Florida Power
CORPORATION

November 17, 1989
3F1189-13

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

Subject: Crystal River Unit 3
Docket No. 50-302
Operating License No. DPR-72
Electrical Systems Adequacy

Dear Sir:

On November 1, 1989, Florida Power Corporation (FPC) met with the NRC staff to discuss the electrical systems design basis reconstitution effort for Crystal River 3 (CR-3). The meeting was productive for both parties and provided a good forum for discussion of issues and concerns.

FPC considers the plant to remain well supported by the present electrical systems design and is safe to operate while our revalidation efforts are being completed. We state below our basis from a safety viewpoint for this conclusion We further conclude that an intensive investigative NRC effort such as a Safety System Functional Inspection, is unwarranted due to the diversion of resources from support of the revalidation effort. The most extensive corrective action from such an investigation would be the revalidation effort already underway.

GENERAL

Several programs at FPC have revealed design basis issues over the past several years. These include the Safety Performance Improvement Program (SPIP), Configuration Management Program, FSAR Chapter 14 rewrite, Analysis Basis Document (ABD) development and others. Furthermore, the development of FPC's Technical Specification Improvement Program lead plant submittal provided an opportunity to review most of the safety significant design aspects. It was broader than the FSAR Chapter 14/ABD effort but not as complete and resource intensive as the overall Configuration Management Program. As part of this effort, the Technical

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Specification Bases are being significantly upgraded. In addition to the formal Bases for each specification, FPC has prepared a detailed Technical Specification Bases Backup Document. The typical format for each new Bases and its backup document is as follows:

1. Background
2. Applicable Safety Analysis
3. Limiting Condition For Operation
4. Mode Applicability
5. Actions
6. Surveillance Requirements
7. References
8. Notes

The Bases backup document compiles applicable design, surveillance and other source information to support the formal Bases. As an example, the Technical Specification Bases Backup Documents for the electrical systems specifications provide detailed information totaling 148 pages. The systems review to prepare these documents has resulted in a reasonably thorough qualitative assessment of the electrical systems design. Some of the electrical system design basis issues reported recently were discovered, directly or indirectly, as a result of this program. This review lends significant additional confidence that safety significant design basis issues related to the CR-3 safety related electrical systems have been identified.

DIESEL GENERATOR SYSTEM

In 1987, it was discovered that under certain accident conditions the "A" EDG could be loaded in excess of its ultimate rating. Modifications were installed to reduce the loads connected to the diesel generators to be within their ratings. In the current configuration, a large LOCA concurrent with a loss of offsite power scenario can load the "A" EDG to approximately 3100 KW which is within its 30 minute rating. The probability of such a scenario is 4.8 E-8 per 24 hour period as modeled in the recently reviewed CR-3 probabilistic risk assessment. Nevertheless, this load is still within the 30 minute rating of the diesel generator. The operator action to reduce loading below 3000 KW is the removal of the motor driven emergency feedwater pump (EFP-1) which is not needed in such scenarios. Further, CR-3 has been analyzed against the NRC's leak-before-break criteria and a GDC-4 exemption issued. Thus, the NRC has effectively agreed that large break LOCA's do not need to be considered credible events. Similar reasoning can be used to demonstrate the minimal impact of the loading condition on the "A" diesel generator during a large break LOCA. The staff proposed expansion of the GDC-4 leak-before-break rulemaking to included issues like this but did not issue it due to apparent lack

of industry interest. FPC currently has an exemption to General Design Criterion 17 (GDC-17) issued by the NRC and is operating within that exemption.

The emergency diesel generators (EDG's) are each capable of supplying sufficient emergency AC power. Extensive analysis on the emergency diesel generators has been performed. This includes a detailed review of the loads connected to the engineered safeguards (ES) 4160 V buses and the loads attached to it during the various design basis accidents. The time sequence for e[illegible] added load was also verified. Detailed scenario analyse[illegible] of [illegible] actual fluid systems was performed to ensure the safe[illegible] el[illegible] mechanical loads were known and reflected as motor l[illegible] diesel generators. These analyses were performed by [illegible] Wilcox (B&W) and verified by Gilbert Commonwealth [illegible]

The large motors on the "A" 4160 V ES bus were [illegible] to validate the technical information in the calcu[illegible] motors on the "B" 4160 V ES bus will be field te[illegible] 7 in 1990. Also, while performing the surveill[illegible] oced[illegible] ES block loading during Refuel 7, voltages at the [illegible] V leve[illegible] V level, and the 120 V level equipment terminals wi[illegible] be me[illegible].

FPC has implemented a diesel generator load management program. This program is maintained in accordance with formal engineering procedures. The load calculation methodology was agreed to by the diesel generator manufacturer.

During Refuel 7, modifications will be installed to improve the EDG's reliability and ratings. As part of the diesel generator upgrade program to be installed during the next refueling outage, the diesel and supporting component design has been extensively reviewed. As a result of this review, the majority of the data to be retrieved during the reconstitution effort has already been reviewed for its adequacy and applicability.

The diesel generators are maintained under a Reliability Centered Maintenance Program to assure the highest reliability reasonably achievable. The reliability data t[illegible]en over the past four years documents the success of this program.

All of these facts lend confidence to the conclusion that the diesel generators at CR-3 are capable of performing their safety function under any design acci[illegible] r transient condition. There is a high degree of confidenc[illegible] the depth and number of reviews recently performed, [illegible] any [illegible]fety significant issues which might have existed wo[illegible]y been discovered.

DC SYSTEM

The existing CR-3 station batteries are capable of supplying the needed DC loads. CR-3 has two safety related 250 V battery banks, each made up of two 125 VDC batteries. An extensive design review and field verification of the DC loads and the starting times and duration of each load has recently been completed. Until recently, an unbalanced loading condition existed between the two halves of the "B" battery. This made the loads on one battery half exceed the tested loads. Modifications were installed to move loads to more closely balance the loads. One non-safety related load was found to start earlier than the original discharge profile had assumed. A small non-safety related battery was installed and the discrepant load was removed from the ES "B" battery and wired to the new temporary battery. The DC loads are now distributed in a configuration such that actual loads are less than tested loads. The configuration which existed before the recent changes has been evaluated and it was verified that the previous loading configuration was within the battery design capability.

The batteries have an expected industry life of 20 years. The Crystal River batteries are approximately eighteen years old. Based on the manufacturers recommendations all batteries have been spiked to assure they have maximum capacity. These batteries will be replaced during Refuel 7 with new batteries that have approximately 10% more capacity.

A non-safety related battery will be installed by the end of Refuel 8. This will allow the large non-safety related loads on the present batteries to be removed. This will greatly enhance CR-3's station blackout coping capability and allow elimination of most, if not all required battery load management actions.

The expected battery loads have been extensively evaluated to make sure the voltage does not drop below the design basis voltage. New discharge profiles following the balancing modifications have been made. The discharge profiles are bounded by the battery profiles used in our surveillance procedures.

SPIP item TR-116-PES was investigated to address the need to make sure DC equipment is rated to operate based on the voltages to which it will be subjected. Low voltage was evaluated as not a problem by using design basis (single failure) accident review. The concern for Crystal River was the possibility of seeing a high voltage due to the batteries being on float or equalize charge. All safety related DC devices were recently reviewed to make sure they are capable of operation at the equalized level. FPC used a conservative approach in assuming the voltage was always at equalize and there was no voltage drop due to cable losses. 2200 DC safety related and non-safety related devices were reviewed.

292 were classified as being suspect. The final resolution of the 292 items was that 63 were replaced, 72 were justified as acceptable for use until Refuel 7, and 157 were determined to be permanently acceptable. This effort was complete in October 1989. Those devices with JCO's will be resolved permanently by Refuel 7.

As a result of the work done to resolve these issues and the calculations performed to demonstrate compliance with the NRC rule on station blackout, a large amount of engineering effort has been expended in the review of the CR-3 DC System. The discrepancies discovered demonstrate the effectiveness of these reviews. The discrepancies which have been discovered have been corrected. The remaining areas to be investigated consist mostly of individual loads served by the batteries. Therefore, it is highly probable that any generic system deficiencies which might have existed would have been detected by the reviews already performed.

AC DISTRIBUTION SYSTEM

CR-3 has two sources of offsite power, the CR-3 startup transformer and the CR-1&2 startup transformer. Both of these sources originate in the 230 KV substation. The 230 KV substation has three large, base loaded generating units and five transmission lines connected to it. The CR-3 startup transformer is the normal source of offsite power. On loss of the normal offsite power source, the ES buses are automatically loaded on the emergency diesel generators. The CR-1&2 startup transformer is the backup offsite power supply of the ES buses for our plant design, which requires manual action from the CR-3 control room to connect. It was recently discovered that the capacity of this winding is not sufficient to support the CR-3 ES loads with the simultaneous starting-up or shutting down of one of the fossil units. During the normal base loaded operation of the fossil units there is sufficient capacity. FPC performed extensive analysis and determined that up to 1500 KVA of fossil load may be on the shared winding and still have sufficient power for Crystal River 3. This is true for both starting and steady state operation of the CR-3 ES equipment. A team was established with members from Engineering, Licensing, Operations and Management from both the Nuclear staff and the Fossil staff to determine all the potential operating modes that could cause the Crystal River 1 & 2 start-up transformer to not have sufficient capacity to support Crystal River #3. This review was documented along with a letter of understanding between the fossil and nuclear plants. The nuclear plant has priority and the fossil unit will take any necessary actions to free the transformer for our service immediately. When the 1500 KVA limit is being approached it is clearly annunciated in the CR-3 control room and the appropriate Technical Specification Action Statement entered. Thus, the source availability is not significantly impeded.

A new, alternate power source, totally independent from Crystal River 1 & 2, is being designed at this time. The present schedule for the new source to be is in service the end of Refuel 7. No design basis questions have arisen to date with respect to the CR-3 startup transformer.

The setpoint for the second level undervoltage relays (SLUR's) has recently been recalculated. The minimum expected 4160 V bus voltage was determined by modelling from the 230 KV switchyard to the 4160 V ES buses, using minimum design switchyard voltage, normal running loads as determined from field data, plus ES loads as previously determined from EDG loading.

The SLUR setpoint was determined by calculating the required voltage at 4160 V ES buses needed to provide adequate voltage at the terminals of 120 V control devices and 480 V motors. The SLUR setpoint thus established was then compared with the minimum expected ES 4160 V bus voltage and it was confirmed that the minimum expected ES bus voltage is sufficiently higher than the SLUR setpoint. This provides assurance that spurious separation from the offsite power source during ES actuation will not occur. This work has all been recently accomplished, including the installation of new relays to permit a wider setpoint range.

The 600 V power cable used in the 480 V systems at CR-3 is manufactured by the Kerite Co. The ampacities of the power cables were based on the Insulated Power Cable Engineers Association (IPCEA) standard and derated by the National Electric Code for tray loading and 50°C ambient temperature. When selecting the proper cable, the load was multiplied by 1.25 before using the above. This in effect provides an additional 20% margin in our 600 V power cables. Both safety and non-safety related cable is purchased to the same high quality standards.

SUMMARY

The issues discovered to date represent regulatory compliance and design concerns which warrant further investigation. They do not compromise plant safety. The electrical systems at CR-3 are capable of performing their intended safety function. FPC has been evaluating/reviewing large portions of our electrical design. The review recently discussed with the staff is a comprehensive review. The actions FPC has planned for Refuel 7 and 8 will constitute significant improvements. The reviews being performed will provide additional confidence that not only are the systems adequate but that significant margin is available and that acceptable configuration can be maintained long-term.

FPC will continue to keep the staff informed of our progress on this issue. Our next meeting is being scheduled for January, 1990.

Sincerely,

W. S. Wilgus, Vice President
Nuclear Operations

WSW/KRW/wla

xc: Regional Administrator, Region II
Senior Resident Inspector