U.S. NUCLEAR REGULATORY COMMISSION

REGION 2

Docket No:	50-302
License No:	DPR-72
Report No:	50-302/96-12
Licensee:	Florida Power Corporation
Facility:	Crystal River 3 Nuclear Station
Location:	15760 West Power Line Street Crystal River, FL 34428-6708
Dates:	August 26 through October 11, 1996
Inspectors:	E. Girard, Reactor Inspector P. Harmon, Reactor Engineer R. Schin, Reactor Inspector
Approved by:	C. Casto, Chief Engineering Branch Division of Reactor Safety

Enclosure

EXECUTIVE SUMMARY

Crystal River 3 Nuclear Station
NRC Inspection Report 50-302/96-12

This special inspection included aspects of licensee operations and engineering. The report includes the results of announced inspections by three inspectors at different times during a seven-week period. The purpose of the inspection was to follow up on URI 50-302/96-201-08, Acceptability of EDG Surveillance Test Values. The URI identified potential Emergency Diesel Generator (EDG) loading issues which resulted from an Emergency Feedwater (EFW) System modification and a related EDG operating procedure revision that were implemented at the facility during the recent refueling outage in April - May 1996.

Operations

The Operations procedures used during a simulator demonstration were adequate to provide guidance during postulated Loss of Offsite Power events. Training personnel were conversant with the Emergency Procedures, Abnormal Procedures, and the procedure transition process. Control room operators were adequately trained to perform the manual operations described in the procedures. (paragraph O3)

Engineering

An unresolved item (URI 50-302/96-12-01) was opened to follow up on an EFW pump net positive suction head (NPSH) problem, wherein a postulated event concurrent with a single equipment failure could result in a low NPSH for both EFW pumps. (paragraph E8)

An apparent violation (EEI 50-302/96-12-02) with three examples was identified where 10 CFR 50.59 safety evaluations for one plant modification and two operating procedure changes failed to identify the introduction of Unreviewed Safety Questions related to increased EDG loading. (paragraph E8)

An apparent violation (EEI 50-302/96-12-03) with two examples was identified where corrective actions were inadequate both prior to, and after, the plant modification in April 1996 that inappropriately introduced Unreviewed Safety Questions related to EDG loading. (paragraph E8)

An apparent violation (EEI 50-302/96-12-04) was identified where an engineering procedure improperly allowed the general use of unverified electrical system calculations, hydraulic system calculations, and station blackout calculations to support the design, installation, and use of plant modifications. (paragraph E8)

A weakness was identified in licensee self assessments. An engineering self assessment dated April 9, 1996, was ineffective in that it had resulted in no corrective actions or improvements as of October 11, 1996. Managers had not responded to the self assessment report. Also, the report failed to reach appropriate conclusions and the findings of the report were not sufficiently highlighted, clear, or conclusive to support prompt responsive actions. In addition, the licensee had provided no guidance or training for conducting self assessments. (paragraph E8)

Report Details

Background

The inspectors followed up on URI 50-302/96-201-08, Acceptability of Emergency Diesel Generator (EDG) Surveillance Test Values. The URI noted that Procedure AP-770, Emergency Diesel Generator Actuation, indicated a different set of KW ratings for the EDGs than the ratings given in the Final Safety Analysis Report (FSAR), Tables 8.1 and 8.2. A resulting concern was that the EDG loading could exceed surveillance test values specified in the Technical Specifications (TS). Also, transient loading of the EDGs could exceed the manufacturer's rating.

I. Operations

O3 Operations Procedures and Documentation

a. Inspection Scope (IP 92901)

In view of the marginal capacity of the EDGs, the inspector reviewed operating procedures that addressed EDG load management and observed operator performance of those procedures on the simulator. The inspector assessed the adequacy of operating procedures and control room instrumentation for preventing EDG overloading during an event concurrent with a loss of offsite power.

b. Observations and Findings

The inspector witnessed demonstrations on the Crystal River simulator using Procedure AP-770, Emergency Diesel Generator Actuation, Rev. 21, dated May 2, 1996. This procedure contained the necessary instructions to the operators to allow manual loading of the EDGs during emergency situations. The procedure also contained a table listing the worst-case KW values of the various emergency equipment. Procedure AP-770 incorporated the new load information developed for a related plant modification that was installed during the April - May 1996 refueling outage. The instructors performed scenarios requested by the inspector and were able to use the procedure effectively. The instructors demonstrated an emergency start, Loss of Offsite Power (LOOP), tripping of a high pressure injection (HPI) pump, and restoration of the pump using the procedure. This required transitioning from the Emergency Operating Procedure (EOP) into the Abnormal Procedure AP-770. In the EOP, the operator was directed to check the EDG running and supplying proper voltage and frequency and then to verify that the proper loads were connected. If a required load was not connected or had tripped, the operator was directed to the Abnormal Procedure. Transition between the procedures was outlined in an Operations Study Book (OSB), an on-shift training guide.

c. Conclusions

Procedure AP-770 contained adequate guidance to direct the operator re-energize tripped equipment onto a loaded EDG during LOOP events. The OSB guidance furnished to the operators was adequate to guide procedure transitions. Instrumentation and control features appeared sufficient to perform the evolutions directed by the procedure.

II. Engineering

E8 Miscellaneous Engineering Issues

E8.1 (Closed) URI 50-302/96-201-08, Acceptability of EDG Surveillance Test Values

a. Inspection Scope (IP 92903)

Procedure AP-770, Rev. 21, and related modification MAR 96-04-12-01, "ASV-204 EFIC Auto Open Removal," were implemented in April and May, 1996, in response to a licensee-identified potential single failure vulnerability of the EFW system. The procedure revision and modification resulted in the potential for increased loading of the A EDG during a design basis accident concurrent with a single equipment failure. The inspectors followed up on the concern with the increased EDG loading and reviewed potential related breakdowns in processes or barriers that may have contributed to problems with EDG loading.

The inspectors reviewed the completed modification package, including the 10 CFR 50.59 safety evaluation that was performed to determine whether the modification could be implemented without receiving prior approval from the NRC. Also, the inspectors interviewed the engineers involved in the modification and several reviewers of the MAR and the procedure revision. In addition, the inspectors reviewed related processes and barriers that might have failed to prevent the inappropriate introduction of Unreviewed Safety Questions related to EDG loading.

b. Observations and Findings

1) Modification MAR 96-04-12 and Related EDG Loading Unreviewed Safety Questions

The purpose of MAR 96-04-12-01, "ASV-204 EFIC Auto Open Removal," and the related Rev. 21 to AP-770 was to prevent a potential single failure vulnerability to the EFW system. The single failure vulnerability, that the licensee had identified in March 1996, involved EFW being called upon to actuate automatically, concurrent with a LOOP and a single failure of the B train vital DC power. In that event, the turbine-driven EFW pump would start (one of the two parallel steam supply valves, ASV-204, which was powered from the A train of vital DC power, would open) and the pump's discharge flow control valves would fail

fully open (due to the loss of B train vital DC power to them). As a result, the turbine-driven EFW pump would operate at its maximum capacity while the motor-driven EFW pump was also operating. This could cause a low NPSH in the common suction pipe for both EFW pumps and potentially challenge the operability of both EFW pumps.

MAR 96-04-12-01 changed the EFIC logic to remove the automatic opening of ASV-204. The other parallel steam admission valve (ASV-5), for the turbine-driven EFW pump, received DC actuating power from the B train of vital DC power. Thus, both before and after the modification, during a transient where EFW was called upon to initiate and with no equipment failures, both the motor- and turbine-driven EFW pumps would start and both pumps would pump water into both OTSGs. However, after the modification, in an event where EFW were called upon to initiate concurrent with a failure of the B train vital DC power, the turbine-driven EFW pump would not start. In this event, there would be no problem with the NPSH for the motor-driven EFW pump. However, the motor-driven pump would need to pump more water and thus, if there were a concurrent LOOP, would represent a larger KW load on the A EDG. Note that in this event, the B EDG would not be available as its output breaker would not have B train vital DC power and thus would not close.

Well into a design-basis event (with a LOOP and a failure of the B train vital DC power), the EOPs required operators to start additional loads which could overload the A EDG. The revision to Procedure AP-770 addressed this problem by providing procedural guidance for operators to close the turbine-driven EFW pump discharge block valve manually, open the EFW pumps' discharge cross-tie valves, and start the turbine-driven EFW pump (by manually opening valve ASV-204). This would allow the turbine-driven EFW pump to use the A train EFW flow control valves, which would have power.

In October 1996, with the unit shut down for secondary plant maintenance, the licensee recognized that MAR 96-04-12-01 had not resolved the potential single failure problem. A design-basis event with a LOOP and a single failure of power to the turbine-driven EFW pump's discharge flow control valves would result in the same NPSH problem that the modification was supposed to prevent. The inspector noted that the licensee had not reported the EFW NPSH issue to the NRC. Also, other B&W units had years ago installed flow limiting venturies in the EFW system and Crystal River had not. The licensee decided to keep the unit shut down voluntarily until the NPSH problem was fully analyzed and resolved. Further NRC review of the EFW NPSH issue is needed; this includes safety significance (effect on operability), when and how the design deficiency was introduced, when and how it became known by the licensee, corrective actions taken by the licensee, reportability of the issue, and any prior notice to the licensee of this design deficiency. URI 50-302/96-12-01, EFW NPSH Issue, is opened to track further NRC review of this issue.

The inspector reviewed the licensee EDG loading calculations that were performed in April 1996 to support the modification and procedure

revision. The calculations showed that the modification increased the potential loading of the A EDG such that the design load limit of 3500 KW would be exceeded for short periods of one to three seconds during certain EDG block loadings. The 3500 KW limit was specified by TS Basis B 3.8.1 and by FSAR Chapter 8.2.3. The modification also caused the automatically connected accident load at the one-minute interval to be increased to approximately 3159 KW. This was in excess of the minimum test load specified by TS Surveillance Requirement 3.8.1.11, which specified a periodic surveillance (24 month interval) of the EDG loaded to between 3100 and 3250 KW for 60 minutes. The TS Basis for the surveillance stated that the "minimum load of 3100 KW provides margin above the predicted worst-case automatically connected accident load at one minute." In addition, the modification increased the motor-driven EFW pump load to 666 KW, which exceeded the TS Surveillance Requirement Basis 3.8.1.8 statement that the largest single post-accident load (that the A EDG would have to reject) was 616 KW. The inspector concluded that the exceeding of these three TS limits inappropriately reduced the margin of safety as defined in the TS Bases; and, therefore, introduced three unreviewed safety questions.

The question of the acceptability of the surveillance test values was originally identified during the Crystal River Integrated Performance Assessment Process team inspection as URI 50-302/96-201-08, Acceptability of EDG Surveillance Test Values. The inspector verified that the licensee performed the specified surveillance on April 30, 1996. The EDG was loaded to approximately 3179 KW; 20 KW above the new one-minute value. Therefore, the inspector concluded that the licensee had a surveillance test in effect that demonstrated the EDG's ability to operate with the maximum calculated one-minute loads.

The licensee researched the origin of the one-minute/3100 KW surveillance requirement. The surveillance was intended to verify EDG load-carrying capability for what was assumed to be the highest demand period: the first few seconds, when block loads are automatically connected to the EDG bus, and their resultant starting loads. In the original TS, the initial block loading was assumed to be complete by the end of the first 60 seconds, when the load would be essentially stable. The earliest design/licensing documents the inspector reviewed stipulated a surveillance of at least 2750 KW. This value was changed and reviewed by a SER dated September 24, 1990, to the present value of 3100 KW. Testing the EDG for at least 60 minutes at a value above the expected loads ensured that cooling and lubrication were adequate for extended periods of operation for the worst case loading value. Since then, the plant has been modified such that block loads were still being applied well past the one-minute time frame, and the one-minute loads, originally less than 2750 KW, had increased to 3179 and 3158 KW for EDG A and B, respectively.

The modification and its attendant EDG load increase also caused the maximum load limit to be exceeded. This limit was referenced in both FSAR Chapter 3.2.3 and TS Basis B 3.8.1. Both sources stipulated that the service rating of the EDG was for a cumulative (30 minutes total)

loading of 3250 to 3500 KW. Lower loads (e.g 3001 to 3250 KW for 200 hours total) allow cumulative run times of longer duration. There were no provisions in either source for loads above 3500 KW for <u>any</u> amount of time.

The engineering review performed for the modification recognized that the upper limit of 3500 KW would be exceeded during loadings for certain accident scenarios. The loads were assumed and calculated to occur in blocks applied at 5 second intervals, for a total of 6 blocks (plus time for the EDG voltage and frequency to stabilize) within the first 60 seconds. The worst case loading scenario was a composite of the calculated maximum EDG loads for those scenarios. This composite showed loads above 3500 KW in two instances during the first minute. At 25 seconds, a peak load of 3696 KW with a duration of one second was shown, and at 53 seconds a peak of 3651 KW with a duration of approximately 2.5 seconds was calculated. Other smaller loads (above 3100 but less than 3250 KW) occurred as late as one hour into the composite scenario.

On April 10, 1996, Engineering contacted the EDG vendor; Coltech, Inc.; to request assurance that the high, short-duration loading peaks would not have an adverse impact on the EDG unit. The vendor responded, on April 17, that the "one-time excursion of 3500 to 3700 KW for up to two seconds is not expected to have an adverse effect on the Genset (diesel generator set)". On April 24, Engineering again contacted the vendor for more specific assurance that several blocks (designated as Blocks 4, 5, and 6) calculated to have loads in excess of 3500 KW were still acceptable. Coltech responded, by letter dated April 25, that the "event" identified was a "one-time" event and was not expected to have an adverse effect on the diesel generator.

The second Coltech letter was telefaxed to Crystal River on April 25. The next day, April 26, all reviewers signed off on MAR 96-04-12-01, the controlling document for this modification. The MAR included a 10 CFR 50.59 screening and evaluation for the modification. The engineer who performed the screening form incorrectly answered two of the three screening questions. Question #2 asks: "Does this change affect the TS Bases?". Question #3 asks: "Does this change involve changes to the Technical Specifications?". Both were answered "No" by the preparer. Question #1, "Is this a change to the facility as described in the FSAR?" was correctly answered "Yes". The screening criteria is that any one of the questions answered "Yes" requires a 10 CFR 50.59 evaluation prior to implementation.

The full 10 CFR 50.59 evaluation asks similar questions. In this case, the same individual who prepared the screening form also incorrectly answered question #7 incorrectly. The question, "Is the margin of safety as defined in the basis for any TS reduced?" was marked "No". Crystal River has not implemented a value below the design or license limit below which load increases to the EDG can be implemented without "decreasing the margin of safety". Therefore, a reduction in margin to the limit (and exceeding the limit for a brief time) was a reduction of the margin of safety. This should have required Question #7 to be

marked "Yes". Marking any of the Questions "Yes" is a determinant that an Unreviewed Safety Question is involved with the change, requiring prior NRC approval of the modification.

The inspector reviewed the MAR and the attached documents in the package. Although the preparer of the 10 CFR 50.59 evaluation noted references he consulted in both the TS and FSAR, copies of the actual documents were not supplied in the MAR package. The MAR preparer did not reference the EDG load requirements from either TS or FSAR in the 10 CFR 50.59 evaluation. He only referenced the Emergency Feedwater TS and FSAR sections. There is no record of any of the several reviewers questioning the conclusions of the 10 CFR 50.59 evaluation. Since the actual FSAR and TS pages were not part of the MAR package, there is no clear record that the reviewers consulted the actual documents.

In summary: the licensee's EDG loading calculation analysis had recognized that the calculated EDG loading exceeded the values stated in the TS Bases but did not recognize that this reduced the margin of safety as described in the TS Bases. Consequently, the licensee did not recognize that USQs were introduced. Based on correspondence with the EDG vendor, the licensee's loading calculation analysis concluded that the EDG could safely handle the increased loading. Also, the licensee had verified that the most recent surveillance test had tested the load rejection ability of the EDG at greater than 666 KW. The modification package for MAR 96-04-12-01 had been independently verified by an engineer other than the one who prepared the MAR; reviewed by a technical support engineer, a senior reactor operator, an environmental qualification reviewer, an engineering supervisor, and the PRC; and approved by the nuclear plant manager. The inspector noted that the MAR package did not include the EDG loading calculation analysis. Also, the licensee's 10 CFR 50.59 safety analysis of the modification, which was included in the MAR package, did not address the increase in EDG loading and consequently did not recognize the USQs and the need to obtain NRC review and approval prior to implementing the modification. This inappropriate introduction of three USQs regarding EDG loading is an apparent violation of the requirements of 10 CFR 50.59. This issue is identified as the first example of EEI 50-302/96-12-02, EDG Loading USQs. URI 50-302/96-201-08 is closed.

2) <u>Corrective Actions Related to MAR 96-04-12-01 Unreviewed Safety Questions</u>

After MAR 96-04-12-01 was installed, the licensee identified that it had introduced potential problems with EDG loading. On May 31, 1996, a member of the plant staff wrote Precursor Card 96-2750, identifying that "the EDGs will exceed 3500 KW while loading blocks 4, 5, and 6. Also, the running load exceeds 3000 KW. The letter obtained from the vendor (Coltech) appears to not meet the FSAR ... and TS Bases." The Precursor Card system is the vehicle for entry-level problem reporting. This particular Precursor Card was reviewed and a determination was made that "Engineering had already analyzed this and were preparing changes to the FSAR and the design basis (EDBD)". This response does not address the

concern directly, but only states that Engineering was aware of the inconsistency.

On July 2, 1996, another Precursor Card, 96-3192 was written to the effect that the 10 CFR 50.59 screenings and safety evaluations for many modifications had failed to address the tabulated EDG loads listed in FSAR tables 8-1 and 8-2. The problem was acknowledged by the reviewer, but was described as "not a safety concern, only a paperwork problem".

On July 3, 1996, a higher level non-conformance Problem Report 96-0210, was issued. This Problem Report addressed the concerns associated with Precursor Card 96-2750, written May 31, 1996. This higher level problem resolution requires more detailed evaluation and a team approach to disposition. The Problem Report concluded that " ...the team decided that a safety concern did not exist, but that the issue identified as question five (whether the one-minute load exceeded the 3100 KW surveillance limit) must be resolved in a timely manner to determine if the EDG auto-connected load at one minute is actually greater than 3100 KW." At that point the licensee initiated a detailed analysis to determine accurate load information. This study was still in process as of October 11, 1996.

Both responses to the problem reports indicated a recognition that TS Bases and FSAR values were being exceeded, but there was no recognition of a USQ being introduced.

Regional inspectors visited the site August 26-30, 1996, and September 9-13, 1996, and reviewed the circumstances and documentation associated with this modification. The inspectors informed the licensee that the modification appeared to involve a USQ and that the 10 CFR 50.59 evaluation reached an inaccurate conclusion that a USQ did not exist. However, the licensee did not begin re-performing the 10 CFR 50.59 evaluation until after the inspectors' exit on September 13, 1996. Subsequently, the licensee confirmed the NRC's finding that the modification had inappropriately introduced USQs. The USQs were not corrected as of October 11, 1996. The inspectors concluded that the licensee's corrective action in response to this issue was not adequate and was an apparent violation of NRC requirements. This inadequate corrective action is identified as the first example of EEI 50-302/96-12-03, Inadequate Corrective Actions for 10 CFR 50.59 Evaluation Errors.

During a subsequent review of this issue, the licensee found that the corrective action for a previous similar event had been ineffective in preventing a recurrence. Problem Report 94-0218, dated June 24, 1994, described a problem where engineers failed to address EDG loading effects of several modifications in the 10 CFR 50.59 evaluations. The corrective action included counseling electrical and I&C design engineers on requirements to address EDG loading effects in 50.59 evaluations. However, in MAR 96-04-12-01, EDG loading effects were not addressed in the 50.59 evaluation. For MAR 96-04-12-01, the 50.59 preparer, reviewer, and supervisor approver were all electrical/I&C design engineers. This ineffective corrective action is identified as

the second example of EEI 50-302/96-12-03, Inadequate Corrective Actions for 10 CFR 50.59 Evaluation Errors.

3) Operating Procedure Revisions and EDG Loading Unreviewed Safety Questions

While reviewing EDG loading calculations, the FSAR, the TS, and the licensee's most recent evaluation of the EDG loading issue, the inspector noted that there were different numbers for EFW pump KW. In a current review of EDG loading calculations, operators had identified that the motor-driven EFW pump was operated differently than assumed in the EDG loading calculation, resulting in a higher KW load on the A EDG. Further licensee review, as requested by the inspector, found that this different operation of the motor-driven EFW pump had originated in a revision to an operating procedure (EOP-13, EOP Rules, Rev. 2) that was made during the April - May 1996 refueling outage. The inspector reviewed the 10 CFR 50.59 evaluation for the procedure revision and found that it did not address a consequent increase in EDG loading. The procedure change increased the motor driven EFW pump post-accident load from 666 KW to 713 KW by directing operators to take manual control and increase EFW flow. The load increase was not reflected in the 10 CFR 50.59 evaluation and also was not considered in the April 1996 end of outage EDG loading calculations. The resulting EDG load was greater than that calculated to support MAR 96-04-12-01, and therefore the same three USQs as discussed above were introduced. The inadequate 10 CFR 50.59 evaluation for EOP-13, Rev. 2, is an apparent violation of NRC requirements. It is identified as the second example of EEI 50-302/96-12-02, EDG Loading Unreviewed Safety Questions.

The inspector also noted that there were different numbers for HPI Pump KW load on the A and B EDGs. Further licensee review, as requested by the inspector, found that a revision to an operating procedure (OP-402, Makeup and Purification System, Rev. 64, dated June 9, 1990) had increased the post-accident HPI pump load on the A EDG by 75 KW and on the B EDG by 86 KW by allowing operators to ES select the swing B HPI pump to either EDG. (The B HPI pump had a larger capacity and therefore used more KW than the A or C HPI pumps.) The inspector noted that the load increase was not reflected in the 10 CFR 50.59 evaluation for the procedure revision and also was not considered in the EDG loading calculations. As a result, the current verified and approved A and B EDG loading calculations, dated June 9, 1993, and the current FSAR included incorrect values for HPI pump loads on the EDGs. Also, the post-accident load of the B HPI pump (691 KW) exceeded the current TS Surveillance Requirement Basis 3.8.1.8 statement that the largest single post-accident load (that the EDG could have to reject) was 616 KW. The current TS requirement had been in effect since 1994. Prior to that, from 1988 until the Improved Technical Specifications were incorporated in 1994, TS Surveillance Requirement 4.8.1.2.2.d.2 required that at least once per 18 months the EDG be tested to verify its capability to reject a load of greater than or equal to 515 KW without tripping. The inspector concluded that OP-402, Rev. 64, had introduced at least one EDG loading USQ that was not recognized by the 10 CFR 50.59 safety

evaluation. The plant had operated with this USQ from June 1990 through October 1996. The inadequate 10 CFR 50.59 evaluation for OP-402, Rev. 64, is an apparent violation of NRC requirements. It is identified as the third example of EEI 50-302/96-12-02, EDG Loading Unreviewed Safety Questions.

4) Maintenance Activities and EDG Loading

The inspector noted that licensee procedures discussed the potential for maintenance activities to affect EDG loading. For example, replacement of a pump impeller could improve the pumping ability of a pump and increase its KW load on the EDG. The inspector inquired about any such maintenance conducted recently, and found that the A HPI pump impeller had been replaced during the April - May 1996 refueling outage. The work had been done under a maintenance work order (a 10 CFR 50.59 safety evaluation was not required). The pump had been tested in May, after the impeller replacement, when its new KW was determined to be 680 (an increase of 64 KW from the previous value of 616). The inspector noted that this increase did not change EDG loading calculations, as they already assumed a maximum HPI pump load on each EDG of 691 KW from the B HPI pump (operators were allowed to select either the A or B HPI pump to be the A train ES pump and either the C or the B HPI pump to be the B train ES pump). The inspector also found that the new A HPI pump load of 680 KW was appropriately included in the EDG loading calculation data. The inspector concluded that, in this case, the maintenance activity did not increase EDG loading and in that respect was not a change to the facility. Nonetheless, the inspector noted that a maintenance activity that resulted in an increase in EDG loading could be considered a change to the facility. Consequently, the prior use of a 10 CFR 50.59 safety evaluation would be conservative and appropriate.

5) Unverified Calculations

While reviewing the EDG loading calculation and analysis that supported MAR 96-04-12-01, which was performed under REA 96-047, the inspector noted that there was no signature for independent verification of the calculation or related analysis. After further inquiry and review, the inspector found that the calculation had not been independently verified. Further, Engineering Procedure NEP-210, Modification Approval Records, Rev. 15, dated January 16, 1996, allowed unverified calculations to be relied upon to support MAR installation and return to service. As a result, REA 96-047, EDG Loading Case Study, which was not verified, was used to support MAR 96-04-12-01 approval in April 1996. The REA analysis was complex - it included a computer run of about 1600 pages and a detailed analysis of EDG loading effects of the modification; and it incorrectly concluded that the MAR introduced no problems with EDG loading (the three USQs discussed above were later identified).

During subsequent verification/review of EDG loading calculations in October 1996, operators found that an EDG loading assumption was incorrect and nonconservative. The assumption that the post-accident

load of the motor driven EFW pump would be 666 KW with the pump in automatic was incorrect - per EOPs, operators would operate the pump in manual at higher flows, resulting in a load of 713 KW. Had operators reviewed the REA 96-047 EDG loading analysis in April 1996, they likely would have identified this error before the modification was installed and placed in service.

The inspector found that the latest verified EDG loading calculation was dated June 9, 1993. Two refueling outages with modifications, procedure changes, and maintenance activities that affected EDG loading had occurred since then. Also, the licensee currently had only one engineer who knew how to perform EDG loading calculations.

Procedure NEP-210 inappropriately exempted electrical system calculations, hydraulic system calculations, and SBO calculations from verification when they were used to support modifications. As a result, the licensee may have relied on many unverified calculations to support modifications that were installed and operated. The fact that NEP-210 inappropriately allowed unverified calculations to be relied upon for the design, installation, and operation of modifications to safety-related equipment is an apparent violation of NRC requirements. It is identified as EEI 50-302/96-12-04, Use of Unverified Calculations to Support Modifications.

6) Engineering Self Assessment

During the inspection of EDG loading issues, the inspector reviewed a related licensee self assessment. An engineering self assessment report, "Nuclear Engineering and Projects Self Assessment: Interdisciplinary Interface Effectiveness," dated April 19, 1996, had identified that NEP-210 and AI-410 requirements for verification of Requests for Engineering Assistance may not comply with regulatory requirements. However, the report failed to conclude whether there was a violation of regulatory requirements or not. The inspector concluded that the licensee had failed to pursue the issue appropriately in order to reach a conclusion. The licensee had not initiated any corrective action on this issue and also had not initiated any improvements in response to the report as of October 11, 1996. The inspector concluded that, since engineering managers had not acted upon the self assessment, it had been ineffective.

The inspector reviewed the entire report and noted that the report had only three recommendations; which were not in the front of the report but instead were located on page 13. Also, the recommendations were not sufficiently clear or conclusive to support prompt responsive actions. The inspector observed that the engineer who was a principal contributor to the report was apparently discouraged that he had received no feedback on the report from engineering management. Also, the licensee had provided no guidance or training on conducting self assessments to the engineer. The inspector concluded that the ineffectiveness of this report indicated a weakness in licensee self assessment.

c. Conclusions

The inspectors opened an unresolved item (URI 50-302/96-12-01) to follow up on an Emergency Feedwater (EFW) pump net positive suction head (NPSH) problem, wherein a postulated event concurrent with a single equipment failure could result in a low NPSH for both EFW pumps.

The inspectors identified an apparent violation (EEI 50-302/96-12-02) with three examples, where 10 CFR 50.59 safety evaluations for one plant modification and two operating procedure revisions failed to identify the introduction of Unreviewed Safety Questions related to increased EDG loading.

Inspectors also identified an apparent violation (EEI 50-302/96-12-03) with two examples, where corrective actions for 10 CFR 50.59 evaluations were inadequate both prior to and after the plant modification in April 1996 that inappropriately introduced Unreviewed Safety Questions related to EDG loading.

In addition, inspectors identified an apparent violation (EEI 50-302/96-12-04) where an engineering procedure improperly allowed the general use of unverified electrical system calculations, hydraulic system calculations, and station blackout calculations to support the design, installation, and use of plant modifications.

Also, inspectors identified a weakness in licensee self assessments. An engineering self assessment dated April 9, 1996, was ineffective in that it had resulted in no corrective actions or improvements as of October 11, 1996. Managers had not responded to the self assessment report. Also, the report failed to reach appropriate conclusions and the findings of the report were not sufficiently highlighted, clear, or conclusive to support prompt responsive actions. In addition, the licensee had provided no guidance or training for conducting self assessments.

III. Management Meetings

X1 Exit Meeting Summary

The inspection scope and interim findings were summarized on September 13, 1996; and final findings were summarized on October 11, 1996. The inspectors described the areas inspected and discussed in detail the inspection results listed below. Proprietary information is not contained in this report. Dissenting comments were not received from the licensee.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

K. Baker, Manager, Nuclear Configuration Management
D. Bates, Manager, Quality Systems
P. Beard, Senior Vice President Nuclear Operations
G. Becker, Operations
G. Boldt, Vice President, Nuclear Production
B. Gutherman, Manager, Nuclear Licensing
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NRC

R. Butcher, Senior Resident Inspector
T. Cooper, Resident Inspector
L. Raghavan, Project Manager

INSPECTION PROCEDURES USED

IP 92901: Followup - Operations
IP 92903: Followup - Engineering

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

Type	Item Number	Status	Description and Reference
URI	50-302/96-12-01	Open	EFW NPSH Issue (paragraph E8.1.b.1)
EEI	50-302/96-12-02	Open	EDG Loading USQs; Three Examples (paragraphs E.8.1.b.1 and E.8.1.b.3)
EEI	50-302/96-12-03	Open	Inadequate Corrective Actions for 10 CFR 50.59 Evaluation Errors; Two Examples (paragraph E.8.1.b.2)
EEI	50-302/96-12-04	Open	Use of Unverified Calculations to Support Modifications (paragraph E.8.1.b.5)

Closed

Type	Item Number	Status	Description and Reference
URI	50-302/96-201-08	Closed	Acceptability of EDG Surveillance Values (paragraph E.8.1.b.1)

LIST OF ACRONYMS USED

AI - Administrative Instruction
CFR - Code of Federal Regulations
CR3 - Crystal River Unit 3
EA - Enforcement Action
EDBD - Enhanced Design Basis Document
EDG - Emergency Diesel Generator
EEI - Escalation Enforcement Item
EFIC - Emergency Feedwater Initiation and Control
EFW - Emergency Feedwater
EGDG - Emergency Diesel Generators
EOP - Emergency Operating Procedure
ES - Engineered Safeguards
FPC - Florida Power Corporation
FSAR - Final Safety Analysis Report
HPI - High Pressure Injection
I&C - Instrumentation and Control
IP - Inspection Procedure
KW - Kilowatt
LOOP - Loss of Offsite Power
MAR - Modification Approval Record
NEP - Nuclear Engineering Procedure
NOV - Notice of Violation
NPSH - Net Positive Suction Head
NRC - Nuclear Regulatory Commission
OP - Operating Procedure
OTSG - Once Through Steam Generator
PR - Problem Report
PRC - Plant Review Committee
REA - Request for Engineering Assistance
SBO - Station Blackout
SER - (NRC) Safety Evaluation Report
SR - Surveillance Requirement
SRO - Senior Reactor Operator
TS - Technical Specification
URI - Unresolved Item
USQ - Unreviewed Safety Question