April 10, 1998

Mr. Roy A. Anderson
Senior Vice President
Nuclear Operations (SA2A)
Florida Power Corporation
ATTN: Manager, Nuclear Licensing
15760 W. Power Line Street
Crystal River, Florida 34428-6708

SUBJECT: AUDIT REPORT OF UNRESOLVED SAFETY ISSUE A-46 SEISMIC IMPLEMENTATION AND SUBSEQUENT EVALUATIONS OF RELATED ISSUES AT CRYSTAL RIVER UNIT 3 (TAC NO. M69440)

Dear Mr. Anderson:

During the week of November 3, 1997, the U.S. Nuclear Regulatory Commission conducted an audit of the unresolved safety issue (USI) A-46 seismic implementation program results performed by Florida Power Corporation (FPC) for the Crystal River Nuclear Generating Plant (CR-3). The purpose of the audit was to verify, on a sampling basis that the implementation of the USI A-46 program was completed and documented in accordance with the commitments in the Plant-Specific Procedure (PSP) for CR-3. The participants in the audit and the audit results are included in Enclosure.1. Also included in the enclosure is the staff evaluation of USI A-46 issues related to the restart of CR-3.

During the audit, the staff requested sample cable tray support calculations. Our initial review has identified certain concerns relating to the suspended ladder-type (trapeze) calculations. These concerns are listed in Enclosure 2. It is requested that you take appropriate steps to address the specific calculations. Please inform us of your planned corrective action.

If you should have any questions regarding this request, please contact me at (301) 415-1495.

Sincerely,

/S/
Leonard A. Wiens, Senior Project Manager
Project Directorate II-3
Division of Reactor Projects I/II
Office of Nuclear Reactor Regulation

Docket No: 50-302

Enclosures: 1. Audit Report
2. Cable Tray Support Calculations

cc: See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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cc: See next page

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List of Meeting Attendees
Audit of USI A-46 Program Implementation at CR-3

Entrance Meeting on November 4, 1997

Name	Title	Organization
Pei-Ying Chen	Sr. Mechanical Engineer	NRC
S. B. Kim	Structural Engineer	NRC
Kamal Bandyopadhyay	Contractor	BNL
Ralph Campanella	Licensing Engineer	FPC
Mike Collins	Engineer	FPC
Al Friend	Licensing	FPC
George Honm	Licensing Engineer	FPC
Harry Johnson	Engr.-Programmatic Sol.	FPC
Dan Jopling	Supervisor, Engineering	FPC
Pat Peterson	Regulatory Specialist	FPC
Tony Petrowsky	Mgr. Nuclear Oper. Engr.	FPC
Walt Pike	Mgr. Regulatory Comp.	FPC
Glen Pugh	Lead Engr.-Structural Engr	FPC
Michael Rencheck	D/Engr and Projects	FPC
Don Rutherford	Engr. -Programmatic Sol.	FPC
Ralph Yost	Mgr.-Quality Programs	FPC

Exit Meeting on November 7, 1997

Name	Title	Organization
Pei-Ying Chen	Sr. Mechanical Engr.	NRC
S. B. Kim	Structural Engr.	NRC
Tom Johnson	SRI/Turkey Point	NRC
Todd Cooper	RI/Crystal River 3	NRC
Kamal Bandyopadhyay	Contractor	BNL
Roy Anderson	Sr. Vice President	FPC
Jim Baumstark	Director, Quality Programs	FPC
Ralph Campanella	Licensing Engineer	FPC
Kevin Campbell	Engineer	FPC
John Paul Cowen	Vice President	FPC
Paul Fleming	OPS	FPC
Al Friend	Licensing	FPC
Bob Grazio	Director, Regulatory Affairs	FPC
Bruce Hickle	Restart Director	FPC
John Holden	Site Director	FPC
George Honm	Licensing Engineer	FPC
Dan Jopling	Supervisor, Engineering	FPC
Dave Kunsemiller	Licensing	FPC
Mark Marano	D/Site & Business Support	FPC

Attachment 1

Bob McLaughlin	Regulatory Compliance	FPC
Chip Pardee	Director, Plant Operations	FPC
Tony Petrowsky	Mgr. Nuclear Oper. Engr.	FPC
Walt Pike	Mgr. Regulatory Comp.	FPC
Glen Pugh	Lead Engr.-Structural Engr	FPC
Michael Rencheck	D/Engr and Projects	FPC
Don Rutherford	Engr. -Programmatic Sol.	FPC
Ed Schrull	Compliance	FPC
Tom Taylor	Director, Training	FPC
Ralph Yost	Mgr.-Quality Programs	FPC

USI-A46 PROGRAM IMPLEMENTATION AUDIT REPORT FOR CRYSTAL RIVER, UNIT 3

1.0 INTRODUCTION

In response to Generic Letter (GL) 87-02, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46," Florida Power Corporation (FPC) submitted its plan (Reference 1) on August 27, 1993, to address the Unresolved Safety Issue (USI) A-46 for Crystal River Unit 3 (CR-3). The staff reviewed the FPC plan, which discusses the licensee's Plant-Specific Procedure (PSP), along with its supporting technical basis. In a letter dated April 12, 1994 (Reference 2), the staff identified a set of minimum criteria that an implementation program should contain to satisfy the intent of GL 87-02 for facilities located in low seismic regions such as CR-3, and noted specific areas in which the PSP along with its technical basis was deficient when evaluated against these criteria. The primary areas of concern involved the lack of an adequate relay evaluation, an unacceptable anchorage evaluation approach, lack of supporting information for cable and conduit raceways, and an inadequate justification for deviation from the equipment caveats developed by the Seismic Qualification Utility Group (SQUG) in its Generic Implementation Procedure, Revision 2 (GIP-2, Reference 3).

Subsequently on September 16, 1994, the licensee submitted Revision 1 to the CR-3 PSP (Reference 4) which incorporated some changes for relay evaluation, but did not commit to an appropriate anchorage evaluation or caveats in accordance with GIP-2. The staff issued a safety evaluation report (SER) on FPC's PSP for seismic verification of CR-3 plant equipment (Reference 5) dated May 2, 1996, identifying the open issues that included many of the earlier concerns delineated in Reference 2.

In the meantime, FPC conducted a seismic "walkdown" for the USI A-46 program at CR-3 and submitted a summary report on January 2, 1996 (Reference 6). The staff reviewed the summary report and sent a request for additional information (RAI) to FPC on January 28, 1997 (Reference 7). FPC responded to the RAI in letters dated March 27 and August 1, 1997 (References 8 and 9). After reviewing the FPC responses, the staff noted that some areas in the RAI were not satisfactorily addressed, especially the resolution of the open issues identified in

the SER (Reference 5) of FPC's PSP and decided to conduct an audit of the licensee's implementation program. The staff performed the audit on November 3-7, 1997. The purpose of the audit was to verify, on a sampling basis, that the licensee's implementation of the USI A-46 program was completed and documented in accordance with the licensee's commitments in the PSP for CR-3, Rev. 1, docketed on September 16, 1994, supplemented by the NRC staff's SER on CR-3 Criteria and Procedures dated May 2, 1996. The audit review also facilitated the staff's view of the FPC summary report, submitted on January 2, 1996, and followup on requests for additional information (RAIs) previously provided to FPC.

This report describes the audit activities, the staff's observations, and conclusions. Additionally, this report describes the staff's evaluation of certain restart issues conducted during the site visit.

2.0 AUDIT

2.1 Audit Team Members

The audit team was led by Pei-Ying Chen of NRR's Mechanical Engineering Branch (EMEB), and included Sang Bo Kim of NRR's Civil Engineering and Geosciences Branch (ECGB) and Kamal Bandyopadhyay from Brookhaven National Laboratory (BNL), a contractor.

2.2 Audit Process

The audit was conducted in accordance with a plan transmitted to the licensee preceding the audit. The audit process consisted of the following major elements:

- Review of the overall USI A-46 program implementation process through discussion with the licensee's engineers and examination of documents.

- Discussion of the licensee's responses to the RAIs including resolution of the open issues identified in the Safety Evaluation (Reference 5) of PSP.

- Focused inspection of selected mechanical and electrical equipment including tanks, and cable tray and conduit supports.

Each of these audit elements is further described in the sections that follow:

2.2.1 Review of Overall USI A-46 Program

The audit team discussed the overall implementation of the USI A-46 program at CR-3 plant site with the licensee's engineers, and focused on the following areas:

- conformance to PSP & Staff's SER (References 4 and 5)
- selection process of USI A-46 safe-shutdown equipment list
- personnel qualification and team organization of review engineers
- interaction among responsible engineers in the mechanical, electrical, I & C, systems and plant operations engineering areas
- meeting the GIP-2 caveats
- anchorage verification
- resolution of outliers
- completion schedule for further walkdown, field modifications and calculations.

The licensee reported that the safe-shutdown equipment list (SSEL) was prepared by Al Friend of FPC with support from an operations engineer. Mr. Friend illustrated the equipment identification process by considering one safe-shutdown system.

The seismic walkdown was primarily performed by consultants, Harry Johnson and Don Rutherford of Programmatic Solutions, Inc., with support from Paul Smith of Readiness Operation, Inc. Glen Pugh was FPC's responsible structural engineer. Charbel Abou-Jaude of VECTRA Technologies, Inc., performed the third-party review.

The seismic engineers present during the audit (Glen Pugh, Harry Johnson and Don Rutherford) reported that although the walkdown was performed in accordance with the PSP (Reference 4),

they also noted additional deficiencies they observed based on their experience and SQUG training.

2.2.2 Responses to RAIs

The staff informed the licensee that responses to some of the RAI items were adequate but others would require additional information. The major limitation of the responses is that they refer to the PSP, portions of which the staff has taken exception in its SER (Reference 5). The responses also refer to some experience data, but do not include the data, nor do they show how the data apply to the CR-3 equipment. The licensee's engineers informed the audit team that they have additional information that became available since the transmittal of the responses to the RAIs and that on many occasions the seismic review engineers went beyond the PSP requirements to verify the seismic adequacy of equipment. The licensee agreed to provide additional information and clarification for staff review before the restart of the plant from Refueling Outage (RFO) 10 (Attachment 3). By letter dated December 16, 1997, FPC provided supplemental responses to FPC's March 27 and August 1, 1997, RAI responses for the resolution of USI A-46 at CR-3. The letter included five enclosures and ten attachments (A through J). Except for the restart issues, the evaluation of this supplemental information, will be incorporated into the plant-specific SER to be issued at a later date.

2.2.3 Inspection of Selected Components

The staff selected a number of electrical and mechanical equipment items, including tanks, for inspection. For most equipment, the inspection was focused and limited to the open issues identified in the SER on PSP and those that were not resolved in the RAI responses. Thus, the scope of inspection was mostly limited to verification of equipment anchorages and, where possible, areas involving the specific caveats that are recommended in GIP-2 (Reference 3) but are not included in the PSP (Reference 4). The following is a list of sample audit equipment identified according to the class description in the licensee's summary report:

- Battery Racks DPBA 1B1 and 1B2

- Distribution Panels DPDP-1B, 1C, 3A, 4A and B, 5B; ACDP 6, 51 and 52
- Low Voltage Switchgear MTSW-3A, 3C, 3D, 3E, 3G and 3J; VBXS-1A, 1C and 1E; DPXS-1
- Instruments on Racks CD-067-LT1 (Transmitters)
- Transformers ACTR-15; VBTR-4A and 4D
- I & C Panels ATCP-1, CCBT, AHCP-4, ECPSC-3B3 and RFL MPLXR
- Medium Voltage Switchgear MTSW-2F
- Inverter VBIT-1E
- Fluid Operated Valves CHV68 and 69
- Chiller CHHE-1A
- Solenoid Valve AH-200 SV
- Fans AHF-17A, and 17B, 19 A and 19B
- Air Handler AHD-5
- Air Compressors AHP-1A, 1B, 1C and 1D
- Diesel Generator EGDG-1B
- Diesel Generator Grounding Resistor
- Motor Control Centers MTMC-3, 4, 18 and 21; MTXS-1
- Motor Operated Valves ARV-49 and ASV-005
- Vertical Pumps RWP-1, 2A and 3A
- Feedwater tank and Condensate Storage tank
- Horizontal Heat Exchangers

During the inspection of the above components, the audit team also examined the support systems for some cable trays and conduits. The pathway through the Turbine Building that would be used for potential operator action subsequent to a seismic event was also examined for potential falling or failure of structures and components. While some of the electrical

cabinets were opened for anchorage verification, many others could not be opened during the staff's audit because of the need for systems protection for the outage.

3.0 OBSERVATIONS

The major observations and actions that resulted from the audit are described below. Appendix A of this report provides the audit team's specific findings relating to the seismic adequacy of some equipment that was examined during the plant walkdown. FPC determined that this equipment was operable. The staff finds the licensee's determination acceptable; however, some of this equipment may not be in full conformance with the acceptance criteria for seismic adequacy and, in some instances, with the design basis requirements for CR-3. Observations relating to programmatic aspects of FPC's A-46 implementation effort are discussed below.

3.1 Overall USI A-46 Program Implementation

The licensee followed the PSP (Reference 4) to implement the USI A-46 program. The staff has taken exceptions to the PSP in Reference 2 and in the subsequent staff SER (Reference 5). As stated earlier, the licensee conducted its seismic "walkdown" following the PSP which did not incorporate the staff's position as delineated in Reference 2. The staff audit team noted that, in general, the licensee's review engineers, because of their previous experiences with USI A-46 program at other plants, have exercised reasonable judgments in addressing some of the review criteria not included in the PSP, but are required by GIP-2. The issue involving the PSP shortcomings in certain areas was discussed with the licensee after the audit. The licensee committed to reassess its position regarding the completeness of the PSP in light of the staff's position in its SER (Reference 5). The licensee committed to submit the results of its assessment, and projected actions to address potential areas that may require further examination and evaluation prior to RFO 11.

3.2 Status of USI A-46 Program

FPC identified 113 outliers based on its seismic "walkdown" using the PSP and subsequently prioritized them according to safety significance. The licensee committed to resolve, prior to restart from RFO 10, 70 items including related field modifications and documentation. For the remaining 43 items, the licensee concluded system or component operability was acceptable for restart from RFO 10. FPC committed to provide a schedule for final resolution of these items prior to the startup from RFO 11. In addition to the outlier resolution, a number of observations and equipment-specific findings that were noted during this audit (as discussed in this report) will need to be addressed by FPC for resolution. After the audit, and prior to the restart from RFO 10, FPC provided its assessment and actions regarding the 70 items mentioned above. Based on its assessment, FPC determined that all system and equipment operability issues had been addressed prior to restart. Where a potential noncompliance with the design basis existed, FPC prepared a JCO to address such conditions in conjunction with the restart of CR-3 from RFO 10.

3.3 Qualification of Review Engineers

The seismic review engineers were found to be competent and their qualifications exceed the minimum requirements of GIP-2. The systems engineer who worked on this program was also highly qualified. However, the audit team noted that, in certain aspects, adequate interaction between the seismic engineers and the systems engineers may have not taken place during the seismic adequacy verification process (examples discussed in Section 3.9).

3.4 Responses to RAI

FPC did not address the open issues identified in the SER (Reference 5) of the PSP (Reference 6) that was used for the seismic verification. In addition, response to many of the RAI items was still incomplete at the time of the staff's audit (RAI Item Nos. 1, 2, 3, 4, 7, 8, 10, 11, 12, 14b, 14c, 18g, 20b and 23). RAI Items Nos. 3, 7 and 8 relate to operator actions. The staff determined that these were not restart issues; the evaluation of these items will be addressed by the NRC Human Factors Assessment Branch in the safety evaluation report. FPC agreed to submit

clarifications and additional data to respond to these incomplete items prior to plant restart from RFO 10. By letter dated December 16, 1997, the licensee submitted additional information concerning these issues. They are under staff review and will be addressed in the safety evaluation report.

3.5 Anchorage Verification

An adequate anchorage verification process should consist of three major steps 1) verify that equipment is anchored, 2) verify that field installation followed standard engineering practice, and 3) verify that the as-installed anchorage configuration is capable of withstanding and transmitting the seismic load.

In the PSP, FPC stated that the preferred method to determine the adequacy of equipment anchorage is through inspection and judgment of the seismic capacity engineers (SCE). During the audit, FPC indicated that the equipment anchorage verification activities encompassed the first two steps described above. However, the audit team identified some instances of anchor installation deficiencies and conditions involving unverified anchorage strength in accordance with GIP-2 guidelines. The audit team acknowledged that, given the low seismic demand at CR-3, experienced structural/seismic engineers may be able to judge anchorage adequacy for properly anchored equipment without performing detailed calculations. For inadequate anchorage (e.g., poor or missing welds and/or bolts), improper/or unconventional anchorage installations, it is questionable whether the licensee's engineers could judge anchorage adequacy for the seismic demand without performing some calculations (e.g., following the GIP-2 guidelines). The audit team reiterated the position delineated in the staff's SER on PSP (Reference 5), that the licensee should reassess its anchorage program following the guidance provided in Section 4.4 of GIP-2. As noted earlier, FPC committed to reassess the PSP's completeness against the staff's SER on PSP. The licensee has also committed, in its December 16, 1997, letter to NRC, that it will perform GIP anchorage calculations for approximately 50% (100 items) of the electrical components identified on the SSEL prior to startup from RFO 11. FPC may expand the sample, depending on the findings from the GIP anchorage calculations.

Additional licensee actions taken and commitments made for the equipment anchorage issue, are addressed in Attachment 3.

3.6 Meeting All GIP Caveats

Meeting all the GIP caveats is a prerequisite for use of the earthquake experience-based approach as pointed out in the staff's SER (Reference 5). It is acknowledged that, for sites with low seismic demands, some of the caveats could be relaxed. However, this would require a systematic review of the experience data that would support the desired seismic demand and demonstrate that certain caveats could be relaxed. In the absence of such data and review (similar to GIP-2 review), the staff does not accept prescreening of caveats based on the argument of low seismicity. Similarly, the staff does not accept the argument that the PSP still requires the seismic review engineers to look for "other concerns" which could include the missing caveats although the PSP has already prescreened them (i.e., the data sheets did not list these caveats). As a minimum, the GIP-2 caveats serve as a systematic checklist to the seismic review engineers for each and every equipment piece so that they confirm that the equipment being reviewed belongs to the generic equipment class that was considered for development of the GIP Bounding Spectrum. One of the weaknesses in the PSP is that it does not require the engineers to adhere to the entire GIP-2 caveats list. The audit team explained these staff positions on the missing caveats and discussed with the FPC seismic review engineers who performed the "walkdown." The review engineers reported that based on their SQUG training and experience with USI A-46 programs in other plants, they were aware of the need to meet all the GIP-2 caveats including those missing from the PSP, and during their seismic "walkdown," they have generally considered the missing caveats even though these caveats were prescreened by the PSP. This approach was adequate if all the caveats were covered. The audit team noted that the issue of missing caveats can be resolved when FPC confirms that all the GIP-2 caveats were systematically verified and satisfied for all safe shutdown equipment. The licensee has submitted additional information regarding the omission of certain GIP-2 caveats from the PSP with its December 16, 1997, letter, and agreed to reassess this issue.

3.7 Operator Action

Regarding operator action that may be needed for safe shutdown following an SSE, the staff audit team reviewed three areas: availability of operators; clear paths to the desired locations; and availability of adequate lighting.

FPC operators reported that at any given time, there will be a minimum of seven operators on site (four inside and three outside the control complex). Among multiple paths that the operators can take to go from the control complex to the desired locations, one path is through the Turbine Building. Although this building is not a Seismic Category I structure, it was designed for other loads and load combinations including wind loads. Accompanied by FPC operators, the audit team walked down the path through the Turbine Building and did not find any potential for falling objects that may block any particular location and prevent free passage. Thus, the audit team is in general agreement with FPC that falling or failure of components during a seismic event is not a major concern for maintaining a clear path through the Turbine Building.

Regarding an alternative emergency lighting arrangement, the audit team did not find any reliable system that was seismically verified. Thus, the only light available would be flashlights or similar portable lights.

3.8 Relay Review

The staff had accepted in its SER (Reference 5) a reduced scope review of relays which includes replacement or otherwise justification for the "Bad Actor" relays and spot checks of mounting of other relays. FPC determined that none of the "Bad Actor" relays would be required to perform any safety function. Spot checks of mounting were conducted as part of the licensee's equipment seismic "walkdown." Therefore, FPC has addressed the issue of relay evaluation identified in the SER except that the SER allowed a reduced-scope review with the understanding that FPC will develop a "top-level" procedure to deal with potential relay chatter. Such a procedure was not developed by FPC and was not available during the audit. By letter dated January 30, 1998, FPC submitted a "top-level" procedure (Revision 8 to AP-961, "Earthquake") which will be reviewed by the staff.

3.9 Identification of Safe Shutdown Equipment

The staff audit team was informed that some equipment items in the safe shutdown path were not included in the safe shutdown equipment list (SSEL) since they were judged to be passive. However, the audit team had a concern that SSEL was determined without adequate interaction among engineers with the needed collective background (e.g., mechanical, electrical, reactor systems, and I & C). This concern about lack of strong engineering interaction was further supported by observation during the field inspection when the staff found examples of inappropriate equipment class identification (e.g., see Appendix A, Items 6, 7 and 15). (Note that assigning the appropriate class to an equipment piece is critical for seismic verification since the caveats are equipment class-specific and vary from one class to another). This issue was discussed with the licensee during the audit. The licensee agreed to take the following actions:

1. FPC will re-examine the completeness of the SSEL by involving engineers with backgrounds in all aspects of safe shutdown path identification and equipment functionality (e.g., mechanical, electrical, I & C, reactor systems, and operations) to confirm that no equipment items need to be added to the current SSEL list.

2. FPC will verify whether all equipment items are appropriately classified (refer to Table 5-6 of the Summary Report). Reevaluation will be necessary for inappropriately classified equipment.

3. FPC will verify whether the diesel generator grounding resistor needs to be added to the safe shutdown list. If so, the adequacy of the ceramic insulators in the load path should be investigated. (Information concerning the grounding resistor was submitted with the December 16, 1997 letter and will be reviewed by the staff.)

3.10 Equipment Internals

The verification of seismic adequacy with respect to the equipment caveats requires that the licensee's seismic engineers open electrical cabinets to verify adequate mounting of internals and confirm that there are "no other concerns." Since most electrical equipment was energized,

the staff audit team could not inspect most of the cabinet internals. Among the cabinets that were opened for inspection, the staff audit team observed one long box-type device built as cantilever and held with screws (see Appendix A, Item 3). In another example, the team noted the presence of ceramic insulators, which are highly brittle, in the transformer bay of a low-voltage switchgear system (see Appendix A, Item 1). FPC agreed to confirm that the cantilever device is adequately supported and that the ceramic insulators are acceptable (e.g., they are not in the load path or they do not experience relative displacement due to an SSE). The licensee also agreed to confirm that similar situations do not exist for other equipment items by addressing this issue with the GIP caveats issue described in Item No. 3.6.

3.11 Supports for Cable Trays and Conduits

The supports for cable trays and conduits were not evaluated by use of the GIP-2 or similar experience-based approach. However, FPC stated that these support systems were analyzed and designed for lateral as well as vertical seismic loads in accordance with the design basis for CR-3. At the entrance meeting, the licensee indicated that they are performing what the GIP called Limited Analytical Review (LAR) for selected cable trays in an attempt to close an open item in the staff SER on the PSP. Inspection of the cable trays and their support system indicated that most of the safety-related cable tray supports appeared to be made of structural steel, some of them box type two-way supports. The staff requested sample calculations which were performed at the time of licensing (1972-73). FPC has submitted the pertinent calculations which are currently under staff review.

3.12 Tanks and Heat Exchangers

The licensee, in general, followed the GIP-2 guidelines for evaluation of tanks and heat exchangers that are within the GIP-2 scope. The audit team inspected the emergency feedwater tank (EFWT) and condensate storage tank (CST) as well as some horizontal heat exchangers (e.g., decay heat removal heat exchangers and emergency diesel generator lube oil coolers, etc.). At the base of the EFWT support pad, the staff audit team noted a radial crack approximately 14-inches long of undetermined width that extends to one of the anchors. FPC's walkdown did not identify this crack; however, the licensee stated that the issue would be investigated. There are several minor radial

cracks of a similar type (about six) all along the bottom of the tank support. The licensee has evaluated the identified cracks and determined that they are confined to the grout only, and do not affect the integrity of the structural concrete foundation. FPC has completed the seismic evaluation of the EFWT. The licensee has submitted the report which is under staff review. Regarding the CST, the license identified this item as an outlier because of the mistakes in the existing analytical calculations, and has committed to resolve this outlier prior to the startup from RFO 11. The licensee has provided the staff with justifications for the operability of EFWT and CST, and they appear reasonable.

4.0 SUMMARY AND CONCLUSIONS

The licensee's USI A-46 program was, in general, conducted in accordance with its PSP. As previously discussed, the PSP does not include all the equipment caveats specified in GIP-2. The staff finds this to be an important limitation in the PSP as well as in the licensee's implementation of its USI A-46 program. Similarly, the anchorage adequacy verification was not conducted in accordance with the GIP-2 guidance. The staff does not accept generic prescreening of caveats or generic elimination of anchorage strength verification. As noted earlier, FPC has committed to reassess the PSP's completeness against the staff's SER on PSP. This commitment will resolve, among other issues, the above two major staff's concerns.

Based on the observations discussed above and in Appendix A, the staff audit team has identified several findings which were conveyed to the licensee during the audit. The resolution of these findings, which are identified as action items in the following list, will be addressed in the plant-specific SER for USI A-46 programs at CR-3:

1. The licensee agreed to provide clarifications to its earlier response to the remaining unresolved RAI items (i.e., RAI Item Nos. 1, 2, 3, 4, 7, 8, 10, 11, 12, 14b, 14c, 18g, 20b and 23). By letter dated December 16, 1997, the licensee submitted additional information concerning these issues. This information is under staff review.

2. The licensee will confirm that all equipment is anchored and anchorage has been inspected following the GIP-2 guidelines. (For details, see Item 3 of Attachment 3. Also, see Items 1, 2, 3, 5, 8, 11, 13 and 15 of Appendix A).

3. The licensee will confirm that all GIP-2 caveats have been verified through the re-examination of previous seismic "walkdown" and satisfied for all safe shutdown equipment items. (e.g., Items 4, 5, 8, 9, 10 and 13 of Appendix A).

4. The licensee committed to develop a top-level procedure for operator action, in general, and relay chatter, in particular. By FPC letter, dated January 30, 1998, the licensee submitted Revision 8 to AP-961, "Earthquake," which is under staff review.

5. The licensee will re-examine the completeness of SSEL and confirm that no additional equipment items need to be included in the current SSEL (see Item No. 3.9 of this Attachment).

*(The responses to the following Item Nos. 6, 7, 8, 9, and 10 were submitted with FPC's letter to NRC dated December 16, 1997. They are under staff review).

6. The licensee will verify that all equipment items are appropriately classified and reevaluate inappropriately classified equipment. (For examples, see Items 4, 6, 7 and 14 of Appendix A).

7. The licensee will verify whether the Diesel Generator grounding resistors need to be included in the safe shutdown equipment list. If so, the seismic adequacy of the ceramic insulators in the load path should be investigated. (see Item 12 of Appendix A)

8. The licensee will confirm that the questionable cabinet internals (cantilever box and ceramic insulators) are, in fact, acceptable (or otherwise have been modified). The licensee will also confirm that similar situations do not exist in other equipment. (For examples, see Items 1 and 3 of Appendix A)

9. The licensee will ensure the seismic adequacy of cable and conduit supports by sample calculations for each type of cable and conduit supports in the Reactor Building.

10. The licensee will submit the seismic evaluation report for EFWT for staff review.

11. The licensee will complete and submit for staff review analytical calculations for seismic adequacy of condensate storage tanks prior to the startup from RFO 11.

12. The licensee will confirm that outstanding outliers have been satisfactorily resolved through adequate documentation and/or field modifications.

5.0 REFERENCES

1. Letter from P. Beard (FPC) to NRC Document Control Desk, "Generic Letter 87-02, Supplement 1; Verification of Seismic Adequacy of Equipment in Older Operating Nuclear Plant," dated August 27, 1993.

2. Letter from L. Raghavan (NRC) to P. Beard (FPC), "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46, Generic Letter (GL) 87-02, Crystal River Unit 3 (Tac No. M69440)," dated April 12, 1994.

3. "Generic Implementation Procedure (GIP) for Seismic Verification of Nuclear Power Plant Equipment," Revision 2, as corrected February 14, 1992, SQUG, February 1992.

4. "Plant Specific Procedure (PSP) for Seismic Verification of Nuclear Power Plant Equipment," Revision 1, transmitted with letter from P.Beard (FPC) to NRC Document Control Desk, dated September 16, 1994.

5. "Safety Evaluation of Florida Power Corporation's Plant-Specific Procedures for Seismic Verification of Crystal River 3 Nuclear Plant Equipment," transmitted with letter from L. Raghavan (NRC) to P. Beard, (FPC) dated May 2, 1996.

6. "Seismic Evaluation Report for Unresolved Safety Issue A-46," Rev. 0, submitted with letter from P. Beard (FPC) to NRC Document Control Desk, dated January 2, 1996.

7. Letter from L. Raghavan (NRC) to P. Beard, (FPC), "Crystal River Nuclear Generating Plant, Unit 3 - Request for Additional Information on the resolution of Unresolved Safety Issue (USI) A-46 (Generic Letter 87-02), (TAC No. M69440)," dated January 28, 1997.

8. Letter from J. Holden (FPC) to NRC Document Control Desk, "Verification of Seismic Adequacy of Equipment in Operating Reactors - Unresolved Safety Issue (USI) A-46," dated March 27, 1997.

9. Letter from J. Holden (FPC) to NRC Document Control Desk, "Crystal River 3 - Request for Additional Information on the Resolution of Unresolved Safety Issue (USI) A-46, (Generic Letter 87-02)," dated August 1, 1997.

APPENDIX A

A brief discussion of equipment items with questionable seismic adequacy or requiring additional investigation is provided in this appendix. The licensee confirmed the operability of these equipment items, and has provided in some cases, and agreed to provide in other cases, additional information for the resolution of these issues. Equipment deficiencies that were already identified and resolved by the FPC engineers are not necessarily repeated in the following list. Since most electrical equipment was energized, the staff audit was generally limited to external visual observation. A very limited number of cabinets were opened for anchorage verification only.

1. Low Voltage Switchgear MTSW-3A, 3C

The transformer bay of the lineup (3A) was opened. Several ceramic insulators were observed. Since ceramic is brittle, the need to assess their adequacy was noted to the licensee. No cabinet anchorage was observed. In another location (3C), plug welds were observed as the means of anchorage. Their strength to fully transmit the seismic loads within allowable stress limits was considered questionable. Sources of potential installation deficiencies for plug welds are as follows:

- Inadequate fusion of the base material of the underlying component (e.g., plate, angle, channel, etc.).
- Lack of fusion in the base metal around the hole.
- Burning of connecting component around the hole, especially if the metal is thin.

The above concerns are generic for electrical equipment supported by means of plug welds.

2. Distribution Panel DPDP-5B

Only the rear side of this two-bay floor-mounted cabinet was externally, visually inspected. There was a large gap (approximately ¾ inch) between the two structural components connected by the base anchor bolts (appears to be ⅜ inch diameter). This was considered to be an example of a questionable and unconventional anchorage installation. The front side could not be inspected, so the overall effect on the equipment anchorage strength could not be judged. The licensee's screening evaluation work sheets (SEWS) do not seem to indicate any anchorage deficiency.

3. I&C Panel, ATWS Logic Cabinet ATCP-1

A box-type device about 6-inches high and 1-foot long was supported as a cantilever by four approximately ⅛ inch diameter screws (slotted holes on one side). The staff audit team judged that further investigation was necessary to confirm the structural adequacy of the connection.

4. Low Voltage Switchgear MTXS-1

The door of the cabinet was found to be extremely flexible and might rattle during an earthquake. Also, the rear side of the tall (over 6 feet) cabinet was too close to the wall (less than ¼ inch). Thus, spatial interaction may not be acceptable. Furthermore, it was unclear whether this equipment piece belongs to the low voltage switchgear class as identified in the SSEL.

5. Low Voltage Switchgear MTSW-2F

It was unclear whether the added weight of the transformer mounted on top of the cabinet exceeds the limit recommended in GIP-2. The caveat on limitation of external weight was not included in the PSP. Further, the reliability of plug welds as anchorage needs to be investigated (see Item No. 1 above, for discussion of plug welds).

6. Low Voltage Switchgear VBXS-1A, 1C

This is a wall-mounted box-type panel 16-inches deep that looked like a distribution panelboard although the SSEL identified the cabinet as a low voltage switchgear (Class 2, Table 5-6 of FPC Summary Report). It was noted that the depth of a typical panelboard in the database is 6 to 12 inches according to GIP-2, and the 16-inch depth may make this panelboard an outlier. The licensee was informed to consider the reevaluation of this item of equipment by use of the applicable caveats for a distribution panel.

7. Low Voltage Switchgear VBXS-1E

Similar to Item No. 6, this wall-mounted panelboard was classified as low voltage switchgear. This was considered to be an inappropriate classification. The depth of this panelboard is within the database and, therefore, is not a problem for this panelboard.

8. I&C Panel AHCP-4

This three-bay floor-mounted panel could not be opened during the audit. An external visual inspection revealed large cutouts on both the top and bottom of each bay. The load path may need to be investigated. The frame anchorage connection may also need to be investigated.

9. Air Compressors AHP-1A, 1B, 1C, 1D

The front and rear ends of each compressor are anchored to separate pedestals through soft pads. The potential of relative displacement and its effect on equipment functionality needs to be investigated.

10. I&C Panel CCBT

This panel is adjacent but not connected to another panel whose anchorage could not be confirmed. The potential impact between the two panels and its effect on equipment functionality should be investigated.

11. Diesel Generator EGDG-1B

The relay cabinet next to the diesel generator appears to be floor- or skid-mounted. It is bolted to a vertical plate which in turn is welded to the skid. This load transfer system seems to be unconventional and may require further investigation including its effect on relays within the cabinet.

12. Diesel Generator Grounding Resistor

There are four ceramic supports in the load path of the grounding resistor. Being brittle, ceramics are typically a poor choice of material to transfer the seismic load. If the grounding resistor is required for safe shutdown, it should be added to the SSEL and the reliability of the ceramic insulators should be investigated from a seismic viewpoint. (Information concerning the grounding resistor was submitted with the licensee's December 16, 1997 letter. It is under staff review.)

13. Motor Control Center MTMC-18

The front welds to the embedded steel appeared questionable on one side (right-hand side when facing the MCC) of the cabinet's lineup. The rear side could not be inspected. If these welds are in the load transfer path, the construction did not seem to meet acceptable industry standards, and the adequacy of the welds should be investigated. Furthermore, the MCC seems to be too close to the wall (a gap of less than ¼ inch at locations of metal protruding the MCC frame for a spatial interaction concern). The credit for any restraints from top conduits needs to be carefully considered since such conduits are typically connected to thin sheet metal on top and these connections can break under seismic loads.

14. Low Voltage Switchgear DPXS-1

This is a wall-mounted panel that may belong to the class of distribution panel; however, the equipment was identified in the SSEL as Class 2 (i.e., low voltage switchgear) and evaluated accordingly. This finding was noted to the licensee for investigation.

15. Vertical Pumps RWP-1, 2A, 3A

Anchorage between the concrete pad and the concrete floor could not be confirmed to ensure adequate load transfer (see RAI Item No. 10, Reference 7). This finding was noted to the licensee for investigation.