder of Cycle VII.

QUESTION 12: Is the Reactor Building Spray Pump (BSP-1A) marginal based on the Head/Flow curve (actual versus calculated)?

RESPONSE 12: When FPC went back to verify the minimum required head for BSP-1A, it was determined that the previous calculation referenced did not include the suction head available to the system. When the suction pressure was subtracted from the discharge pressure [surveillance procedure (SP results)], the resulting ΔP was below the calculated required head. FPC subsequently verified that the calculations being used were the proper ones and also re-ran the SP at various flow rates to generate a new pump curve. The SP results confirmed previous test results. A detailed evaluation of the test data and instrument location/orientation revealed that the pressure gauges may not be giving a true indication of the total head developed across the pump for the following reasons: Both the suction and discharge pressure gauges are not reading directly from the process piping, but rather from a seal water tap off of the discharge pipe. It is felt that the seal water flow through this 1/2" and 3/4" piping (in addition to a cyclone separator) is affecting the pressure readings. FPC is presently putting together a modification package which will install measurement equipment directly on the suction and discharge process piping in order to get a true TDH measurement across BSP-1A. This is underway, with another test presently scheduled to be run early during the week of February 1, 1988. If this test indicates that BSP-1A is actually performing below the minimum system requirements, the applicable Technical Specification Action statement will be entered. FPC is also pursuing the following actions:

1) <u>Calculations</u> - A) A system curve will be plotted along with the pump curve (plotted from actual test results) to determine how BSP-1A will perform in the present configuration (both flow and pressure). This will be compared against the system design requirements.

   B) FPC has an analysis that confirms that a spray flow as low as 1200 gpm is acceptable from the standpoint of iodine removal, pH and equipment qualification. It is being confirmed that the lower iodine removal (at lower flows) is acceptable for Control Room Habitability.

2) <u>Maintenance</u> - A) FPC is researching past testing data to determine if there was a large decrease in BSP-1A performance. If so, maintenance records will be evaluated to determine if there were any major overhauls (e.g., impeller replacements/modifications) that occurred during this period of time.

   B) Required spare parts for a pump rebuild are being identified and located, should pump maintenance be required. Additionally, if maintenance is performed which would affect the load KW, another load test will be performed for BSP-1A.

In conclusion, if pump performance has degraded, actions are underway to insure that it remains capable of performing its safety function.

QUESTION 13: Describe assumptions used to support system line-up for each function [LOSP, LOCA, Failure of d.c. (one train of ESF's)] since the Emergency Feedwater flow of 430 gpm does not appear to be acceptable.

RESPONSE 13: The large break LOCA Flow of 430 gpm for the emergency feedwater pump (EFP-1) is a result of shared flow with the turbine driven pump and EFIC control logic as follows:

1) EFIC Logic will require filling of both steam generators at a rate of 8 inches per minute until the natural circulation setpoint is reached or the operator terminates EFW. This is a conservative value because EFIC varies the level rate from 8 to 2 in/min based upon steam generator pressure from 1050 to 800 psig, and during a large break LOCA this pressure drops very rapidly. In addition, when the turbine-driven pump is unavailable due to depletion of the steam supply the level rate would be 2 in/min which requires a flow rate of 365 gpm including recirculation.

2) Each steam generator requires from 330 gpm for an 8 in/min fill rate down to 82.5 gpm for a 2 in/min fill rate.

3) The common emergency feedwater pump recirculation line allows a combined flow of 200 gpm for pump protection (100 gpm each pump).

4) The turbine-driven emergency feedwater pump is actuated by either A or B channels of EFIC through opening of steam admission valves ASV-5 from "B" train and ASV-204 from "A" train. These valves are DC motor operated with corresponding DC power separation.

5) The EFIC flow control valves fail open on loss of power. This assures flow will be from the turbine-driven pump even in the event the failure is the "B" battery. Overfill protection in this event will be provided by vector valves which are from the "A" train side of the system.

6) The turbine-driven pump requires no support systems for operation other than opening of either steam admission valves.

QUESTION 14: Identify training, procedures, and instrumentation that has become essential to ensuring successful "load management" on EDG "A". Name each action. Also document which loads would be considered candidates to be shut down in order to permit restarting loads required (e.g., chargers, turbine bearing oil pump, control complex fans) say 30 minutes after a DBA.

RESPONSE 14: This information was originally provided by letters 3F1187-26 dated November 25, 1987 and 3F1287-16 dated December 14, 1987. It has been revised to address additional concerns discussed during the January 20, 1988 meeting and is presented below.

In order to aid the operators in managing the diesel generator loads, alarms have been provided in the control room. These alarms indicate when the diesel generator is being operated in the 30 minute rating. The alarms (which deal with diesel generator loading) have been placed in close proximity of the diesel generator load indication (kW meter). This allows the operator to remain near the location of the annunciator alarm and be able to determine the magnitude of the load on the diesel generator. Additionally, an elapsed time indicator (which records the cumulative time the diesel generator has operated above 3000 kW) is located below the alarms.

Following completion of immediate actions in emergency and abnormal procedures, a control room operator will be available and assigned the task of EDG load management until the EDG load is within the 2000 hour rating. In response to the 30 minute alarm, this operator is instructed to refer to the abnormal procedure concerning diesel generator actuation. This procedure indicates that if the diesel generator load is greater than 3000 kW, the load should be reduced by stopping diesel generator supplied equipment that is not required. A revision was made to provide guidance regarding possible loads to shed. This guidance addresses loads of large components that have 100% redundant components (i.e., SWP-1A or SWP-1B) available. Additionally, symptom based procedures currently exist which indicate the conditions when high pressure injection (HPI) and building spray (BS) pumps are not required. Guidance is also provided to indicate the conditions when emergency feedwater (EFW) pumps are not required. A description of the guidance provided for EDG load management (including instrumentation utilized) is attached.

Training for this procedure revision on diesel generator actuation was provided to each of the licensed operators at Crystal River Unit 3. This was conducted as part of the abnormal procedure revision process and included a discussion of the rationale for the changes. During operator training it was stressed,

1) components which are required will not be prematurely removed from service, and

2) where specific guidance indicates the conditions when components may be removed from service (i.e., HPI, BS, and EFW), that guidance will be followed.

EDG Load Management Guidance

Action	Load	Instrument	Range
EDG load is >3000 kW, Reduce load <3000 kW		Megawatt meter MVAR meter	0-4 Mw (-4)-(+4) MVAR
Stop EDG supplied equipment that is not required (Any 100% capacity equipment may be stopped if its redundant equipment is operating)	EFP-1	EFP-2 flow	0-820 gpm
	SWP-1A or 1B	discharge pressure	0-200 psig
	RWP-2A or 2B	breaker status lights current meters	 0-150%
	AHF-1A, 1B, or 1C	breaker status lights current meters	 0-150%
LPI flow >400 gpm, EFP-1 may be secured	EFP-1	LPI flow	0-5000 gpm
LPI flow >1000 gpm per injection line for ≥20 min, HPI may be secured	HPI pumps (Makeup Pumps)	LPI flow	0-5000 gpm
RB pressure is <10 psig and not rising, RB spray may be secured	BSP-1A	RB pressure	(-10)-(+70) psig

For components where specific guidance is not provided for removal from service, the decision making process of the Shift Supervisor will be relied upon. However in this case, it was stressed during training that components for which 100% redundant components are available should be considered as primary candidates for removal from service. The training for this procedure revision was completed prior to reaching Mode 1 (Power Operation) after Refuel VI, and provides assurance that each of the operators is able to manage the diesel generator loads.

QUESTION 15: What will you do if you inadvertently use up (load >3000 kW) the remaining portion of the EDG 30 minute rating (24-25 minutes currently exist)?

RESPONSE 15: Should the "A" EDG operate at a load greater than 3000 kW (for any reason) during the remainder of Cycle VII, the manufacturer required inspection and surveillance 4.8.1.1.2.d.4 as provided in TSCRN 157, Revision 1 (dated 11/16/87) would be performed. This will provide assurance that the "A" EDG will remain capable of supplying its required engineered safeguards loads. In the event the EDG is required to operate in the 30 minute rating, this provides the operators with a minimum time of 23 minutes to reduce EDG load.

QUESTION 16: Discuss your commitment to your long term fix. Is it apparent to you at this time that you need more EDG capacity in operation following the refueling of the present core?

RESPONSE 16: The commitment for the long term corrective action to the EDG load concern is currently scheduled to be provided by the end of March, 1988.

QUESTION 17: Discuss the EDG power derating that would be required if the combustion air temperature exceeds 105 F (95 F outside ambient). What percent per degree F would you expect? What is your fix (tentative)?

RESPONSE 17: FPC has completed a combustion air temperature transient analysis for the "A" Diesel Generator room. The results indicate that with the diesel operating at rated load, the maximum room temperature will be 106.6 F (on the hottest projected day of the year, 95 F). This is 1.6 F above the maximum room temperature recommended by the vendor, Fairbanks Morse. This analysis assumed that both HVAC fans were running. FPC has completed the design of an HVAC modification that will provide outside air directly to the inlet of the EDG turbocharger. This will assure that combustion air will remain below 105 F. The decision to implement this modification will be made as soon as the total EDG projected loading is finalized (and before outside air temperatures exceed 93 F). If the modification is not implemented, CR-3 would be required to de-rate the EDG from the standpoint of maximum load capability. This would be approximately 11 KW for each degree of temperature above 105 F. (e.g., for a room temperature of 106.6 F, the de-rating would be approximately 18 KW).

If this HVAC modification is implemented, a portion of the total supply air from outside will be diverted directly to the turbocharger. As a result, the room air will increase above 106 F. The following addresses this concern:

> Both fans running provide 47,000 CFM of air. With 15,000 CFM diverted for combustion, only 32,000 CFM is available for room ventilation/cooling. A GC/I analysis showed that with only one fan running (31,800 CFM without the HVAC modification) the temperature of the room could reach 120 F when the outside air temperature was 95 F. The equipment in the room was qualified to 120 F, taking into consideration that the equipment would only see this high temperature under the Equipment Qualification design conditions of 1) outside air temperature = 95 F and, 2) EDG running at rated load [this would occur only during surveillance testing (X # of times per year) plus an additional 7 days running, post-accident]. As a result, with two fans running, the room temperature is not expected to exceed 120 F.

QUESTION 18: Confirm that modifications to annunciators have been reviewed for human factors (e.g., verified that information provided is clear and that no new HEDs were introduced).

RESPONSE 18: The additional annunciator windows that were added were reviewed for human factors before they were installed. They were prioritized, the legends were properly worded, and the appropriate location selected in accordance with the Human Factors Design Conventions Document for the Main Control Board for Crystal River Unit 3.